

BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

VOL. III

APRIL, 1932

No. 2

NOTES ON THE BREEDING OF THE TREE SWALLOW¹

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THE relative abundance of the Tree Swallow on Cape Cod during its breeding season depends directly on the availability of nesting sites. Natural sites are few, for not only do the predominating pitch pines and scrub oaks seldom grow large enough to contain holes the size swallows require, but there are never many standing dead trees, since the sandy soil does not enable them to become firmly rooted enough to withstand the high winter gales. What few deserted woodpecker holes there may be are quickly preempted by the ubiquitous Starling, and were it not for the fact that bird-boxes of many types are used extensively all over the Cape, the Tree Swallow might not be able to breed here at all.

In April, 1931, ninety-eight wooden boxes were erected on the Station grounds, of which sixty-one were appropriated by Tree Swallows. Data on these birds were gathered with special attention to the distribution and choice of sites, the construction of the nests, the incubation period, the period of adolescence of the young, and the juvenal mortality and reproductive efficiency of the species.

DISTRIBUTION AND CHOICE OF SITES

Previous to 1931 an intensive study of Tree Swallows was not contemplated, and hence no concentrated effort was made to band them. However, one adult and twenty-five young were banded about two miles south of the Station in 1929. One of these young was retaken in a nesting-box at the Station in 1930. In 1930 two young birds were banded at the same place two miles to the south, one of which bred at the Station in 1931. Thirteen young were raised in boxes here in 1930, all of which were banded, and one of which returned to nest in 1931 within

¹Contribution No. 6 from the Austin Ornithological Research Station.

four hundred feet of where it was hatched. One adult male and one adult female were banded in different boxes in 1930. Both returned in 1931, but although each of their old houses was available, each bird chose one of the new, more suitable boxes, the female nesting three hundred and seventy-five feet from her former site, the male but twenty-five feet from his.

Adults apparently return to the same locality each year to breed, but little is known as yet of the laws governing the selection of a locality by the young bird returning northward for the first time. We know they may return to the immediate vicinity of the place where they were reared, or they may nest two miles away, provided there is a nesting site available, but to what distances from "home" they may ultimately wander to make their first selection is yet to be determined. The most important single factor involved must be the presence of suitable nesting sites.

The first Tree Swallow for 1931 arrived at the Station on April 3d; it was joined by several others two days later; and by April 8th large numbers were in evidence. The birds began to inspect the boxes soon after they arrived, and shortly made individual selections, which they defended against rival pairs. They had a choice of boxes in open fields, in partial cover, on the salt marsh, and in dense woods. They showed a preference for those in the open fields, most of which were occupied, and used none of the ones that were sheltered by vegetation. Of the eight houses on the salt marsh but two were used, and those bordering it were but sparingly taken.

The swallows began nesting operations by placing in the boxes only enough material to lay claim to them—often but a few blades of grass, rootlets, or pine-needles. Some two weeks were occupied in this fashion, and there was much bickering over the sites before the actual nest-building was undertaken. Several swallows were captured in boxes adjoining the ones in which they eventually nested. In one case a pair was taken on April 28th in a box in which they had placed a few grasses, but in which they never nested. The female was found on June 16th nesting in another box a quarter of a mile away. (Unfortunately her mate at that time evaded recapture.)

CONSTRUCTION OF NESTS

The time occupied by the nest-building varied individually from a few days to two weeks. The peak of these activities occurred during the last week in April and the first week in May.

In general the foundation and bulk of the nests were of

upland or marsh grasses, pine-needles, or a combination of these materials woven together. A hollow was formed in this foundation, sometimes in the center, but as often in one side or corner, and profusely lined with gray and white feathers packed in tightly with the quills buried in the grass or pointing away from the central hollow. In forty-six boxes were found over 3300 feathers, ninety-nine per cent of which were those of the Herring Gull, though a few feathers of domestic fowl, Black Duck, Scaup Duck, Wood Duck, Canada Goose, Great Horned Owl, and Red-tailed Hawk were mixed in with them. There was an average of 72 feathers to a nest, but over a hundred were found in each of ten boxes; one contained 132, one 134, and another a maximum of 147.

In the selection of materials for the nest individual taste is a large factor. The source of supply for gull and duck feathers is the windrow of flotsam at the edge of the salt marsh. A box next to a hen-yard fully three hundred yards from the marsh contained 116 white gull feathers and not a single plume from the Black Orpingtons and Rhode Island Reds. Yet in two boxes a quarter of a mile from the hen-yard, in addition to the usual gull feathers, there were eight and four black hen feathers respectively.

This individuality was equally noticeable in the choice of grasses and other substances for the foundations. The selection of materials could in no case be correlated with the proximity of the supply. One female was distinctive in using the needles of the pitch pine almost exclusively for the foundations of her nest. She built her first nest in Box 74 using 617 clusters of needles. She had not finished the lining (there were but eight feathers in it) when she deserted and started to build anew in Box 75, about fifty yards away. Her second nest (in which she laid her eggs and reared her brood) contained 691 clusters of needles and 78 gull feathers. In no other nest were more than two hundred pine-needles found.

INCUBATION

The Tree Swallow generally deposits its eggs at the rate of one per day until the clutch is completed. We noted several exceptions, for one female laid two eggs in twenty-four hours, and in two other instances there was a lapse of two days, and in one case four days between layings. Incubation usually is not commenced until the full clutch is laid.

The normal incubation temperature is slightly below the body temperature of the parent which is given by Wetmore as 106° to 107° F. Development will go on at considerably lower tem-

peratures, but its rate is retarded in proportion to the lowering of the temperature, and ceases altogether in the neighborhood of 70° F. Cooling in its early stages does not result in the death of the embryo, which will resume its development when it is brooded even after the egg has been kept for many days at ordinary temperatures.

A wide individual variation in the duration of the incubation period is to be expected in wild birds, owing principally, among other factors, to the individual brooding idiosyncracies of the parents. We found the length of the period, estimated from the day the last egg was laid to the day the first one hatched, to vary from a minimum of 13 days to a maximum of 16, as follows:

<i>Duration of Incubation</i>	<i>Number of Nests</i>
13 days.....	7
14 ".....	19
15 ".....	17
16 ".....	6

The first egg was laid on May 7th, and the last on June 18th. The average date for the first egg was May 18th, and the period of greatest laying, from May 15th to May 25th. The number of eggs per clutch varied from two to seven, but five predominated:

<i>Eggs per nest</i>	<i>No. of nests</i>
7.....	2
6.....	4
5.....	29
4.....	17
3.....	7
2.....	3 (2 incomplete)

The only cases of second laying observed occurred when the eggs of the first clutch were either destroyed or deserted. In no instance did one adult rear two broods of young.

The eggs in each clutch hatched not infrequently within a single day, and usually within two days of one another. Such inequalities in development may be attributed in part to the small amount of incubation given the first eggs laid while subsequent eggs are being deposited, and partly to the different times that different eggs may occupy in traversing the oviduct. Occasionally eggs do not reach the cloaca until towards sundown, in which case they are retained overnight within the female, where they continue to develop.

PERIOD OF ADOLESCENCE

Apparently the adults brood the young but very little, and spend most of the hours of light during this stage on the wing

catching food. It also appears that neither adult spends the night in the nest after the young are half grown, for the only adults taken in the boxes during nocturnal visits were either brooding eggs or newly-hatched young.

Estimated from the day the first egg hatched to the last day young remained in the nests, the lengths of the periods of adolescence were as follows:

<i>Duration of Adolescence</i>	<i>No. of nests</i>
16 days.....	1
17 "	0
18 "	4
19 "	6
20 "	7
21 "	7
22 "	8
23 "	9
24 "	4

It is to be expected that the rate of growth of the young should be in direct proportion to the amount of food received. Granting that the ability to procure food is approximately equal in the adults, and that all parents carry approximately the same amount of food to the nest daily, regardless of the number of young it contains (a point yet to be investigated), it follows that the most food per young will be delivered in those nests containing the fewest nestlings, and hence the rate of growth will be slowest where the broods are largest. Although the following table does not take into consideration the weather conditions throughout each separate adolescent period (which might have a strong bearing because of the relative absence of insects in the air during cold and rainy periods) it nevertheless furnishes a basis for the reasoning:

<i>Duration of Adolescence</i>	<i>No. of young per nest</i>	<i>Average Y. P. N.</i>
16 days	2	2
17 "	0	0
18 "	4-3-3-3	3.25
19 "	5-5-5-4-2-2	3.8
20 "	5-4-4-4-4-4-3	4
21 "	5-4-4-4-4-4-2	3.9
22 "	5-5-5-4-4-4-3-2	4
23 "	5-5-5-5-5-4-3-2-2	4
24 "	6-4-4-4	4.5

The first fledgling left the nest on June 17th, and the last flew on July 18th. The times of departure in some instances, however, may have been slightly premature because the young were disturbed. In cases where the young were all of one size, they generally all departed on the same day, otherwise according to gradation in size. In a few instances the young hopped out of

the boxes before they could fly, but usually they showed remarkable ability on their first flight, often remaining in the air well over a minute, and flying a quarter of a mile.

At no time were the young birds observed to return to the boxes once they had flown. Even before the last young was able to fly most of the Tree Swallows had left the vicinity. The last seen were three immature birds flying over the pond on July 31st.

MORTALITY AND REPRODUCTIVE EFFICIENCY

In the 62 nests under observation (two sets of eggs were laid in one box) 278 eggs were laid. Of the twelve nests in which none of the eggs hatched, three were destroyed by natural enemies, either English Sparrows or red squirrels, and the remaining nine were deserted by their owners for unknown reasons. All or part of the eggs hatched in each of the remaining fifty nests, but 38 of the 233 eggs they contained proved to be sterile, and two were broken during handling. Of the 193 young hatched, 36 died during adolescence. Seven of these were crowded to death by their older and larger geschwister, but the remainder were victims either of starvation or exposure to the elements. Cold winds and easterly rains prevailed for nine of the ten days from June 8th to June 18th during the height of the adolescent period, and it is indeed remarkable that the mortality from this cause was not higher, for during such weather the air is practically clear of insects. In but fifteen nests were all the eggs laid hatched and the young reared to the point where they could fly; sixteen nests were complete failures.

The reproductive efficiency of the Tree Swallows is summed up in the following table:

Number of eggs laid	278
Eggs destroyed by natural enemies	16 (5.7%)
Eggs deserted by parents, cause unknown	29 (10.4%)
Eggs broken in handling	2 (.7%)
Eggs sterile	38 (13.6%)
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Eggs which failed to hatch	85 (30.6%)
Nestlings killed by exposure or starvation	
owing to weather	29 (10.4%)
Nestlings smothered by larger young	
in nest with them	7 (2.5%)
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Young died	36 (12.9%)
Number of eggs laid that failed to produce	
young that flew away	121 (43.5%)
Number of young raised	157
REPRODUCTIVE EFFICIENCY	56.5%

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