

CHANGES IN BIRD LIFE IN CAMBRIDGE, MASSACHUSETTS FROM 1860 TO 1964

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THIS paper includes additional data to those presented in preliminary reports (Walcott 1953, 1959) to document the nesting bird life in a residential section of Cambridge, Massachusetts, over the past 100 years and to correlate the changes in bird life with the environmental changes associated with progressive urbanization.

Residence for 50 years on a 6-acre tract B on Sparks Street, 150 yards north and of comparable size and character to Brewster's study tract A of 1860-73 and 1900-04 (Brewster 1906: 11-15), afforded the opportunity to compile data on the summer bird life of the locality for the years 1940-43 and 1960-64 on tract B to compare with the earlier records, as well as to observe the changes in the area over half a century. Moreover constant travel throughout the city at all hours and seasons for more than 30 years provided less detailed observations sufficient to indicate that the changes in the study area reflect those throughout the residential section of the city. The wide scope of changes in bird life similar to those observed in the study area in both North America and Europe over the past 40 years (Wallace 1970, Nisbet 1971) renders this study of general interest that transcends the location and bounds of the study area.

Three criteria serve to evaluate and compare the bird life of the study periods. The number of nesting species and the ratio of nesting species to the number that occur as transients during the summer measure the quantity of breeding birds and evaluate the suitability of the area for breeding. The ratio of insectivorous migratory summer resident to seed-eating or omnivorous permanent resident species in the nesting population affords a subjective measure of the quality or character of the bird life in contrast to its quantity.

Brewster's nomenclature is followed in classifying the birds as "summer residents" for migratory insectivorous species such as the Gray Catbird and Northern Oriole which are absent in winter, or "permanent residents" for such seed-eating and omnivorous species as the Common Crow, Blue Jay, House Sparrow, and Starling, which are seen throughout the year. As a rule the nest was found for a bird to be classed as nesting, but birds accompanied by young during the breeding season are included, as the Downy Woodpecker and Purple Finch. Those accompanied by young after the nesting season are classed as transients.

Implicit in urbanization is replacement of natural habitat with hous-

TABLE 1
SPECIES NESTING IN 6-ACRE RESIDENTIAL AREA IN CAMBRIDGE¹

	1860-73	1900-04	1940-43	1960-64
SUMMER RESIDENTS				
American Kestrel (<i>Falco sparverius</i>)			n×1	T
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	1	n×1		
Black-billed Cuckoo (<i>Coccyzus erythrophthalmus</i>)	1	1		
Common Nighthawk (<i>Chordeiles minor</i>)			T	T
Chimney Swift (<i>Chaetura pelagica</i>)	1-3	T	2-3	T
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)	T	T		
Eastern Kingbird (<i>Tyrannus tyrannus</i>)	1		T	
Common Flicker (<i>Colaptes auratus</i>)	occ.n	n×1	1	T
Least Flycatcher (<i>Empidonax minimus</i>)	2-4	T		
Eastern Wood Pewee (<i>Contopus virens</i>)	1-2		T	
Tree Swallow (<i>Iridoprocne bicolor</i>)	12			
House Wren (<i>Troglodytes aedon</i>)	1-5		1	
Gray Catbird (<i>Dumetella carolinensis</i>)	1	1	1	1
American Robin (<i>Turdus migratorius</i>)	5-8	2-3	2-3	1
Wood Thrush (<i>Hylocichla mustelina</i>)			n×1	T
Eastern Bluebird (<i>Sialia sialis</i>)	1-3			
Cedar Waxwing (<i>Bombycilla cedrorum</i>)	2-3	T	T	T
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	1-2	1		
Red-eyed Vireo (<i>Vireo olivaceus</i>)	1-2	1	n×1	T
Warbling Vireo (<i>Vireo gilvus</i>)	1	T		
Yellow Warbler (<i>Dendroica petechia</i>)	3-4	1-2		
American Redstart (<i>Setophaga ruticilla</i>)		1-2		
Bobolink (<i>Dolichonyx oryzivorus</i>)	1			
Northern Oriole (<i>Icterus galbula</i>)	4-5	1-2	n×1	T
Common Grackle (<i>Quiscalus quiscula</i>)	T	T	T	T
Brown-headed Cowbird (<i>Molothrus ater</i>)	1			
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)		1-2		
Indigo Bunting (<i>Passerina cyanea</i>)	1			
Purple Finch (<i>Carpodacus purpureus</i>)	2-3	T	T	1
American Goldfinch (<i>Spinus tristis</i>)	1-3	T	T	T
Chipping Sparrow (<i>Spizella passerina</i>)	5-6	1-2		
Song Sparrow (<i>Melospiza melodia</i>)	3-4		T	T
PERMANENT RESIDENTS				
Screech Owl (<i>Otus asio</i>)		T	1	
Downy Woodpecker (<i>Dendrocopos pubescens</i>)			1	T
Blue Jay (<i>Cyanocitta cristata</i>)	occ.n	n×1	1	1
Common Crow (<i>Corvus brachyrhynchos</i>)		T	1	1
Black-capped Chickadee (<i>Parus atricapillus</i>)			1	1
White-breasted Nuthatch (<i>Sitta carolinensis</i>)			T	
Starling (<i>Sturnus vulgaris</i>)			1-3	1-3
House Sparrow (<i>Passer domesticus</i>)		1-6	1-5	1-3
Cardinal (<i>Cardinalis cardinalis</i>)				1

¹ Numbers indicate nesting pairs. T, transient during summer; occ.n, occasional nesting; n×1, nested one year during study.

TABLE 2
SPECIES NESTING AND TRANSIENT IN 6-ACRE RESIDENTIAL AREA, CAMBRIDGE¹

	Tract A Unsprayed		Tract B 50% sprayed	
	95% open 1860-73	30% open 1900-04	50% open 1940-43	15% open 1960-64
Nesting species	26	14	16	9
Transient species	2	10	10	12
% nesting : % transient	93:7	60:40	60:40	44:56
S.R. nesting species	25	12	9	3
P.R. nesting species	1	2	7	6
% S.R. : % P.R.	96:4	85:15	56:44	34:66

¹ S.R., summer resident migratory; P.R., permanent resident; tract A, Brewster's study area; tract B, Walcott's study area; % open, percentage of study area natural habitat not replaced by houses.

ing development, a process that taxes the adaptive powers of native species of birds by depriving them of their accustomed habitat, and is assessed by the percentage of the study area that remained open and undeveloped during each study period, 95% in 1860-73, 30% in 1900-04, 50% in 1940-43, and 15% in 1960-64. The study, therefore, illustrates the impact on bird life of both an increase and a decrease in the variety and amount of natural habitat in the study area.

The birds recorded on the two 6-acre study areas, tract A and tract B, during the four study periods are listed in Table 1, grouped as summer residents or permanent residents, and their incidence during each period recorded in number of nesting pairs or as transient. The data from Table 1 are classified in Table 2, according to the percentages of open areas, and the presence or absence of insecticide spray in each period.

Brewster described his first study area tract A during the years 1860-73 as follows (Brewster 1906: 11-15): "From the time of my earliest recollection to the year 1873 our home place in Cambridge comprised about six acres of smooth, gently sloping land lying at the point of intersection of Brattle and Sparks Streets, Cambridge. It was bordered along both streets by rows of tall elms growing just within the enclosing fences, while a dozen German lindens of the largest size, and probably more than a century old at the date of my birth, were grouped about the front of the house, which had been built before the Revolutionary War. The rear of the house was embowered in purple and white lilacs, behind which was an old-fashioned flower garden. Still further back were orchards of apple, pear and peach trees, besides rows of raspberry, blackberry, currant and gooseberry bushes. The unshaded portions of the grounds were devoted chiefly to mowing fields, although a generous

space was always set aside for the vegetable garden; there was also a small pasture for the cows and horses. Several of the neighboring estates were similar in character and of equal extent, while most of those scattered along the northerly side of Brattle Street, in the direction of Mount Auburn, backed on a wide expanse of open, farming country which stretched west and north to Fresh Pond and the Concord Turnpike." The residential section of the city afforded a variety and amount of natural habitat comparable to that in the Fresh Pond reservation today. The study area afforded relative sanctuary from predators compared to the outlying countryside. A few egg-collecting boys, a little indiscriminate shooting, a few cats, and the Blue Jay nesting only occasionally made a total of three predators. Under these favorable rural conditions the summer bird life was at its peak for the century with 26 nesting species, mostly in multiple pairs, and predominantly summer resident migratory songbirds (Tables 1, 2). Moreover, nesting species greatly outnumbered transients, an indication of favorable conditions for breeding.

During the interval 1873 to 1900 between Brewster's study periods, four of the acres of the first study tract were subdivided and closely built upon, thereby reducing natural habitat to 30% of the study area with loss of open field. Environmental change was not confined to the study area and Brewster wrote (1906: 10): "Although most of Cambridge is now thickly covered with houses, it possesses many more trees than it did forty or fifty years ago." In 1875, the introduced House Sparrow first nested in the study area and soon became abundant with effects on the native bird life thus described by Brewster (1906: 66): "It is probable, however, that only those of us who personally remember the conditions which existed before the sparrows came, and who actually witnessed the changes that accompanied their increase and general dispersion, can realize to the full the disastrous and far-reaching effects which their introduction has had on our native bird population.

"When the House Sparrow began to invade Cambridge, the native bird fauna of this city was rich and varied for so large and populous a place. As the alien hordes multiplied and spread, several of the indigenous species which, up to that time, had bred numerously throughout the entire city, retired first from its central portions and finally beyond its suburbs. The Bluebirds, House Wrens and Tree Swallows were the first to go, and the Eave Swallows soon followed them. So quickly and completely were these four species banished that they had nearly or quite ceased to breed anywhere in the thickly settled parts of Cambridge within ten years from the first appearance of the House Sparrows. The Purple Finches, Song Sparrows, Indigo-birds and Least

Flycatchers disappeared more slowly, but in the end almost as completely."

Forbush (1907: 370) corroborates the above and adds: "All careful observers who have watched the Sparrow ever since its introduction, and have noted the effect produced upon other birds by its presence, agree that it is pernicious." Such unfavorable reports are not confined to North America, for at Seebach, Germany, Heisemann (1912: 92) considered the House Sparrow to be thoroughly harmful. "Sparrows, though they do not directly injure other birds, interfere very much with their settling. Their wild behaviour and continued noise make other birds take a dislike to a place, and drive them away from feeding and nesting-places. Where success with nesting boxes is aimed at, the fight against sparrows must not be overlooked." Possibly the exaggerated aggressiveness of the House Sparrow, so well-documented in this country, may represent a change in behavior similar to that reported in the European Song Thrush (*Turdus philomelos*), which, when introduced into New Zealand, became carnivorous, and ate the eggs and young of native birds (Griscom 1945: 51).

The 6-acre study tract A during Brewster's second period of observation, 1900-04, was 30% open natural habitat including his half acre "garden" that was thickly planted to attract birds and surrounded by a cat-proof fence. Another 1½ acres included lawn and shade trees, and open country lay within a quarter of a mile. The four predators included the Common Crow and Screech Owl as transients, the Blue Jay that continued to nest occasionally, and the gray squirrel as resident. The change in the bird life over that of the preceding period reflects the effects of decrease in the variety and amount of natural habitat and the arrival of six nesting pairs of House Sparrows, for total nesting species and summer resident nesting species were reduced to half the number during the preceding period. Nine nesting species were lost to the study area, but six species that formerly nested had become transients during the summer, and contributed to a more even balance, 60%:40%, between nesting and transient species, evidence of impairment of the area for breeding. The continued predominance of summer resident over permanent resident nesting species indicates no fundamental change in the quality of the nesting population as a result of decrease in natural habitat and the arrival of the sparrow.

Arsenate of lead shade tree spray began city-wide in 1912, and involved half the study area until replaced by chlorinated hydrocarbons including DDT spray about 1950. The Starling appeared in 1915 and soon joined the House Sparrow as the most abundant city birds, competing with native species for hole nesting sites and for food. By 1920,

the automobile had replaced the horse in the city, and the House Sparrow population, which had depended on the oats from horse's feed bags and droppings for food, declined city-wide (Eaton 1924).

Tract B, the study area for the third period, 1940-43, comprised 6 acres at the intersection of Sparks Street and Huron Avenue 150 yards north of Brewster's tract A, and comprised 50% open natural habitat, the increase in habitat over that of the preceding period including orchard and field, both lost to Brewster 70 years before. The land was pleasingly variegated with a deep valley in the southeast corner containing a thick tangle of berry-bearing shrubs and trees, honeysuckle, crabapple, dogwood and mountain ash, with an overstory of huge old willows. There were thick border plantings of young hemlock, white pine and arborvitae, as well as a good number of century-old white pines, oaks, ash, and hawthorn here and there, as well as an old apple and pear orchard. Open country lay within three quarters of a mile. Predators were doubled in number over the first study period, 1860-73, for the American Kestrel was a frequent transient and nested at least once, the Blue Jay and Common Crow nested regularly, the Screech Owl occasionally, the gray squirrel continued abundant, and the cat was no longer excluded. The benefit from an increase in the amount and variety of natural habitat over the preceding period, 1900-04, is indicated by an increase in the number of nesting species from 14 to 16, and, as the number of transient species remained constant (Table 2), the ratio of nesting to transient species continued at 60% to 40%, evidence of the favorable effect of increase in natural habitat in neutralizing the ill-effects of insecticide spray. On the contrary, the number of summer resident nesting species declined from 12 to 9, reflecting the loss of several hitherto familiar species, and, as permanent resident nesting species increased, the nesting population became more evenly divided between summer residents and permanent residents, a change in the quality of the nesting bird life associated with the advent of arsenical spray, despite an increase in natural habitat.

It is noteworthy that the loss of such insectivorous nesting species as the Northern Oriole, Yellow Warbler, American Redstart, Rose-breasted Grosbeak, and both cuckoos had occurred by 1915, when the 6-acre tract B of my study was 90% open and afforded habitat approximating that of tract A in 1860-73, but was subject to arsenical spray. Nevertheless, the House Wren, a migratory insectivorous songbird, reappeared as a nesting species in 1935 after an absence of 60 years attributed to the advent of the House Sparrow and continued to breed in numbers throughout the residential section of the city until 1952. Its reappearance coincided with an expansion in the population of the House Wren

throughout the northeast (Griscom and Snyder 1955: 172) and may be related to the widespread decline in the House Sparrow 15 years before, and its survival may have been possible by the provision of nesting boxes with entrances too small for the sparrow to enter. The disappearance of the wren coincided with the substitution of DDT for lead arsenate tree spray, as well as with the virtual disappearance of the previously abundant nesting city population of the American Robin. However the wren's disappearance also coincided with decrease in natural habitat, which also occurred at the time of its previous loss. In any case, unexplained vagaries in the occurrence of the House Wren, as well as other species, long antedate the House Sparrow and insecticide eras (Samuels 1875: 197).

During the interval 1943 to 1960, in tract B new houses reduced natural habitat from 50% to 15% of the 6 acres with loss of open field. Nevertheless, the basic planting was not disturbed and continued to include large pines, border plantings of pine, hemlock and arborvitae, thick shrubbery, berry-bearing trees and shrubs, shade trees and lawn, but the field was lost. At least half the area was contaminated with chlorinated hydrocarbon spray. Predators continued at six, for the raccoon replaced the Screech Owl; nesting Common Crows and Blue Jays, resident gray squirrels, cats, and the transient American Kestrel continued undiminished.

Competition for food and nesting sites continued from a nesting population of the House Sparrow and Starling up to five pairs each. The neighborhood, for the most part, still maintained its character of single family dwellings with grounds, lawn, shade trees, and some shrubbery, but apartment houses had walled off the study area from open country for miles by 1960. The bird life of tract B during 1960-64 showed the effects of decreased natural habitat and DDT spray, for nesting species were reduced to half the number during the preceding period, one-third that of a century before (Table 2), and transient species had increased to outnumber nesting species for the first time in the century, evidence of serious deterioration of the area for breeding. Moreover only three nesting species were still summer residents, one-third the number during the preceding period, and permanent residents outnumbered summer residents in the nesting population by 66% to 34%, a reversal of the situation that had prevailed through 1904. The change in the quality of the nesting bird life pertains throughout the residential section of the city.

In contrast to the residential section of the city, where new houses have progressively replaced natural habitat during the past century, and the trees have been subjected to insecticide sprays for 50 years, the

TABLE 3
SUMMER BIRDS OF THE FRESH POND RESERVATION¹

	1940-44	1960-64
SUMMER RESIDENTS		
Green Heron (<i>Butorides virescens</i>)		T×1
Killdeer (<i>Charadrius vociferus</i>)	1	T
Spotted Sandpiper (<i>Actitis macularia</i>)	T	
Chimney Swift (<i>Chaetura pelagica</i>)	T	T
Common Flicker (<i>Colaptes auratus</i>)	1	2
Eastern Kingbird (<i>Tyrannus tyrannus</i>)	1	2
Tree Swallow (<i>Iridoprocne bicolor</i>)	T	
Gray Catbird (<i>Dumetella carolinensis</i>)	1	2
Brown Thrasher (<i>Toxostoma rufum</i>)		2
American Robin (<i>Turdus migratorius</i>)	3	6
Red-eyed Vireo (<i>Vireo olivaceus</i>)	1	1
Warbling Vireo (<i>Vireo gilvus</i>)	3	3
Yellow Warbler (<i>Dendroica petechia</i>)	1	4
Common Yellowthroat (<i>Geothlypis trichas</i>)		T
Eastern Meadowlark (<i>Sturnella magna</i>)	2	1
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	12	12
Northern Oriole (<i>Icterus galbula</i>)	2	3
Common Grackle (<i>Quiscalus quiscula</i>)	12 ²	25 ²
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)		T
Indigo Bunting (<i>Passerina cyanea</i>)		T
Chipping Sparrow (<i>Spizella passerina</i>)	1	1
Song Sparrow (<i>Melospiza melodia</i>)	6	12
PERMANENT RESIDENTS		
Mallard (<i>Anas platyrhynchos</i>)		2
Black Duck (<i>Anas rubripes</i>)	1	1
Ring-necked Pheasant (<i>Phasianus colchicus</i>)	1 ²	1 ²
Herring Gull (<i>Larus argentatus</i>)	T	T
Blue Jay (<i>Cyanocitta cristata</i>)	1	1
Common Crow (<i>Corvus brachyrhynchos</i>)	2	1
Starling (<i>Sturnus vulgaris</i>)	12 ²	25 ²
House Sparrow (<i>Passer domesticus</i>)	3 ²	2 ²

¹ 150 acres, 90% undeveloped, unsprayed. Numbers indicate nesting pairs derived from singing males in June. T×1, transient 1 year of study; T, transient during summer.

² Estimated from number seen with young.

150-acre Fresh Pond reservation lying half a mile west of the study area has been exempt from insecticide spray and relatively free from housing development, 90% open, because it is the watershed of the city reservoir. Over half the 150 acres is developed as golf course, as playing fields and tennis courts, while a formal park covers several acres, but a few acres are as yet unimproved, as white pine grove, hardwood grove, wet field thickly grown up to herbaceous flowering plants and scattered shrubs, as well as one small maple swamp. The summer birds of the reservation are listed in Table 3, grouped as summer residents or permanent residents, and their incidence in number of nesting pairs or as transient during each of two study periods, 1940-44 and 1960-64 indicated. Nesting pairs are determined by the number of singing males

TABLE 4
SPECIES NESTING AND TRANSIENT IN 150-ACRE FRESH POND RESERVATION

	90% open, no spray	
	1940-44	1960-54
Nesting species	20	22
Transient species	5	6
% nesting : % transient	80:20	80:20
S.R. nesting species	14	15
P.R. nesting species	6	7
% S.R. : % P.R. nesting species	70:30	70:30

¹ S.R., summer resident migratory; P.R., permanent resident; 90% open, percentage of study area natural habitat not replaced by houses, unsprayed.

through June in most cases. Data from Table 3 are presented in Table 4 for comparison with those from Table 1 in Table 2.

The reservation in 1940-44 was still bordered on the north by the great Fresh Pond swamps and miles of open farming country, but by 1960-64 the marshes had been filled and developed industrially and the former farm land thickly covered with houses, so that the reservation had become deeply engulfed within the city. Nevertheless, 20 nesting species continued to outnumber transients 80% to 20% and summer resident predominated over permanent resident species in the nesting population by 70% to 30% throughout the study, an approximation to the conditions in the residential area of a century before, evidence of favorable breeding conditions for a migratory insectivorous songbird population within the city in an area with natural habitat preserved from housing and exempt from insecticide spray.

SUMMARY

The species of birds nesting and transient during the summer on two comparable 6-acre tracts in a residential section of Cambridge, Massachusetts, are listed, grouped as summer residents or permanent residents, and their incidence in number of nesting pairs or as transient recorded on Brewster's tract A during 1860-73 and 1900-04, and on Walcott's tract B during 1940-43 and 1960-64. The amount of natural habitat in the study areas changed from a high of 95% of the 6 acres in 1860-73 to 30% in 1900-04 on tract A, to 50% in 1940-43, and to 15% in 1960-64 on tract B, and the area was subject to insecticide spray during the last two periods. For comparison, the summer birds in the Fresh Pond reservation, an unsprayed, 90% undeveloped tract within the city, are listed as in the residential study areas for the years 1940-44 and 1960-64. In the course of the study the bird life of the

residential area changed from 26 nesting species, mostly summer residents, and few transients, to 9 nesting species composed of a majority of permanent residents, and outnumbered by transient species. In the reservation a score of nesting species composed of a majority of summer residents continued to outnumber transients throughout the study.

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