ENEMIES AND SURVIVAL RATIO OF THE TREE SPARROW[1]

By A. MARGUERITE BAUMGARTNER[2]

I. ENEMIES

FEW birds die of old age. Man seeks some for food or plumage or to protect his "interests"; some fall prey to predacious birds or mammals, to parasites, or to the elements. Many drop by the wayside in the long migrations; many never live to make the first flight. In the following paper an attempt has been made to list and evaluate the known forces which affect the populations of the Tree Sparrows.

Man—The first destructive agent, man, is probably of negligible importance to the Tree Sparrow. This bird is too small for game, its habits in winter are entirely harmless if not actually beneficial, and in summer it nests beyond the economic considerations of civilization. Chapman's (1933) list of the birds seen on ladies' hats in an hour's walk on Fifth Avenue about 1885 includes two Tree Sparrows among forty species, indicating that even this bird was not entirely immune from such attack, but since the days of legal protection this factor is, of course, non-existent. Lighthouse casualties, for which man is indirectly responsible, occasionally occur. Two are recorded by Snyder and Logier (1931) during the spring migration of 1930. Miss Phœbe Knappen, from her census of the birds killed at the Washington Monument, tells me that Tree Sparrows have never been taken there, possibly because of the downtown location of the monument.

Predators—Predacious animals undoubtedly take their toll of the population. A. A. Allen's list (1909) of species destructive to the Red-wing would be fully as applicable to the Tree Sparrow found in like situations: mink, weasel, and also the following birds— Marsh, Sharp-shinned, Cooper's, and Pigeon Hawks. Sutton (1928) reports three instances of Tree Sparrow remains found in Sharp-shinned stomachs. Bendire (1888 and '89) reports depredations by Screech and Pygmy Owls in the West. Shrikes and Squirrels frequently find banding stations and cause the death of

birds in traps, chiefly from fear. The common house cat probably causes as many fatalities as all the remaining predators combined.

On the breeding grounds, however, the Tree Sparrow is unusually free from such enemies. Beyond the domain of the domestic Cat, the wild animals consist of a few Weasels, Foxes, Red Squirrels, and Hawks, and the tremendous numbers of the Tree Sparrow population plainly indicate that these do not constitute a serious menace. There are no snakes there, and few Crows and Jays. The Lemming (*Dicrostonyx richardsoni*) may be a disturbing factor when abundant. In 1933, at Churchill, Manitoba, I caught one in the act of tearing up a nest. The nest, however, was not yet completed, so that he was obviously after neither eggs nor birds, and this may represent merely a chance occurrence. When frightened away he never returned; the bird remade her nest and raised her family undisturbed.

Competitors—The presence of competitors for nesting territory is again a negligible factor. The North is still free of those pests the English Sparrow and the Starling, whose pugnacity drives away our native songbirds in the States. Those cheerful little scrappers of garden and marshes, the Wrens, are likewise absent. The principal inhabitants of the scrubby willows of the North are White-Crowned, Savannah, Fox, and Harris's Sparrows and Redpolls. Among these, the Tree Sparrows maintain most amicable relations, often nesting within a few feet of them.

Social Parasites—Parasites are likewise no problem. The Cowbird, whose habits are a menace to the more southern birds, does not invade the nesting grounds of the Tree Sparrow...

Parasites—Ectoparasites are relatively few. Of some six hundred specimens carefully inspected, including both winter and breeding birds, many were entirely free and none harbored more than three or four of the larger biting lice or a scattering of mites about the head. Dr. Francis H. Wilson, of Tulane University, New Orleans, has kindly sent me a list of all known ectoparasites of many of the sparrows. Those found in the Tree Sparrow are as follows, adding one new form to the list given by Peters (1936):

> *Analgopsis* sp.
> *Dageerella vulgata* (Kell.)   } in common with many other
> *Philopterus subflavescens* Geoff. } small birds of various families.
> *Ricinus diffusus* (Kell.) or
>   *melospizæ* (McGregor)

Thus far the subject has dealt only with adult birds. Of twenty-six nests observed at Churchill in 1933 and 1934 none showed evidence of infestations, and thirty-eight young ranging from ten days to molting birds in almost fully adult plumage seemed to be quite free from lice.

Endoparasites were occasionally found in the form of nematode worms within the stomach or the body cavity. Two from Churchill

were identified at the United States Biological Survey as *Diplotriæna* sp., probably *D. pungens* (Cottam, corres.).

Minor Accidents—A number of deformities noted at banding stations on otherwise healthy birds indicate that they have the capacity to overcome minor accidents. Mrs. J. S. Chamberlain writes me of one Tree Sparrow which was blind in one eye; Mr. R. S. Davis (corres.) of one without an upper mandible; Mrs. R. Caughey (corres.) of a one-legged bird which visited her station for two years. Mrs. H. D. Thorp finds frequent evidence of legs having broken and healed, and discusses in detail the healing of a deep head wound (Thorp, 1929).

Several tailless birds have been observed in the field and about the banding station, apparently suffering no disadvantage, though the loss would probably impede extensive flight. Two birds handled in 1936 offer incomplete evidence of the rate of feather-renewal. Both, when first captured, lacked most of the tail-feathers. In nineteen days the new feathers of one bird were over half grown (38 mm.); the other in fourteen days had quills only 8mm. long.

Elements—The most serious enemies of this species are the elements—snow, storms, and sudden cold spells, especially during the long migrations. In summer the nesting season is not begun until the weather has become more or less stabilized, thereby largely elminating the danger of loss of early nests. The earliest egg, for example, of which I have a record at Churchill was laid on June 11, 1933, the last day on which there was any snow that season. An occasional storm, however, is never really surprising in the North, and Dr. Sutton (1932) records a severe blizzard at Churchill on June 18, 1931, which undoubtedly destroyed innumerable nests.

In winter there is more danger from excessive snow than from cold. While the birds can withstand temperatures 20° and 30° below zero, they cannot survive if their food-supply is buried. Not only must they glean enough for the day's activities, but they must be able to fill their crops to capacity for the long hours of darkness. It is interesting to correlate the severity of the season with the abundance of this species in different parts of its range. Thus, for example, Mr. W. E. Saunders writes me that this species was very scarce during the excessively severe winters of 1933–34 about London, Ontario, near the northern limit of its range; while Wilson (1922) reports their initial entry into Bowling Green, Kentucky, on the southern border during the hard winter of 1917–18. Through the Middle West their center of abundance is estimated at central Iowa in mild seasons; in winters of severe storms and heavy snows, the bulk settles farther south, in central Missouri, and the birds are found much more commonly in Ohlahoma and Texas.

It is during the long migrations, however, that the Tree Sparrow is in greatest danger. A late traveller in the fall, an early one in spring, he has to run the gantlet of the equinoctial storms at both

seasons. Forbush (1923) records a heavy storm and cold snap on April 22d, after which many were picked up dead or in weakened condition, many others caught by cats, crows, etc., others killed by flying into buildings. John Burroughs, in his "Wake-Robin", after referring to the exhaustion of the birds' supply of fat during this winter and the unusual demands on their vitality caused by the sudden and severe changes in the weather at that season, says of the Tree Sparrow: "Among a troop of Canada Sparrows which I came upon one March day, all of them evidently much reduced, one was so feeble that I caught it in my hand." An idea of the magnitude of the destruction caused by storms to birds in migration is given by W. E. Saunders (1907), who counted the dead birds along the shore of Lake Huron after a severe snowstorm on October 10th. In three hours 358 Tree Sparrows were counted.

SURVIVAL RATIO

The relative importance of many of these destructive agencies can only be surmised. However, if known factors included the nest mortality, the proportions between adult and first-year birds during the fall and winter, and return ratios over a period of years at winter banding stations, it may be possible to calculate the potential life of the Tree Sparrow and to evaluate the factors that limit it.

Nest Mortality—Of 75 eggs laid in the 16 nests studied at Church- ill, Manitoba, 5 eggs were infertile, 9 were deserted (females probably destroyed), and in 2 others the young died the day they hatched, making a total nest mortality of 21.33 per cent. The 14 remaining broods were raised successfully, and there are no records of further casualties before the migration. If these figures can be considered representative, the proportion of young to adults stands 59 : 30, practically a two-to-one ratio.

The number of non-breeding birds might alter this proportion somewhat, but they are believed to have been relatively scarce, as no flocks were observed in summer and most of the birds seemed to be paired and occupied with domestic cares. During midwinter and the early spring migration there is an unequal number of males and females, as brought out in a previous paper (Heydweiller, 1936). This was explained by the fact that the females winter farther south. During the fall, however, although the sexes were obviously travelling together, males exceeded females 7 to 5, a ratio which is probably fairly stable. These extra males, comprising 16 per cent of the total population, may represent the proportion of non-breeding birds.

Proportions of Young and Old—The age of winter Tree Sparrows can be determined definitely only by examination of skull and gonads. The collection of specimens at Ithaca, New York, during the winter of 1934–35 revealed the following proportions:

	♂ *Ad.*	♂ *Im.*	♀ *Ad.*	♀ *Im.*
Oct. 29—Dec. 17.........	33	40	21	32
Jan. 3—Mar. 20...........	48	50	indistinguishable	

The numbers of immatures and adults thus show a shift from the summer 2 : 1 ratio to a proportion by early fall of 3 : 2 and finally during the winter to an almost equal number of old and young birds, indicating that the span of life of at least 50 per cent of this species is less than six months.

Return Ratios at Banding Stations—We may now turn to banding records to determine what share of the remainder survive the rigors of winter, the spring migration, another nesting season, and yet another fall migration. In order to proceed with these figures the faulty but necessary assumption must be made that birds are banded in their first year. During the 1933–34 season at my stations 40.3 per cent of the 1933 birds were recaptured. This figure for two reasons is somewhat higher than first-return ratios at most stations: (1) it is based upon winter residents only; and (2) several substations were in operation which caught a number of birds that did not return to the trap where banded. Consequently the figure is believed to be more nearly the true survival ratio, though it also may be too low.

From six stations whose banding records extend over four or more years I have obtained survival figures for this species as indicated in the accompanying Table 1. Birds that returned after missing a year were counted for both years, since obviously they were alive. The large numbers of migrants at some of the stations greatly lower the first-return ratios, since the vast majority of returning individuals are regular residents of the vicinity. For this reason the percentage of survivors for each year is deduced from the number that returned the season just preceding.

TABLE 1

SURVIVAL RATIO OF TREE SPARROWS AS INDICATED BY
RETURNS TO BANDING STATIONS

Station	Total	Percentage of Birds Returned from Preceding Season						
		1st yr.	2d	3d	4th	5th	6th	7th
A. C. Fraser......	347	20.0	50.9	34.0	58.3	14.3	...	...
W. E. Lyon......	560	12.3	37.7	42.3	18.2	0.0	0	0
Smiley Bros.......	142	30.9	36.3	31.2	40.0	0.0	...	...
O. L. Austin......	582	15.9	44.4	37.0	33.3	...		
R. S. Davis.......	1525	3.2	39.0	26.3	0.0	0	0	...
D. Baldwin.......	437	9.2	50.0	36.5	20.0	50.0	50.0	100.
Average per cent...		15.2	43.1	34.5	28.3	16.1	50.0	100.0
Heydweiller......	62	40.3						

(... indicates station not in operation.)

Substituting the more representative return ratio of 40.3 per cent from my station for the first year, we can then see a steadily decreasing proportion of survivors after the second year, until by the fifth year there is but a handful remaining, which may live one or two years longer (indicated by the sudden rise in the percentage). Fourth year birds are uncommon, but not rare. Birds older then this are decidedly unusual, and of the thousands upon thousands of this species that have been banded, only fifteen records could be found in the literature of individuals over four years old. These are distributed as follows (for details see Table 2):

Fifth-year returns   —6 birds
Sixth-year returns   —6 "
Seventh-year returns—2 "   (banded by Miss D. Baldwin, Hardwick, Mass.,) and F. B. White—*Bird-Banding*, 1934)
Eighth-year returns —1 "   (B. S. Bowdish, Demarest, New Jersey; bird at least eight and one-half years old when last taken)

TABLE 2
RETURNS OVER FOUR YEARS OLD

Fifth Year
2 by D. Baldwin (Corres.)
1 by A. C. Fraser, Ithaca, New York (files)
1 by Goellner (1928—Ages of Tree Sparrows, *Bulletin N. E. B. B. A.*, 4 (2) 69)
1 by Middleton (1935, *Bird-Banding*, 6 (2) 68)
1 by Wharton (1933), *Bird-Banding*, 4 (2) pp. 100 and 107)

Sixth Year
1 by Burtch, Branchport, New York (files)
1 by Middleton (1935, *Bird Banding*, 6 (2) 68)
2 by Wharton (1933, *Bird-Banding*, 4 (2) pp. 100 and 107)
2 by White (1934, *Bird-Banding*, 5 (4) 191)

Seventh Year
1 by D. Baldwin (corres.)
1 by White (1934, *Bird-Banding*, 5 (4) 191)

Eighth Year
1 by Bowdish (corres.)[1]

[1]If any readers have additional longevity records, the author would be more than pleased to hear of them.

SUMMARY

With few enemies beyond the occasional predator, the chief limiting factors in Tree Sparrow abundance are the elements, particularly in migration and in severe winters. As a summary of the foregoing material, let us compute the fate of a potential 750 eggs from 150 nests of the Tree Sparrow. Recalling the nest mortality of 21.3 per cent, then

78.7 per cent survive the nestling period   = 590 birds
50 per cent of these 590 survive the first migration
  and winter   = 295 birds (which presumably live until spring)

Assuming that the dangers of spring and fall migration are equal after the first journey, then of the 60 per cent mortality from first

to second winter, 30 per cent may have occurred in spring and 30
per cent the next fall, so that

70 per cent of these 295 return north to nest   = 207 birds, and
40 per cent of the 295 make first return-W   = 119 birds

Now following the winter-to-winter survival figures obtained from
the banding records:

43 per cent of these 119 birds make second return-W = 51 birds
34 "   "   "   "   51 "   " third   "   " = 18 "
28 "   "   "   "   18 "   " fourth   "   " = 5 "
16 "   "   "   "   5 "   " fifth   "   " = 1 or 2 birds.

By the sixth summer only one old veteran remains, who may sur-
vive another year or two.

Of the adults which reared these 590 birds, the original 150 pairs
may be increased by a probable 16 per cent of non-breeding birds,
making a total of 348 birds. Since the majority of these are in their
second or third season, with approximately a 60 per cent death
rate from year to year 139 will return for the next season of nesting.
These are joined by the 207 survivors of the first-year birds to make
a summer population of 346 individuals as compared with the 348
of the season before, and the balance of nature, if these figures are
properly interpreted, is admirably maintained.

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SOME LONGEVITY RECORDS OF WILD BIRDS

By MAY THACHER COOKE

BANDING returns are furnishing many data regarding the
longevity of wild birds. Many records have been published of the
length of time that birds have lived in captivity, but now, for the
first time we begin to get some idea of how long birds can live in
their wild state. Only through banding can this information be
obtained.

The present paper is only a cursory study of the returns that have
been received in the last three years, and does not include any duck
records, those being a separate study. No birds less than five
years old at the latest date of recovery have been included, and no
attempt has been made to complete the records of returning
individuals. In a few instances the entire record has been given on
the last return card submitted.

As would be expected, larger numbers of long-lived individuals
have been found among the species that trap readily. The list is
remarkable as much for the species not included as for those that
are. No Song Sparrows and few Robins are included in the present
list, though both species have been banded in large numbers. It
will be noted that all the returns listed for White-throated Sparrows
are of winter birds. Although thousands of this species have been
banded while in migration, there are few returns except of birds
banded on their wintering grounds.

In previous papers of this series will be found other long-time
records, notably three for the Osprey, of 21, 20, and 8 years, re-
spectively, published in the January, 1936, issue of *Bird-Banding*.

Numbers preceded by an asterisk indicate that the bird was a
young bird when banded, so that the exact age of the last return is
definitely known.

BROWN PELICAN. *Pelecanus occidentalis*
*A700348, banded at Merritt's Island, Fla., on September 5, 1929, by C. Brooke
  Worth, was found dead, with a fish fin three inches long stuck in its throat,
  at Indian River, near Vero Beach, Fla., on December 11, 1935.