

NEST DISTRIBUTION AND SURVIVAL RATIO OF  
TREE SWALLOWSBy SETH H. LOW<sup>1</sup>

The aim of the investigation of the Tree Swallow (*Iridoprocne bicolor*) this past year was to obtain data on the nesting distribution and the survival ratio. With this in mind three new substations were established and most of the old substations enlarged.<sup>2</sup> All the old boxes of the 1931 type were replaced by new boxes at the main Station and used at the substations. Table I lists the substations, their locations, direction, and distance from the main Station, and the type and number of boxes at each.

The program was to trap both adults in every one of the 147 nests in which eggs hatched. Birds of both sexes may be captured while building the nest, but I doubt if it would be practicable or judicious. The females when incubating are caught easily by merely walking quietly up to the boxes. Both parents feed the young and thus may be readily captured. However, it is not advisable to trap a nest until the young are three or four days old. Moreover, the young after they are half grown can reach up to the hole of the box. This obviates the need for the parents to enter the box and it thereby ends trapping. Since in most of the nests the young reach this stage about the same time, the trapping period is short. I arrived on the Cape a week earlier than usual, but the trapping stage had already been reached. Unfortunately there followed a week of poor weather which not only made trapping impossible but wiped out many nests before they could be trapped.

Though I was handicapped as described, I trapped two or more adults in 88 nests; and single birds, almost all females, in 46 nests. Together, in both the nests and boxes, 230 adults were caught. Of these, 109 were returns<sup>3</sup> and one a recovery.

The following table (II) is based on these returns and those of previous years, and is designed to show the survival rate. The italicized figures give the number of birds banded each

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<sup>1</sup> Contribution No. 16 from the Austin Ornithological Research Station.

<sup>2</sup> For status of stations in 1931 and 1932 see Notes on the Breeding of the Tree Swallow, by O. L. Austin, Jr., and S. H. Low. *Bird-Banding*, Vol. III, No. 2, April, 1932. Further Notes on the Nesting of the Tree Swallows, by Seth H. Low. *Bird-Banding*, Vol. IV, No. 2, April, 1933.

<sup>3</sup> A recapture at a substation although more than five miles away is considered here as a return.

TABLE I

Substations	Location	Direction and Miles from Station	Type of Hoz	No. of Hozes	No. of Nests	No. of Eggs	No. of Hatch	Mortality	Fledged	Efficiency Per cent
A	Parnet Point Road, Wellfleet	N 5.8	32	32	14	58+	55	28	27	..
B	Bridge Road, South Eastham	S 5.4	31	25	12	39	15	11	4	..
C	Camp Meeting Road, North Eastham	S 2	31	25	8	42	20	11	9	..
F	Near Gull Road, Wellfleet	N 5	32	10	5	25	24	3	21	..
H	Lieutenant's Island, South Wellfleet	N.W. 1	32	4	4	19+	19	5	14	..
M	Longnook, Truro	N 9.2	31	15	6	23	22	10	12	..
O	Monument Road, Orleans	S 7	31	25	6	25	10	9	1	..
P	Village, Wellfleet	N 3.9	31	10	7	26+	0	0	0	..
W	Minister's Pond, Eastham	S.E. 3				No data				
Substations			..	146	62	257	165	77	88	34.3
Main Station			..	387	113	553	502	292	210	38.0
Total			..	533	175	810	667	369	298	36.25

year. The other figures show the number of birds known to be *alive* each succeeding year and *not* the number of returns obtained that year. Of the twenty-five young banded in 1929 at Substation C., one was captured in 1930 and two others in 1933 at the Station. Thus at least three were alive in 1930 and two in 1931-32-33.

TABLE II

	Banded as Adults					Banded as Nestlings				
	a	b	c	d	e	g	h	i	j	
1929.....	1	0	0	0	0	25	3	2	2	2
1930.....	23	2	1	0		15	3	2	1	
1931.....	83	29	18			161	29	17		
1932.....	90	37				404	34			
1933.....	120					267				

Remembering that birds banded or recaptured in 1933 cannot return until next year, it is seen from columns a and g that there are 211 adults of which 89, or 42.2 per cent (columns b and h), were alive at the end of one year. From columns a and g it is evident that out of 92 individuals there were, according to columns c and i, 22 or 23.9 per cent alive two years afterwards. Practically the same percentage is obtained for the survival at the end of one year of birds from a single season's banding. Of 83 adults banded in 1931 there survived 29 (34.9 per cent); of 90 banded the following year, 37 (41.1 per cent). These figures, however, do not show the survival rate, for they are based on a number of birds of all ages. What these figures should show is what portion of the resident breeding population is replaced each year, either by return nestlings from the preceding year or by new birds from elsewhere. From the present figures it appears to be about 60 per cent. However, all the above figures are incomplete because the number of returns is incomplete. Only 230 of the 350 adults were captured. Of these, 109 were returns, so by the same ratio there ought to have been about 50 more returns among the 120 uncaptured birds. The returns would raise the survival percentages and reduce the replacement percentage.

An accurate indication of the survival rate must be based on returns from nestlings. As will be shown later, some of the young return to the vicinity of their birthplace and others spread into new territory. Therefore the percentage obtained for birds surviving at the end of the first year will be low. The following summary indicates, however, that after the first year the mortality rate is gradual.

Of 605 nestlings 69 were alive at the end of one year.....11.4 per cent  
 " 201 " 21 " " " " " " two years.....10.4 per cent

DISTRIBUTION OF SUCCESSIVE NEST-SITES

Table III summarizes the distances in feet between the successive yearly nesting-sites of Tree Swallows. On the left side is listed the number of males and females which on returning bred in a box at each of the given distances from the box each bird had bred in the previous year. The males and females have been separated to show that the matter of sex is apparently not a factor. The records of females outnumber those of males because they are more easily captured than the males. To date only seven birds have used the same box two consecutive years, and two of these were a mated pair. The cases of birds nesting within two hundred feet and possibly some of those within three hundred feet are those of birds choosing the next nearest box to their former one. Some of these are 1931 birds which returned in 1932 and chose a new-type box in preference to the old-type box which they had used previously. From the table, it is evident the birds show little attachment for a particular spot. This is not surprising, for the Tree Swallows do not feed each within a particular territory but roam together over and beyond the territory covered by the boxes, now all skimming over the marsh, in the evening dipping together over the pond, and at dusk lining a section of telephone-wires.

TABLE III

Adults			Distance	Nestlings		
♀	♂	Total		♀	♂	Total
3	4	7	Same box . . . . .	0	0	0
8	1	9	Up to 100' . . . . .	0	0	0
9	5	14	100' to 200' . . . . .	2	0	2
9	2	11	200' to 300' . . . . .	1	0	1
6	1	7	300' to 400' . . . . .	1	0	1
2	0	2	400' to 500' . . . . .	2	1	3
6	0	6	500' to 1,000' . . . . .	3	0	3
4	0	4	1,000' to 1,500' . . . . .	3	2	5
2	1	3	1,500' to 2,000' . . . . .	4	2	6
8	0	8	2,000' to 3,000' . . . . .	7	0	7
0	0	0	4,000' to 1 mile . . . . .	2	2	4
0	0	0	1-2 miles . . . . .	1	0	1
0	0	0	3 miles . . . . .	2	3	5
0	0	0	3.9 miles . . . . .	1?	0	1
0	0	0	5.4 miles . . . . .	1	0	1
0	0	0	5.8 miles . . . . .	2	1	3
0	0	0	7 miles . . . . .	1	0	1
0	0	0	9.2 miles . . . . .	1	1	2
0	0	0	11 miles . . . . .	1	0	1
0	0	0	30+ miles . . . . .	1	0	1

The right-hand column of Table III gives the distances between the birthplace of a bird and its breeding-site the

following year. There is a general scattering of distances running up into miles, which are cases of interchanges between stations. These interchanges will probably prove to be more numerous with the establishment and the thorough trapping of more substations. The thirty-mile record is not a first-year return. The bird, a female, was banded as a nestling on June 30, 1931, at Chiltonville, Plymouth, Massachusetts, by Clarence L. Hawthaway. The bird bred at the Station this season, but where she was in 1932 is not known. However, in view of the tendency of adults to breed in the same region successive years, it seems probable that she nested on the outer Cape in 1932. Under this assumption I have included the record in the table. The table shows a tendency of the nestlings to return to the general vicinity of their birthplace, but the small percentage of returns and the Plymouth record suggest that a greater proportion spread farther afield, beyond the present area covered by the substations.

#### CONSTANCY OF MATING

In 1931 the identities of 16 pairs of Tree Swallows were known and in 1932 those of 27 pairs. To prove constancy a pair must be recaptured, making a total of four captures. To prove inconstancy five captures are necessary, for each of the original pair must be retaken and the new mate of one trapped. Therefore, the chances of obtaining all the captures for a good case are infrequent. I have two cases of constancy; in one case the pair used the same box, and in the other they returned to a near-by box. Below on the left is a diagram of two similar cases of inconstancy and on the right one of a mixed case.

1931.....	♂D x ♀E    ♂F x ♀G
1932 ♀A x ♂B.....	♂D      ♀E x ♂F      ♀G x ♂H
1933 ♀A    ♂B x ♀C.....	♀E x ♂F

On the basis of these five cases no tendency towards or against constancy in mating can be established, nor are the factors which determine the subsequent relationship of a pair apparent. The box location is not a factor, for one pair used the same box and two pairs moved to other boxes. In one of the inconstant cases the male returned to the same box and the female took another box close by. In the other case all participants changed boxes.

THE 1933 SEASON

Cape Cod experienced a cool and late spring in 1933, with numerous chilling northeast winds and many showers. The first Tree Swallows did not appear till April 3d, and throughout the entire migration there was no heavy concentration as in 1932. However, before the season was over 553 eggs were laid in 113 nests at the main Station. Last summer there were 115 nests, but two were second attempts, so the population was apparently practically the same. Table IV summarizes the past three seasons at the main Station alone. The excep-

TABLE IV

Season	Nests	Lay	Hatch	Mortality	Fledged	Efficiency			
31	62	278	193	69.4%	36	18.65%	157	81.35%	56.5%
32	115	575	480	83.5%	153	31.9%	327	68.1%	58.6%
33	113	553	503	90.9%	293	58.2%	210	41.8%	38.-%

tionally high hatch, 90.9 per cent of the lay, foreshadowed a very fine season. On June 11th I inspected all of the 387 boxes at the main Station and found all the nests in perfect condition, and most of them containing young less than half grown. Late the following afternoon there occurred a very severe thunder-storm, accompanied by a deluge of hailstones as large as robin's eggs and heavy rain. A box containing six young was hit squarely by a bolt of lightning. Only a few feathers and splinters were recovered. Observations the following day showed the parents of another nest to be missing. The following morning their five young died. Whether the adults deserted or were killed by the storm is not known. During the period of June 17th-21st another complete round of the boxes showed that every nestling in 32 boxes was dead or dying and there was partial mortality in about thirty other nests. Fifty per cent of the hatch had been wiped out in a week, most of the birds being well feathered and some ready to fly.

The mortality occurred mostly between June 11th and 20th. The weather during this period is given in the following brief account based on Station notes and a recording thermograph. The temperatures are the highest reached during the day, generally for a short time in the early afternoon, and lowest reached during the night.

		Temperature Highest Day	Lowest Night
June 12	Fair, towards evening terrific thunder storm, hail and heavy rain. Temperature 84° just before storm; dropped to 69° in two hours. . . .	88	69

June 13	Overcast, A.M. Showers, P.M., clearing to- wards evening . . . . .	69	60
" 14	Clear; cool east wind . . . . .	70	51
" 15	A.M., fair. P.M., increasing cloudiness . . . . .	69	51
" 16	Showers late in afternoon and evening . . . . .	71	62
" 17	Raw; overcast; occasional drizzle . . . . .	64	58
" 18	Cool; showers in P.M. Average temp. 65° except for one hour . . . . .	70	56
" 19	Unsettled, clearing towards evening . . . . .	66	47
" 20	Fair, easterly wind . . . . .	76	47

The average high temperature for this period was 69.4° Fahrenheit, whereas for the week preceding and the rest of the month the averages were 78° and 84.4° respectively. These periods cover the time most of the nests contained young. During the period of mortality the temperature was low and there were strong winds and showers, all of which are unfavorable for a plentiful supply of insects. Under such conditions it is not surprising that 230 adults could not find food enough for themselves and their 400 young.

A summary of the nests at the main Station follows:

	<i>No. of Nests</i>
Eggs deserted or destroyed . . . . .	6
Wiped out June 17th-21st . . . . .	32
Lightning . . . . .	1
Parents deserted or killed . . . . .	1
Shutters to boxes closed by strings blowing . . . . .	2
All died after June 23d . . . . .	2
Disappeared—mammal? . . . . .	1
Complete failures . . . . .	45
Partially successful . . . . .	54
100 per cent successful . . . . .	14
	158

One point not brought out by the above table is that one or more young died in each of 81 nests. The failure of an egg to hatch accounts for some of the partial successes.

A surprising development arose in the trapping during and immediately following the period of heavy mortality. Three and even four adults were caught actually bringing food to the same brood. In each of three different boxes a female whose young had previously died was caught along with the rightful parents feeding the brood. Apparently this is a carrying-over of the maternal instinct.

A summary of the season will be found in Table I. From the point of view of birds raised it was not at all successful, for the nesting efficiency dropped from 60 per cent in 1932 to 36.8 per cent this past season.

North Eastham, Cape Cod, Massachusetts.