

Recent Declines of House Sparrows, *Passer domesticus*, in Canada's Maritime Provinces

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Erskine, Anthony J. 2006. Recent declines of House Sparrows, *Passer domesticus*, in Canada's Maritime Provinces. *Canadian Field-Naturalist* 120(1): 43–49.

House Sparrows, *Passer domesticus*, were introduced to North America after 1850, increased and spread up to 1920, and stabilized or decreased thereafter until 1960. In the Maritimes (and perhaps some other areas), a further decline set in after 1970, continuing to the present. Now the species is rare to absent in much of the Maritimes, except around farms with livestock. Decline here since 1970 probably approaches 90 per cent in most other areas of human settlement except south of 45°N. Similar declines are known in the U.K., but seem poorly documented, if recognized, in North America outside of our region.

Key Words: House Sparrows, *Passer domesticus*, declines, New Brunswick, Nova Scotia, Prince Edward Island.

Fifty years ago, House Sparrows (*Passer domesticus*; HoSp hereafter – a standard abbreviation used in many reports of organized birding activities) were so nearly ubiquitous in and around human settlements in eastern Canada that one sometimes had to “tune them out” to hear other birds. Then, it would have been unimaginable that this abundant species could become scarce in our lifetimes. HoSp, and their (urban) habitats, were virtually beneath notice both of birders and academics, so few serious studies of the species were made (see Kendeigh 1973), and none in Canada, during the rapid expansion of research on birds after World War 2. The result is a continuing scarcity of hard data on HoSp, precluding rigorous discussion of its population ecology. This study is a first look at what happened in the recent past and what may still be investigated usefully, in the Maritime Provinces of Canada [New Brunswick, Nova Scotia, and Prince Edward Island (hereafter “the Maritimes”)].

HoSp were first introduced to North America around 1850, and became established in the Maritimes by the 1880s (Christie 1979; Lowther and Cink 1992). Numbers and densities in the next century are known mainly from anecdotal remarks in general accounts. As was general in eastern North America by the early 20th Century, HoSp were nearly ubiquitous and very common around human settlements, including cities, towns, villages, and even isolated farms. HoSp thrived on grain wastage, as well as using other food wastes. Nearly all human settlements, through the 1940s, harboured domestic animals, especially livestock and poultry, which were fed on small grains at least seasonally.

Motor vehicles began replacing horses in transportation by the 1920s, and the resulting decrease in horse droppings and other waste grain sources led to a decline in HoSp, documented mainly by general statements (e.g., Bent 1958). Motor vehicle use in the Maritimes was much less during the Great Depression of 1930s, when most people could not afford cars, and in World

War 2, when gasoline and tires were reserved for military use. Use of horses again became widespread in those decades, and that presumably slowed or halted the earlier decline of HoSp. After the war, motor vehicles again became available, use of horses declined rapidly, and probably HoSp also declined. Very few bird counts were made in the Maritimes before 1960, when HoSp still were considered widespread and abundant (Squires 1952; Godfrey 1954; Tufts 1962). Winter bird counts at Wolfville, Nova Scotia (J. S. Erskine 1968) showed no obvious trend in HoSp numbers between 1948 and 1968. Christie (1979) summarized bird status changes in the Maritimes over the century to 1978, noting arrival, increase, and subsequent decline in HoSp, with numbers likely stable after 1930.

Starting in 1977, winter plot counts through 1988 in Sackville, New Brunswick (Erskine 1992b), showed further decreases in HoSp – evidently *not* related to decline of horses and other livestock, which already were absent in such towns (compare Erskine and McManus 2005). Also in the 1980s, Christie (1985 and following years) remarked on generally lower HoSp numbers on New Brunswick Christmas Bird Counts (CBCs hereafter). Some naturalists (personal communications) remarked on similar decreases in Nova Scotia in the early 1990s. The cooperative Breeding Bird Survey (BBS) documented HoSp declines across eastern Canada in summers 1967–1996 (Downes and Collins 2003), with decreases each decade (significant only in 1981–1990) in the Bird Conservation Region (BCR 14) including the Maritimes. HoSp continued to decline, and by 2000 were rare in Sackville, New Brunswick (personal observations), and in nearby towns.

In the near-absence of even quasi-systematic counts of HoSp, CBCs provided the only widespread sampling of bird numbers in the Maritimes, with many more counts in more years than the BBS. Although CBC data are poorly standardized (e.g., Dunn et al. 2005), those surveys are extensive enough, both here and across

Canada, to allow examination of HoSp occurrence in various habitats, in an attempt to identify factors involved in their recent declines.

Methods

Christmas Bird Counts are single-day annual counts in the period 13 December to 5 January, each restricted to a 24-km diameter circle selected subjectively. Bird species richness and availability of observers are usual selection criteria.

CBC data for HoSp in the Maritimes in 1960-2003 were extracted from *N. B. Naturalist* (formerly *Nature News*), *Nova Scotia Birds* (formerly *N. S. Bird Society Newsletter*), and *Island Naturalist*. Audubon publications (*American Birds*, formerly *Audubon Field Notes*) included many fewer counts ("circles" hereafter) in the Maritimes, and were used only to fill gaps in regional publication series. All data were tabulated in year vs. location matrices.

Data were selected by excluding circles surveyed in ≤ 20 years and others with obvious "discontinuities" in coverage or effort. The selected circles were grouped by major non-urban habitat combinations, most including also some human settlements, thus (names in parentheses used in text and tables hereafter):

- **(Forest)** inland, predominantly forested, little or no farming;
- **(Coastal)** much forest or bog, farming insignificant;
- **(Farm=forest)** inland or coastal, farms and other open areas minor or unproductive but roughly equal in area to forests;
- **(Farm>forest)** farming major (much exceeding forest), relatively productive, usually around a sizable town;
- **(Major urban)** cities or larger towns, other habitats minor.

To allow for varying observer effort, between years or circles, published counts ("raw data") were also converted to birds/10 party-hours ("adjusted data"; see also Discussion).

Statistics on area changes in major habitats of the Maritimes over the study period (roughly 1960-2000) were assembled from Statscan websites, Canada Year Books, and some other directories.

Extrapolation from CBC data to Maritimes HoSp populations was attempted. Counts from the selected circles were expanded across the five habitat groupings above. Further adjustment was made to cover two important omissions in coverage:

- not all suitable areas within active CBCs were surveyed, and
- not all HoSp in the areas surveyed were detected.

Those factors could not be assessed rigorously, but "informed guesses" from personal experience (see Appendix) allowed tentative adjustment of extrapolated estimates.

Results

HoSp counts (adjusted data) for each selected circle in the various habitat-groupings were summarized as decade-means (1960-69, 1970-79, etc.; Table 1). Circles lacking data for >1 decade were excluded, as were those lacking 1 decade and ≥ 3 years in a 2nd decade. Mean data were estimated for circles missing one decade, using ratios of HoSp counts in other circles in that and the next decade(s). Some general patterns were evident:

- (i) a HoSp decline (from an earlier "plateau"), most often starting in the 1980s, was apparent nearly everywhere, in all habitats, and whether raw or adjusted data were compared;
- (ii) the recent decline was less pronounced in circles where farmlands were important, or at least equal in area to forests, than elsewhere;
- (iii) the recent decline began earlier in cities and large towns than elsewhere.

Observer effort in and around cities and towns in 1960-1979 increased so much that increased detection of HoSp then sometimes balanced or exceeded declines, which were less apparent in raw data vs. adjusted data.

Area changes in major habitats were substantial, as follows:

(a) Forests remained the largest land cover type in New Brunswick and Nova Scotia throughout; forest cover increased in Prince Edward Island, but that was minor in the overall picture. HoSp were never found in or near forests except in association with human settlements, so changes in forest area are ignored in further discussion.

(b) Among farmlands, "improved lands" (= crops, pasture, fallow; the main farmland types used by HoSp, aside from buildings) decreased in all provinces, by 35% in Prince Edward Island (where those remain dominant land-uses), and by 55% in New Brunswick and Nova Scotia, between 1961 and 1996. Published statistics available did not distinguish "commercial" and "marginal" farms; most decline in New Brunswick and Nova Scotia was in marginal farms, on which before 1960 farming was only one of several sources of income. Land-use on commercial farms became more intensive in 1961-1996 (personal observations), in the Maritimes as elsewhere, but that was not obvious from the published statistics.

(c) Urban area statistics allowed few generalizations. Larger communities mostly increased in human population and area, whereas many smaller ones decreased, some dwindling to scattered houses. Cultural changes within urban areas were many and widespread, involving sweeping changes in commerce, transportation, heating, garbage disposal, tolerance of livestock and poultry, recreation, etc. [see review in Erskine and McManus 2005]. Correlations with single factors in urban change could not be made rigorously so did not warrant statistical tests.

Table 1. Comparison of CBC HoSp means over decades, by habitats: (a) Raw data, (b) Adjusted data. Missing data added from ratios (of all groups) to next decade. Circles with no HoSp ever omitted.

(a) Raw data	1960-69	1970-79	1980-89	1990-99	2000-02
Forest areas					
7 circles	439	530	450	117	49
Coastal settlements, no farming					
11 circles	875	1306	1023	404	138
Farming & woodlands nearly equal					
11 circles	2120	2482	1823	949	735
Major farming areas, larger communities					
8 circles	3306	4596	4953	2695	1296
Cities					
4 circles	4017	3569	1664	374	157
Grand totals:	10757	12483	9913	4539	2375
(b) Adjusted data					
	1960-69	1970-79	1980-89	1990-99	2000-02
Forest areas					
7 circles	599	476	331	58	25
Coastal settlements, no farming					
11 circles	596	442	211	101	37
Farming & woodlands near equal					
11 circles	1255	927	672	216	160
Major farming areas, larger communities					
8 circles	2130	1840	1153	500	240
Cities					
4 circles	1568	1001	283	39	19
Grand totals:	6148	4686	2650	914	481

Extrapolated HoSp populations by decades, expanded from surveyed circles across suitable habitats, and adjusted for incomplete coverage and detection, are shown in Table 2.

That suggested that since the 1970s total HoSp numbers in the Maritimes decreased greatly, probably by three-quarters or more, with urban numbers – in New Brunswick and Prince Edward Island – diminishing to less than 10% of levels prevailing before 1980. Farmland HoSp numbers still may be one-half to two-thirds of those present 30–40 years earlier – more likely less. They now account for the vast majority of all HoSp remaining in New Brunswick, Prince Edward Island, and northern and eastern parts of Nova Scotia, where winter conditions and especially snow cover limit survival at that season. Numbers in western and southern Nova Scotia declined to a lesser degree.

Discussion

Johnston and Klitz (pages 15–52 in Pinowski and Kendeigh 1977) stated “The house sparrow seems clearly a product of interaction between sparrows and sedentary, agricultural man... This is a long-term relationship, sufficient to allow fine-grain adaptation of the birds to man’s way.” There seems no reason to dispute that generalization, on the long-term, broad-scale stage for which it was stated, but regional evidence suggest-

ed that “man’s way” in the Maritimes recently changed more rapidly than did HoSp adaptations to it.

Generalization from CBC data. Rigorous conclusions regarding the recent HoSp decline in the Maritimes (or elsewhere) will not emerge from CBCs alone, but improved understanding may result when various kinds of information are combined. The scarcity of hard data on this species, anywhere in North America, is embarrassing. In the Maritimes and adjacent regions, the only multi-year study found that provided HoSp density indices directly was the one in Sackville, New Brunswick (Erskine 1992b) that stimulated this investigation. Knowledge of habitats and diet here relied on casual observations, as no planned studies had been made – and HoSp numbers in most areas now are too low for economical study.

CBC data are poorly standardized, and adjusting effort using party-hours addressed only a small part of variation in CBC data (compare Dunn et al. 2005). Regional data have not been examined rigorously, but it was obvious that the few – mostly urban – circles deploying large numbers of observers detected far fewer HoSp relative to effort than were found on most counts with fewer observers. Thus, declines in large urban areas may have been less drastic than indicated by the counts adjusted by party-hours, but they were impressive: compare means of raw data for 1966–1970 vs.

Table 2. Expansion of counts in Table 1 (raw data) to total Maritimes population estimates (explanation in Appendix).

Habitats	Extrapolated estimates				
	1960s	1970s	1980s	1990s	2000s
Forest+urban	1694	2045	1735	452	189
Coastal+urban	16944	25290	19809	7824	2673
(Farm=forest)+urban	55506	64980	47730	24846	19242
(Farm>forest)+urban	78520	109160	117630	64010	30780
Large urban	120510	107070	49920	11220	4710
farming	67013	87070	115752	71085	45020
urban	206161	221475	121072	37267	12574
Grand totals:	273174	308545	236824	108352	57594

1996-2000 at Fredericton (3379 vs. 53), Moncton (1046 vs. 142), Saint John (501 vs. 74).

Also, CBC data often were less adequate for HoSp than for most other bird species. When HoSp were abundant and ubiquitous in urban areas, some CBCs did not actually count them during the "census", merely inserting round-number estimates as reported totals. Where such obvious guesses recurred in several years, those counts were excluded. A more frequent problem was that parts of many urban areas, where HoSp were the most expectable birds, were ignored as unproductive (of more interesting species!) until HoSp decline was far advanced.

HoSp declines in urban areas. That the recent HoSp decline in the Maritimes began earlier in cities (except perhaps 'Greater Halifax') than less urbanized situations suggested that influences formerly encouraging HoSp to associate with human settlements are now less strong. Changes since 1960 in the regional urban milieu that might have been expected to affect HoSp numbers included:

Favourable influences

- (i) winter bird-feeding increased greatly since 1960; however, small grains – preferred by HoSp (Bent 1958, also personal observations) – are now much less often presented (Rutherford 1984), feeding stations now offering mostly sunflower and thistle seeds, rather than oats, cracked corn, or "chicken scratch feed" mixtures;
- (ii) shelter in urban hedges and other shrubs increased, presumably in response to increased disposable income of home-owners;

Negative influences

(a) food from human garbage, livestock wastage and manure decreased greatly, by disappearance of livestock, especially horses, and improved garbage disposal, these factors all related to increasing "urbanization";

(b) nesting and wintering shelter within buildings decreased, through removal of dilapidated structures and renovation of others – especially closing of openings (personal observations);

(c) transmittal of pathogens (e.g. *Salmonella*) may have been aided by increased transportation between urban areas (Erskine 1980b; a HoSp die-off at Charlottetown, Prince Edward Island, had been reported in the preceding winter);

(d) avian predators in towns (especially Merlin, *Falco columbarius*, and Sharp-shinned Hawk, *Accipiter striatus*) increased, with Merlins breeding in urban areas here since the 1980s; domestic cats, *Felis catus*, also increased.

The recent major decline of urban HoSp in the Maritimes indicated that urban areas no longer provide a favourable environment for this species, in winter or summer or both. Complete disappearance of HoSp in winter in many smaller human settlements suggested a "threshold effect"; below some population level, which likely varies with winter severity and availability of suitable habitats nearby, production in urban HoSp may no longer balance winter losses in this resident species.

HoSp declines in farmlands. HoSp decline in farming areas seemed better correlated with decreases in farms with livestock than with total numbers of farms or areas of "improved farmland". Loss of invertebrate food through pesticide use, as in England (D. Summers-Smith, letter), seems plausible but is unstudied here; chemical treatments in regional agriculture are obvious especially in potato- and fruit-producing areas, less so in grain production (mostly oats). Much Maritimes farmland area is inaccessible to HoSp in winter owing to snow cover. Livestock disappeared completely from most urban areas, and also from many former farms now used as rural residences or "hobby farms". Horses are scarce generally, and cattle now are mostly found in large feed-lot operations, where larger birds (gulls, pigeons, corvids, starlings) often out-compete HoSp – though a few of the latter persist (personal observations). Concentrations of HoSp persist in productive farming areas, even when disappearing from nearby towns, presumably because livestock operations now are mainly in better farming areas.

From the viewpoint of agriculture (and general economy), the Maritimes are a "backwater". Agriculture here ranks far behind forestry, tourism, fisheries, and "gen-

eral service” on economic and employment indices, despite the local importance of potatoes and orchards. Snow cover and related temperatures are major factors limiting agriculture (and HoSp) here. Soils and geology underlie the picture, with limestone areas very limited. Agricultural changes since World War II involved abandonment of former marginal agricultural lands rather than intensified use of better farmlands.

HoSp responses to habitat changes. All CBC habitat groupings used herein involved combinations of human settlements, of varying size, with nearby habitats, among which only farmlands were regularly used by HoSp. Human settlements formerly provided HoSp with both sheltered nesting places and nearby feeding opportunities. After nesting, urban HoSp often withdrew from built-up areas to glean waste grain in agricultural lands within a radius of 2-3 km, returning to towns and villages with the approach of winter (personal observations; Summers-Smith 1963). Where little farmland exists near urban settlements, in forested regions (e.g., Miramichi, New Brunswick) or within larger cities, urban HoSp presumably depended year-round on feeding opportunities within the city.

Cultural changes altered urban areas more, as well as in different ways, than farmlands. Thus, HoSp in areas that combined extensive farming with urban settlements were (and are) less restricted for feeding than those relying year-round on urban areas. Recent trends suggest that HoSp might disappear within a few decades from most urban habitats in New Brunswick and Prince Edward Island, where snow-cover limits their use of non-urban habitats in winter. They may persist longer in “Greater Halifax”, and in some towns in farming areas of western Nova Scotia, where snow cover is less and winter temperatures more moderate. Such changes presuppose continuation of climates similar to recent decades; if “global warming” brings markedly less snow here, numbers of a winter-limited species – as HoSp appears to be – might again increase.

Estimating HoSp populations. Extrapolating observed numbers across potential HoSp habitat to regional populations (Table 2) involved much “informed guesswork”, as hard data do not exist for most needed adjustments. Valuable perspective may emerge from such simple “modeling”, even though it lacks rigour and precision.

Modeling allowed comparison with the only other independent estimate of Maritimes HoSp populations, derived from abundance indices in the Maritimes breeding bird atlas (Erskine 1992a) in 1986-1990. The Atlas estimates used a general algorithm (C. Field and P. Payzant, Appendix D in Erskine 1992a) for extrapolation to areas unsampled or lacking abundance indices; that algorithm may not have been fully appropriate for HoSp, of which density varied greatly between habitats. The Atlas estimate of HoSp (140 000 pairs) was

of a similar order to that for the same period (1980s) in Table 2 (ca. 240 000 individuals).

The HoSp situation elsewhere. No systematic studies of HoSp were available in other parts of Canada. CBC data there – tabulated and adjusted for party-hours as in the Maritimes (unpublished MSS) – revealed no such drastic HoSp declines as seen here in 1960-2003.

Continuing availability of small grains in both rural and urban areas of the Prairie Provinces south of the boreal forest were well-correlated with the highest HoSp CBC counts on the continent, with no suggestion of declines unrelated to count efforts. British Columbia CBC data were extremely variable, with generally low numbers, as was to be expected from the varied geography and relative scarcity of arable farming. No long-run counts suggested continuing declines in HoSp there. Very few long-run counts were available in northern, deep-snow areas of western Canada, where most showed no HoSp at any time.

Quebec experiences the largest average snowfalls in Canada outside the western mountains. Most of the few long-run (>20 years) CBCs in Quebec suggested some decline in recent decades, from “adjusted counts”, as reported also from independent surveys (1970-1991) by Cyr et Larivée (1995); those declines were less extreme than in the Maritimes.

In Ontario, where CBCs are more numerous than elsewhere in Canada, HoSp (raw) numbers remained generally stable over the decades, except in a few long-run urban circles near the northern limits of human settlement. Adjusted data, however, suggested declines, starting in 1980s, on nearly half the long-run counts; Sudbury showed the largest proportional decline, and counts at Sault Ste. Marie and Thunder Bay, also northern areas with much snow cover – and despite both being ports involved in grain shipping from the Prairies, also declined.

In the United Kingdom, where the HoSp situation has been followed for decades, especially by Denis Summers-Smith (1963, 2003, and letters), declines evidently are of a similar order to those found in the Maritimes. Although research on HoSp is limited there too, much detailed information is available on habitat relations of HoSp in the U.K. Summers-Smith’s conclusions (op. cit.) regarding causation agree well with tentative inferences suggested here for the Maritimes – despite the near-absence of snow cover as a limiting factor in the U.K. The intensity of agriculture there is much more comparable to that in southern Ontario or the Prairie Provinces than to the Maritimes. At this time it seems likely that many different factors, some general and widespread, others applying only regionally, are involved in recent declines of HoSp in the wider picture.

A recent discussion of HoSp decline in North America (Holder 2003) drew on wide-ranging surveys, including BBS and CBC, but reached few con-

clusions except that competition with recent House Finch populations had not affected HoSp numbers. Use by Holder of only CBCs reported to Audubon limited his understanding of the Maritimes situation. His expressed suggestion (page 65) that the HoSp situation in Canada might parallel that in the U.K. – where very different climatic and economic regimes prevail – seems unlikely.

Acknowledgments

Thanks to the many observers and compilers of CBCs whose data were used in this study, and also to publishers and editors of magazines (named in text) in which those reports were presented. Denis Summers-Smith (U.K.) and Jenny De Laet (Belgium) commented very helpfully on an earlier version of the MS. Reviewers for this journal provided much-needed encouragement as well as helpful suggestions for improvement of the text.

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Received 14 February 2005

Accepted 13 September 2005

Appendix

(i) Factors, by habitat groupings, for expansion from long-run CBC circles to total areas in Maritimes. Note: Forest areas support very few or no HoSp, so those areas were ignored, except where CBCs had been done.

Habitats	Number long-run CBC circles		Potential CBC circles + other potential habitat
Forest + urban	7	add	8
Coastal + urban	11	add	60
(Farm = forest) + urban	11	add	37
(Farm > forest) + urban	8	add	11
Large urban	4	add	4

(ii) Expansion factors, by habitat groupings, for incomplete coverage of suitable habitats in circles and incomplete detection of HoSp in areas covered.

Habitats	Coverage	Detection
Forest + urban	1.2	1.5
Coastal + urban	2.0	1.5
(Farm = forest) + urban	3.0	2.0
(Farm > forest) + urban	5.0	2.0
Large urban	5.0	3.0

(iii) Segregation of HoSp numbers among habitats, where appropriate. Forest and coastal habitats omitted as not used by HoSp; thus only 3rd & 4th categories above required segregation, with proportions varying over time.

Decades	1960s	1970s	1980s	1990s	2000s
Farm:urban ratio	50:50	50:50	70:30	80:20	90:10