

FURTHER DATA ON REMOVAL AND REPOPULATION OF
THE BREEDING BIRDS IN A SPRUCE-FIR
FOREST COMMUNITY

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DURING June and July of 1950 the writers were engaged in a study of bird populations in northern Maine in conjunction with investigations to determine the effectiveness of the breeding bird population as a controlling agent of the spruce budworm, *Choristoneura fumiferana*. The field work was started in 1949 and the current project was a continuation. The entomological phase of the study during both seasons was conducted under the supervision of Philip B. Dowden and V. M. Carolin of the Bureau of Entomology and Plant Quarantine; the initial bird population study was made by John W. Aldrich and Robert E. Stewart of the Fish and Wildlife Service (See page 471 of this issue of "The Auk").

Many data were accumulated concerning bird population dynamics during the initial study. To compare the results of the two seasons and to present other significant facts, additional data are presented here.

The study was conducted in the same 40 acre tract of spruce-fir forest that was established as the experimental area during 1949. Balsam fir, *Abies balsamea*, and black spruce, *Picea mariana*, were the predominant trees in the area and ranged from 40 to 60 feet in height. The vegetation complex was somewhat varied due to selective cutting in several small sections of the forest. This resulted in a rather dense undergrowth of conifers. Where the canopy was unbroken very little understory was present. The area was crossed by a state highway.

An attempt was again made to eliminate, or to reduce drastically, the bird populations on the experimental area which was then closely studied to determine any difference in the numbers of budworms. Stomachs of most of the birds collected were preserved, and an analysis of their contents was made by Robert T. Mitchell of the U. S. Fish and Wildlife Service.

Prior to the collecting period a series of bird censuses was conducted to determine the breeding bird population of the area. The spot-mapping method (Aud. Field Notes, 4 (2): 185-187, 1950) was utilized for this phase of the work. A total of 28 censuses involving 45 man-hours was taken from June 6 to June 13, inclusive. Most of the trips were made between 6:00 a. m. and 10:30 a. m. with the exception

TABLE 1
ADULT BIRDS REMOVED FROM EXPERIMENTAL AREA, SHOWING TENDENCIES OF THE VARIOUS SPECIES TO MOVE INTO THE AREA

	Breeding population (males)		Breeding birds removed				Ingressing birds removed				Undetermined birds removed		Total collected	
	1949	1950	Males		Females		Males		Females		1949	1950	1949	1950
			1949	1950	1949	1950	1949	1950						
Bay-breasted Warbler, <i>Dendroica castanea</i>	35	34	35	34	9	16	46	48	—	—	—	—	90	98
Magnolia Warbler, <i>Dendroica magna</i>	24	18.5	24	17	6	6	12	—	—	—	—	—	42	23
Cape May Warbler, <i>Dendroica tigrina</i>	12	12	12	12	4	3	11	2	—	—	—	—	27	17
Blackburnian Warbler, <i>Dendroica fusca</i>	9	13	9	13	1	5	6	—	—	—	—	—	16	18
Myrtle Warbler, <i>Dendroica coronata</i>	8.5	10	8.5	10	5	5	20.5	17	—	—	—	3	34	35
Olive-backed Thrush, <i>Hylocichla ustulata</i>	7.5	13.5	7.5	13.5	5	8	3.5	1.5	—	—	2	—	18	23
Slate-colored Junco, <i>Junco hyemalis</i>	5	7.5	5	7.5	5	3	8	7.5	—	—	6	3	24	21
Yellow-bellied Flycatcher, <i>Empidonax flaviventris</i>	4	3.5	3	3.5	—	2	—	2.5	—	—	4	—	7	8
Golden-crowned Kinglet, <i>Regulus satrapa</i>	4	8.5	4	8.5	4	5	—	6.5	—	—	4	—	8	24
Nashville Warbler, <i>Vermivora ruficapilla</i>	4	4.5	4	4.5	—	4	2	4.5	—	—	—	—	6	13
Red-breasted Nuthatch, <i>Sitta canadensis</i>	3.5	2	3.5	1	3.5	—	.5	—	—	—	1	—	11	1
White-throated Sparrow, <i>Zonotrichia albicollis</i>	3.5	5	3.5	5	3.5	3	1.5	2	1.5	—	3	2	13	12
Solitary Vireo, <i>Vireo solitarius</i>	3	1.5	3	1.5	1	1.5	1	6.5	—	—	1	—	6	10
Tennessee Warbler, <i>Vermivora peregrina</i>	3	3	1	3	1	3	—	2	—	—	—	—	2	10
Brown-capped Chickadee, <i>Parus hudsonicus</i>	2.5	1	2.5	1	2.5	1	.5	1	1.5	1	5	2	12	6
Purple Finch, <i>Carpodacus purpureus</i>	2.5	2	2.5	2	2.5	2	3.5	37	.5	16	7	7	64	64
Black-capped Chickadee, <i>Parus atricapillus</i>	2	—	2	—	—	—	1	3	—	—	4	—	9	4
Ruby-crowned Kinglet, <i>Regulus calendula</i>	2	2	2	2	1	2	—	3	—	—	—	—	3	8
Winter Wren, <i>Troglodytes troglodytes</i>	2	1.5	2	1.5	1	1.5	—	3.5	—	—	—	—	2	7
American Robin, <i>Turdus migratorius</i>	2	4	2	4	2	2	12	3	9	.5	4	7	29	16
Hermit Thrush, <i>Hylocichla guttata</i>	2	1	2	1	—	1	2	2	1	—	—	—	4	5
Blue Jay, <i>Cyanocitta cristata</i>	1.5	1.5	1.5	1.5	1	1	.5	3.5	—	—	—	—	3	6
Red-eyed Vireo, <i>Vireo olivaceus</i>	1.5	1	1.5	1	—	1	5.5	5	—	—	—	—	4	8
Oven-bird, <i>Seiurus aurocapillus</i>	1.5	—	1.5	—	1	—	1.5	—	—	—	—	—	4	4
Northern Flicker, <i>Colaptes auratus</i>	1	.5	1	.5	—	.5	1	2.5	—	—	—	—	2	4
Parula Warbler, <i>Parula americana</i>	1	2	1	2	—	—	3	3	—	—	—	—	4	6
Canada Warbler, <i>Wilsonia canadensis</i>	.5	—	.5	—	—	—	.5	1	—	—	—	—	1	4

TABLE 1—Continued

	Breeding population (males)		Breeding birds removed				Ingressing birds removed				Undetermined birds removed		Total collected			
	1949	1950	Males		Females		Males		Females		1949	1950	1949	1950		
			1949	1950	1949	1950	1949	1950	1949	1950						
Ruffed Grouse, <i>Bonasa umbellus</i>	+	+	—	—	—	—	1	—	—	—	—	—	—	—	2	—
American Crow, <i>Corvus brachyrhynchos</i>	+	+	—	—	—	—	1	1	1	1	—	—	—	—	2	2
Chestnut-sided Warbler, <i>Dendroica pensylvanica</i>	+	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—
Hairy Woodpecker, <i>Dendrocopos villosus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Gray Jay, <i>Perisoreus canadensis</i>	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	3
Veery, <i>Hyllocichla fuscescens</i>	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	15
Cedar Waxwing, <i>Bombycilla cedrorum</i>	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	2
American Redstart, <i>Setophaga ruticilla</i>	V	—	—	—	—	—	6	15	2	6	2	11	—	—	10	32
Pine Grosbeak, <i>Pinicola enucleator</i>	V	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Eastern Goldfinch, <i>Spinus tristis</i>	V	—	—	—	—	—	3	2	2	1	1	—	—	—	4	3
Arctic Three-toed Woodpecker, <i>Picoides arcticus</i>	—	—	—	—	—	—	2	1	1	3	—	—	—	—	5	1
Chipping Sparrow, <i>Spizella passerina</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
Eastern Wood Pewee, <i>Contopus virens</i>	—	—	—	—	—	—	1	3	—	—	—	—	—	—	1	1
White-winged Crossbill, <i>Loxia leucoptera</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Bronzed Grackle, <i>Quiscalus quiscula</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7
Least Flycatcher, <i>Empidonax minimus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Black and White Warbler, <i>Mniotilta varia</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Sharp-shinned Hawk, <i>Accipiter striatus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
TOTAL	148	154	144	150.5	60	77.5	160	201.5	22	48.5	34	49	420	528		

A "+" sign indicates that less than 0.25 of a territory was present on the area and "V" denotes those species nesting in the general vicinity but only occasionally recorded on the area.

of a few which were taken during the late evening when the thrushes are usually more vocal.

From June 14 through June 10, a total of 322 man-hours was spent in a concentrated effort to eliminate as many birds as possible from the area by shooting with a 16-gauge shotgun. A combined total of 527 adult birds was taken during 1950, as contrasted to 420 collected the previous year, an increase of 107 individuals. Combining the two seasons gives a grand total of 947 birds removed from the 40-acre tract during the two consecutive breeding seasons. A combined total of 49 collecting days was involved.

The breeding population was remarkably similar during the two consecutive nesting seasons (Table 1). A slight increase in overall populations was apparent during the second season and was noted in two additional check areas studied, as well as in the experimental plot. Whether this increase was due to an increase in the budworm populations is not known. It is interesting to note, furthermore, that no nestlings, except those of the American Crow, Golden-crowned Kinglet, and Red-breasted Nuthatch, were raised on the area during 1949. The effect of the collecting during 1949 was not apparent, in any way, on the breeding population in the experimental area, which indicated the same population tendencies as did the check areas. The species composition and populations of the major breeding species were quite similar (Table 1), with the exception of the Olive-backed Thrush which almost doubled in density (7.5 to 13.5 pairs) over 1949, and the Magnolia Warbler which dropped from 24 to 18.5 pairs on the 40-acre tract.

During the 1949 studies about two times as many males were removed as were originally found with established territories. The 1950 season produced two and a quarter times as many. This corroborates the data of Stewart and Aldrich who concluded that a large surplus "floating" population was apparently present. Practically all of the 1949 males were territorial birds, while in the following season many more wandering non-territorial males were taken. Moffat (1903) suggested that there is a large reserve of unmated birds of both sexes ready to replace losses of birds on territories. Nice (1937), on the other hand, found very little evidence of this phenomenon with Song Sparrows; only two cases were noted of banded males serving as a reserve supply for females in need of mates. In his study of the bird populations during a spruce budworm outbreak in Ontario, Kendeigh (1947) found a larger number of birds recorded in some areas that remained to nest, citing one instance of five extra Bay-breasted Warblers in an area where 18 pairs had become established

for nesting. He further suggested that these birds, particularly younger individuals, tend to shift around and occupy various habitats to the extent of the attractiveness of the habitat, nesting only if suitable conditions prevail. This is essentially the motivating factor responsible for ingress. Speaking in relation to insects, Thompson (1930) suggested that if the population is smaller than the area might support, the gaps soon fill in from the outside. It is apparent, then, that the presence of this reserve or surplus of individuals has long been recognized, but its extent, as compared to the established breeding populations, is little understood.

Considering only the breeding population of the experimental area, an attempt was made in Table 1 to estimate the extent of ingress for the various species during the two years. All birds removed in excess of the pre-collecting population, where numbers were obtained by censusing, were considered as ingressing individuals. In cases where the breeding population (Table 1) was expressed by a decimal figure, and all these individuals were removed, instances of fractional numbers of birds collected are listed. This, of course, does not mean that a half-bird was collected but indicates that either one or both sexes of the pre-collecting component was completely removed. The possibility exists, also, that a few of the original occupants may have deserted their territories and were not collected, thus introducing a slight discrepancy in this ingressing component. The picture is somewhat further distorted by species such as the Purple Finch and Cedar Waxwing which invaded the area in considerably larger numbers than during the previous season. This can perhaps be attributed first to the somewhat abnormal weather conditions during the current study, which retarded the budworm activity to the extent that collecting had to be continued two days longer, and secondly to the fact that these species are subject to sporadic movements. By the end of the collecting period the Cedar Waxwings were commencing preliminary nesting activities in increasing numbers. Moreover, an early warm spell during late May stimulated the early-nesting Purple Finches to breed even earlier, with the result that many family flocks constantly invaded the area during the last few days of the collecting period. For the majority of the remaining species, however, a slight increase was also indicated. Of 13 species showing no increase, about half were less abundant on the area during the current season. Due to weather conditions indicated above, some 12 species managed to fledge young, as compared to only three species during the preceding year.

The problem of whether the "floating" populations, which were in evidence during the two seasons, were made up of a surplus of unmated birds or whether, in effect, migration was still underway at the time must be considered. It is conceivable that some individuals of a species could be nesting while migration of that species was still in progress (Kendeigh, 1947). In "A Summary of Spring Migration 1889-1938" (U. S. Fish and Wildl. Serv. Mem. No. 6, 1940) the average date of earliest arrivals during that 50-year period for the nesting species of Scotch Lake, New Brunswick, ran from three to four weeks earlier than the date collecting was commenced on the experimental area at Fort Kent. In fact, intensive ingression did not begin until about one week after collecting began or until June 21. This meant at least a 27-day differential between the average earliest date of arrival at the Scotch Lake area and the date of the initial intensive period of ingression at Fort Kent. During the 1949 collecting period no appreciable difference or change in the rate of ingression was noticeable. Cooke (1929) recorded certain migrating species as lingering as long as six weeks. Trautman (1940) confirmed this fact. It must be remembered, however, that these are migrating species and as they get farther northward the migration is speeded up as nesting activities become more "urgent" (Allen, 1930). It is the authors' belief, on the basis of the circumstances mentioned above and of field observations, that migration for the most part was negligible at the time collecting had begun and that the great number of birds removed represented an ingress rather than migratory activity. The unusually large number of ingressing individuals recorded July 5 was not likely to have been the result of migration at that date.

As noted previously, the ratio of males collected to the number of territorial males on the area prior to the collecting period was found to vary considerably with different species. The Red-eyed Vireo again showed the greatest difference, with six times as many males collected as were present originally. The ratio for this species in 1949 was about five to one. In so far as the five most abundant warbler species were concerned, considerable differences were noted in some cases. The comparative ratios are listed as follows with the 1949 figure mentioned first: Magnolia Warbler, 1.9-1.0; Blackburnian Warbler, 1.7-1.0; Cape May Warbler, 1.9-1.1; Bay-breasted Warbler, 2.3-2.3; and Myrtle Warbler, 3.4-2.7. All species, with the exception of the Bay-breasted Warbler, showed a marked decrease in the number of males taken per "pre-collecting" male present. Whether or not this significant decrease is due to the collecting of the previous year, which may have created an excessive unreplenished drain on the

surplus population, is hypothetical. However, the individuals occupying the niches made available by the 1949 collecting and which comprised part of the breeding population of the 1950 season probably were members of this floating aggregation. Once they found niches the following year and vacated the ranks of the reserve population, their change of status diminished the numbers of this reserve supply of potential breeding birds, which may not be as readily replenishable. The effect of the concentrated removal then is noticeable in the "floating" population which may act as a buffer during catastrophic periods, but which would be seriously affected by a continued series of unfavorable circumstances that demanded more replacements than could be produced by the reserves. Only continued longer term studies of this nature could provide a more enlightened picture of the overall effect on the bird populations as a whole. The fact that the most abundant species, the Bay-breasted Warbler, appeared to be unaffected indicates that a more substantial number of non-breeding individuals of the species may be available and only a continued unfavorable drain on the supply would appear noticeable.

A total of 108 more birds was collected during the 1950 season, including 48 more males and 44 more females. The presence of substantially larger numbers of individuals of the sporadically occurring species (Purple Finch, Cedar Waxwing, White-winged Crossbill) during the current season accounts largely for the difference. Some 16 more, unidentified as to sex, individuals were taken. This increase of 48 more males collected probably is due to the presence of the higher population level and two collectors on the area during the 1950 study. The increase in the number of females taken can be partially accounted for by the additional collector or it can more probably be attributed to the advanced stage of nesting during the latter study. Nesting activities were considerably advanced over the 1949 season, by at least a week, due to the extended warm spell in late May. Females are less inclined to desert and leave the area as the nesting season advances. Therefore, the disturbance created did not affect them as drastically as it would have had the nesting not been so far along; thus they remained on the area and were subjected to collecting for a longer period of time.

The overall sex ratio in the birds collected varied considerably between the two seasons. In 1949 there was a 3.7 to 1 ratio of males to females taken, as contrasted to the 2.8 to 1 ratio existing in 1950. The difference is due, primarily, to an increase in the numbers of females collected in 1950.

The sex ratios varied greatly from species to species, as was found by Stewart and Aldrich, with the greatest disparity occurring in the warblers (Parulidae) and vireos (Vireonidae). A total of 226 warblers was collected, of which 49 (21 per cent) were females. This figure is higher than the 13 per cent determined during the 1949 season for the same group of birds.

As a means of comparing the sex ratios, the individuals of the six most abundant species during both seasons are tabulated as follows with the first set of numbers indicating the 1949 ratio: Blackburnian Warbler, 15 : 1 and 3 : 1; Bay-breasted Warbler, 9 : 1 and 5 : 1; Magnolia Warbler, 6 : 1 and 3 : 1; Cape May Warbler, 6 : 1 and 5 : 1; Myrtle Warbler, 6 : 1 and 6 : 1; and Olive-backed Thrush, 2 : 1 and 2 : 1. Each, with the exception of the Myrtle Warbler and Olive-backed Thrush, shows a distinct reduction from the 1949 figure as regards the number of males. It is not likely, moreover, that the differences in the ratios listed are due entirely to variation in the conspicuousness of the sexes.

The population trend on the experimental area during the collecting period (Table 2) was subject to considerable fluctuation. An attempt was made to maintain the population at a minimum low level. However, it was found impossible to reduce the total numbers below 20 per cent of the original population and it was difficult to hold at that concentration. Much of the ingress occurred during the night or early morning. The behavior of the new males was distinctly different from that of males having had territories for a longer period of time. The songs of the new arrivals were louder and uttered more frequently, and the individuals were more active in inspecting the territory. Their activity was similar to the characteristic behavior of spring arrivals on the breeding ground. The rôle of ecological niches in the local distribution of breeding birds becomes rather apparent. The newcomers established territories in the same areas as their predecessors.

Tabulations of individuals recorded on six weekly census trips (June 21, 28, and July 5) during the collecting period are presented in Table 2. The censuses were made in the early morning and include the newly ingressed individuals as well as those birds surviving the collecting of the preceding day. To gain a more accurate picture of the stable population present on the area, all males collected on the census days were subtracted from the number of territories recorded on the same day. By combining this figure with daily observation notes, a somewhat reliable estimate of the birds persisting on the area could be made (Table 2). On the July 5 census a substan-

TABLE 2
POPULATIONS ON THE EXPERIMENTAL AREA BEFORE, DURING, AND AFTER THE
COLLECTING PERIOD, JUNE 14-JULY 10, SHOWING THE NUMBER OF
ADULT BIRDS REMOVED ON THE CENSUS DAYS

<i>Species</i>	<i>Pre-collecting June 13</i>	<i>Collecting period</i>			<i>Post-collecting July 11</i>
		<i>June 21</i>	<i>June 28</i>	<i>July 5</i>	
Bay-breasted Warbler	34	9	8	14	5
Magnolia Warbler	18.5	6	5	5	6
Olive-backed Thrush	13.5	2	3	9	5
Blackburnian Warbler	13	2	3	9	5
Cape May Warbler	12	4	1	4	—
Myrtle Warbler	10	3	2	3	1
Golden-crowned Kinglet	8.5	1	5	1	1
Slate-colored Junco	7.5	3	3	—	2
White-throated Sparrow	5	3	2	2	—
Nashville Warbler	4.5	3	4	3	1
American Robin	4	1	4	2	2
Yellow-bellied Flycatcher	3.5	1	—	2	1
Tennessee Warbler	3	—	—	1	—
Purple Finch	2	—	2	2	2
Ruby-crowned Kinglet	2	—	—	—	—
Parula Warbler	2	1	2	1	2
Red-breasted Nuthatch	2	—	—	—	—
Solitary Vireo	1.5	—	—	1	—
Winter Wren	1.5	2	3	3	4
Blue Jay	1.5	1	—	—	—
Brown-capped Chickadee	1	—	—	1	1
Hermit Thrush	1	—	1	—	—
Wood Pewee	1	—	—	—	1
Red-eyed Vireo	1	—	1	—	—
Yellow-shafted Flicker	.5	—	1	3	—
Black-capped Chickadee	+	—	—	2	—
Canada Warbler	+	—	—	1	1
Ruffed Grouse	+	—	—	—	—
American Crow	+	—	—	1	—
Chestnut-sided Warbler	+	—	1	—	—
Brown Creeper	V	—	—	—	—
Hairy Woodpecker	V	—	—	—	—
Gray Jay	V	—	1	—	—
Cedar Waxwing	V	1	2	1	—
American Redstart	V	—	—	—	—
Evening Grosbeak	V	—	—	—	—
Pine Grosbeak	V	—	—	—	—
American Goldfinch	V	—	—	—	—
Arctic Three-toed Woodpecker	V	—	—	—	—
Northern Yellow-throat	V	—	—	—	—
Broad-winged Hawk	V	—	—	—	—
Black and White Warbler	V	—	—	—	—
Indigo Bunting	V	—	—	—	1
White-winged Crossbill	—	—	—	—	4
TOTAL MALES RECORDED IN CENSUS	154	42	52	63	40
TOTAL MALES REMOVED ON CENSUS DAYS	—	9	21	16	—
NET NUMBER OF MALES REMAINING	—	33	31	47	—
PER CENT OF ORIGINAL POPULATION REMAINING	—	21	20	30	—

tially larger number of territorial males was recorded, which was due to the unusually large number of ingressing individuals appearing on the area during the two preceding days. On these two days a total of 69 birds was removed, of which 47 were collected on July 4, the day before the census. The total numbers of birds collected during the periods between the census days are as follows: June 14 to 20, 156; June 22 to 27, 114; June 29 to July 4, 123; and July 6 to 10, 116. The first figure (156) represents the number required to reduce the population to the 20 per cent level while the remaining figures (114, 123, and 116) indicate the weekly removal rate to keep the population at that level.

SUMMARY

The population of territorial male birds in a 40-acre tract of spruce-fir forest in northern Maine was 148 pairs during the 1949 season, June 6-14, and 154 pairs during the 1950 season, June 6-13. An attempt was made to remove, or to reduce drastically, the bird population with the use of fire-arms. By this means the population was reduced to 21 per cent by June 21, 1950, and held at this level by continuous collection of new arrivals until July 11, 1950. A total of 528 adult birds was collected, 108 more than during the previous year.

A rapid influx of new males and the establishment of the same territories as used by their predecessors were very much in evidence. Apparently the carrying capacity of this Spruce-Fir forest was not sufficient to meet the combined requirements of all the males. This, therefore, resulted in a surplus population of birds unable to establish territories and to mate. This surplus acted as a reserve supply to fill in or replenish gaps when an area was depleted. The ratio of males collected to the number of territorial males on the area prior to collecting was quite different for each species.

The number of adult females collected was much less than the number of males. This is due in part to the inconspicuousness of the breeding female. Forty-four more females were taken during the 1950 season than in the 1949 study. The increase can be partially accounted for by the presence of an additional collector and by the fact that nesting activities were considerably advanced due to the warm period which occurred during the latter part of May. The females were thus more attentive to nesting activities and stayed in the area longer; consequently, they were subject to collecting pressure longer in the 1950 season than in 1949.

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SOUND PRODUCTION IN PASSERINE BIRDS

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In spite of widespread popular and scientific interest in the singing of birds there is some difference of opinion with regard to the actual functioning of the vocal organ, the syrinx. The British writers, Thomson (1923) and Parker and Haswell (1940) regard the semilunar membrane as the actual sound-producing organ. Miller (1947) by experimental methods determined that in owls and some other birds sound is produced by "the vibrations—set up in loose membranes between bronchial and tracheal rings" but he ascribes the sound produced by singing birds to vibrations of the semilunar membrane. Stresemann (1934), however, asserts that in passerine birds the vibrations produced by air passing over the tympaniform membranes produce the sounds heard in song, and that in song birds the intrinsic syringeal muscles regulate the tensions of these membranes. Cole (1945) in his writing accepts the opinion of Stresemann. The purpose of this study was first, to determine by experiment the way in which sound is produced in passerine birds, and second, to determine whether the structure of the syrinx correlates in any way with the quality of the song.