Causes of Decline in Band Encounter Rates for Small Landbirds

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ABSTRACT

Canadian banding of small landbirds has increased over the past 40 years, but the rate at which these birds are encountered has decreased. Cessation of reporting recaptures at the site of banding explains only part of this decline. Rate of recapture distant from the banding site has also declined; and since banders are expected to report such encounters, this suggests that banded birds today may be less accessible to being found than in the past. There was no evidence of greater banding effort over time on Neotropical migrants or nestlings, both of which are encountered at lower rates than other birds. However, numerous other factors can affect encounter rates and only a few can be tested with analysis of the banding database. A direct study of reporting rates by the public is needed to determine whether failure to report findings of banded birds could have contributed to the decline in encounter rates.

INTRODUCTION

Data in the *Canadian Atlas of Bird Banding* (summarized from Appendix 1 of Brewer et al. 2000) indicate that the number of small landbirds banded in Canada increased between 1955 and 1995 (Fig. 1), but that the rate of re-encountering banded birds declined over the same period (Fig. 2). This raises a concern that people finding bands might be reporting them less often, suggesting that more public education could be warranted to maintain reporting rates. That this is an issue is supported by estimates that the rate at which waterfowl bands are reported has more than doubled since 1995 when bands started to have an 1-800 phone number printed on them (Lucie Métras, Canadian Bird Banding Office, *pers. comm.)* However, it is also possible that decline in encounter rates is due to factors other than failure to report findings of banded birds. For example, birds being banded in recent years might differ in ways that make them less likely to be found by the public than birds banded in the past. The aim of this paper is to document the temporal changes in banding statistics for small birds and to try to identify possible causes of decline in band encounter rates.

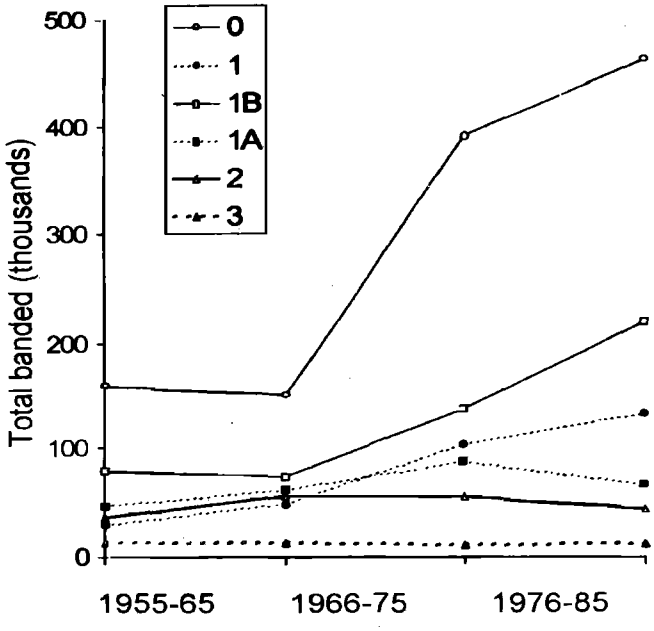

Fig. 1. Total small bird bandings in Canada by band size. Size 0 includes size 0A, and size 1 includes 1C.

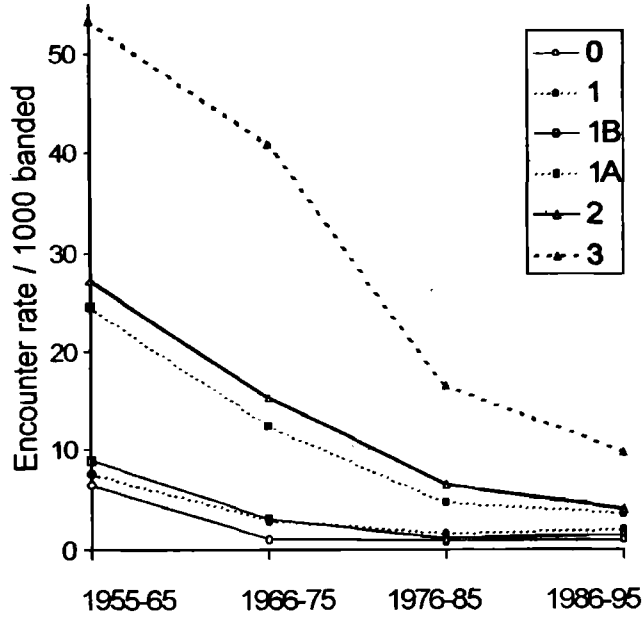

Fig. 2. Encounter rate of Canadian-banded birds by band size and decade.

METHODS

The data set analyzed here is limited to Canadian-banded passerines and "near passerines" (doves, cuckoos and hummingbirds) that are banded with size 3 bands or smaller. It includes banding totals and encounters for the period 1955 to 1995. (The term "encounter" is used throughout instead of "recovery," as the latter properly refers only to a bird found dead, whereas the encounter database includes retraps and other birds found alive.) If a bird was encountered more than once, only the most recent record was considered.

Banding totals and encounter rates were tallied by band size for each of four analysis decades: 1955-1965,1966-1975,1976-1985, and 1986-1995. (The number of bands put on non-game species was not computerized until 1955; the first analysis "decade" includes that first year.) Encounter rates were calculated for the entire data set, and separately for several sub-groups, as detailed below: birds recaptured at site of banding and elsewhere, birds found dead that were reported by the general public, and birds with different migration distances. All codes are as defined in Gustafson et al. (1997).

Recaptured birds were those with "how obtained" code 99 (recaptures at site of banding) or code 89 (recaptures elsewhere). Birds reported by the general public were defined as those with "who reported" code 20 or 21 (Gustafson et al. 1997) and were considered "dead" if they met either of the following two sets of criteria: (1) "present condition" code 3, 4, or 5 (indicating the birds were dead), or (2) "present condition" code 0, 1, or 2 (unknown whether dead or alive) but "how obtained" code other than 28, 29, 33, 36, 41, 46, 48, 52, 53, 87, 88, 89, or 99 (all which refer to birds that were sighted or captured alive.) Finally, separate encounter rates were calculated for species that are Neotropical (long-distance) migrants, temperate (short-distance) migrants, and residents. For each of these calculations, numbers of birds banded and encountered were summed across species prior to calculating the encounter rate for each band size. Because temporal patterns in encounter rates did not vary across band sizes (although different in magnitude), encounter rates were recalculated without regard to band size. Encounter rates calculated as the mean of the separate rates for each species gave results that differed quantitatively, but not qualitatively, and are not presented here.

For a more detailed examination of the causes of change in encounter rates, I analyzed data for 35 species for which at least 825 individuals were banded in each analysis decade (listed in Appendix 1). These focal species were selected to include a variety of band sizes, and they accounted for 53% of the nearly 2.5 million bandings in the total data set.

For focal species, encounter rates were calculated separately for each major "how obtained" code (Gustafson et al. 1997). To increase sample size, several similar codes were combined. Code 13 (caught due to striking stationary object other than wires or towers—the code used for window kills) was combined with code 54 (caught due to striking radio, TV, high tension, etc. wires or towers, or ceilometers). Code 14 (caught due to striking or being struck by motor vehicle) was combined with code 45 (found dead or injured on highway, with no further information). Encounters of birds recaptured in a different 10' block from that of banding (code 89) were split into those that had moved $\leq$ 50 km and those that had moved farther, so that separate encounter rates could be calculated for each group. Distance of movement was calculated as in Brewer et al. (2000: Appendix 4). In addition, encounter rates for the focal species were calculated separately for bands put on Locals (non-flying young) and those put onto birds post-fledging (excluding any recaptures at the site of banding, i.e. "how obtained" code 99). As for the full data set, all recoveries and numbers banded were summed across species before calculating en-counter rates.

RESULTS AND DISCUSSION

Canadian banding activity grew rapidly in the 1970s, mainly for the smallest band sizes (Fig. 1). The increase paralleled the adoption of the mist net as a bird catching device in North America. Mist nets made the capture of small insectivorous birds vastly more easy, although increase in the number of banders and of high-volume migration monitoring stations have probably contributed to higher banding rates, as well.

While bandings increased, encounter rates decreased dramatically (Fig. 2). Some of the decline can be explained by the cessation in 1958 of the requirement to report birds retrapped in the same 10' block where banded ("how obtained" code 99). Although such records can still be reported, many banders have gradually discontinued routine submission (Fig. 3). While the decrease in reporting of encounters for this reason accounts for some of the overall decline in reporting rates of small landbirds shown in Fig. 2, it does not explain all of it. An important additional factor is a decrease in reports of dead birds found by the general public (Fig. 4). This factor is especially important for larger band sizes (Fig. 4A), but public reporting of dead birds also declined for smaller species (Fig. 4B; note difference of vertical scale in parts A and B). The difference in importance of this factor with respect to band size is probably related to the fact that band sizes 1A and smaller have reporting information on the inside of the band, such that reporting rates by the general public have always been very low for small birds (Hussell et al.1993).

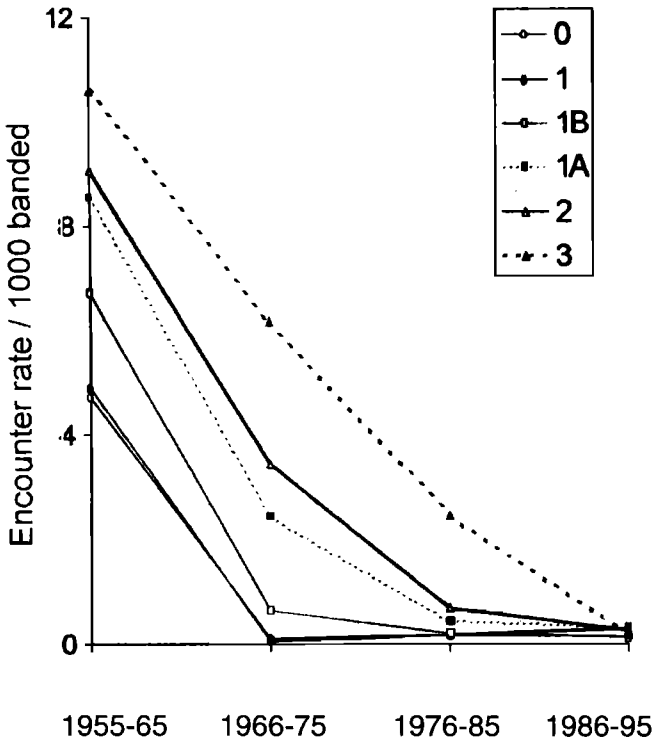

Fig. 3. Encounter rate of birds recaptured by bander at site of banding ("how obtained" code 99).

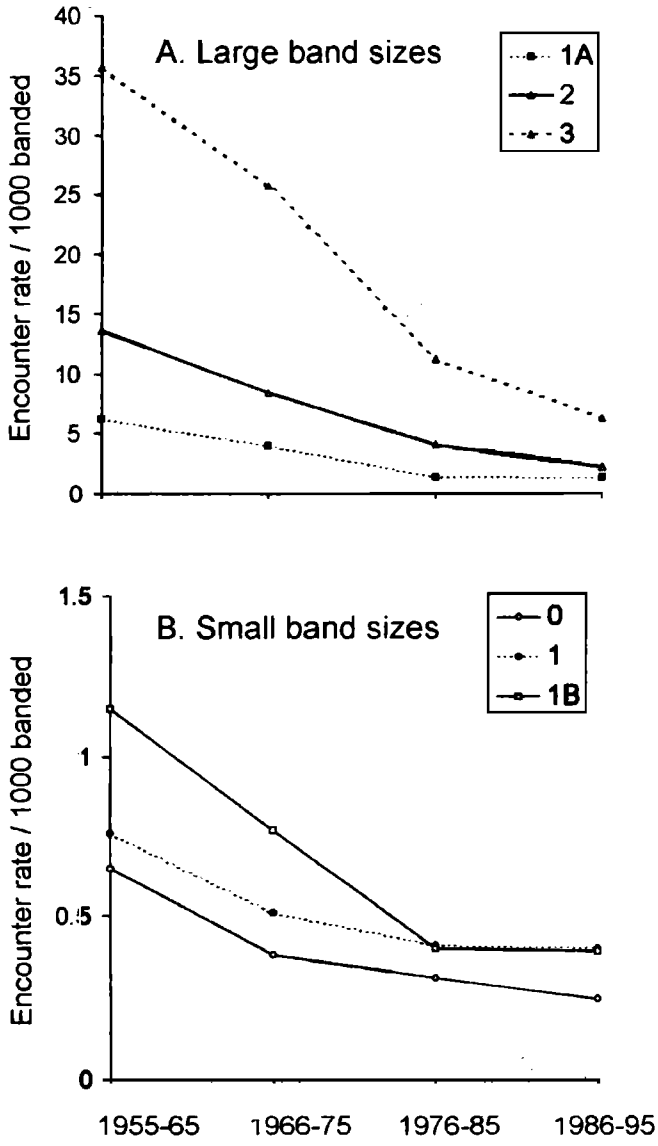

Fig. 4. Encounter rate of dead birds reported by the general public (see Methods for definitions).

The encounter data base offers one way of checking whether banded birds that are actually found are being reported at similar rates as in the past. Banders are almost certain to report recaptures of banded birds that were banded by others. If public rates of reporting found birds have not changed over time, then encounter rates from these two sources should vary in parallel. If public reports have declined but bander reports have not, then this could be evidence of a decline in public reporting of found birds. Both rates declined over the study period (Table 1). This result was consistent within band sizes and migration categories as well. The implication of this finding is that declining encounter rates may instead be caused by lowered chances of finding banded birds now than in the past.

Table 1. Rate at which small landbirds were recaptured in a different 10' lat-long block than where banded, compared to overall encounter rate[1].

	Decade			
	1955-65	1966-75	1976-85	1986-95
Overall encounter rate[1]	6.92	5.48	1.76	1.46
Rate of distant recapture	1.44	0.70	0.29	0.29
Total number banded	359,896	400,897	782,932	934,644

[1] N/1000 banded, excluding encountered birds that were recaptured at the site of banding ("how obtained" code 99).

One possibility for reduced accessibility of banded birds is that a greater proportion of bands may now be used on Neotropical migrants, which spend the winter in Latin America (where band reporting rate is known to be especially low) and in many cases breed in boreal forest zones north of dense human population (thus reducing their chances of being encountered by other banders or the general public). However, although residents and temperate migrants are indeed encountered at higher rates than Neotropical migrants, the proportions of bands used on species of different migratory classes have remained fairly steady over time (Table 2), including within band sizes. Moreover, there has been a decline in reporting rate over time within all migratory classes. Thus, factors other than a shift to more banding of Neotropical migrants, or a shift in the proportions of migratory classes within band sizes, must be responsible for the decline in encounter rates.

Table 2. Encounter rates[1] of small landbirds according to migratory status. Figure in parentheses shows the percent of all bands used in the decade that were put on species in this migratory class.

	Decade			
	1955-65	1966-75	1976-85	1986-95
Neotropical migrants	1.75 (28.3)	1.34 (20.0)	0.53 (34.8)	0.67 (27.5)
Temperate migrants	8.93 (68.0)	6.64 (77.1)	2.46 (60.9)	1.77 (67.9)
Resident species	10.82 (3.7)	4.38 (2.9)	2.23 (4.3)	1.67 (4.6)

[1] See note for Table 1.

To examine encounter rates in greater detail, separate rates were calculated for various "how obtained" codes in a group of 35 commonly banded species (Table 3). Part of the purpose was to determine whether particular species were responsible for most of the temporal change in reporting rates. While there were large differences in encounter rates among species (depending in large part on band size and migratory status), temporal patterns were similar across most species (Appendix 1).

As with the full data set, there was a decline in rate of recaptures in a different 10' block than where banded ("how obtained" code 89), suggesting that banded birds are increasingly less likely to be re-encountered in well-populated areas. At least some of these recaptures might involve recapture by the original bander, however, for which the reporting rate could have dropped off after reporting of one's own recaptures was made optional. I therefore calculated encounter rates of these birds separately for birds caught within 50 km of the original banding site and those captured farther away. Rate of recapture at a distance still declined over the study decades (Table 3), supporting the idea that banded birds are now less likely to be found or recaptured than in the past However, this was not true of every species, and a few–notably Veery, Gray-cheeked Thrush, and Swainson's Thrush–showed increased rates of recapture over time (probably reflecting the growing number of migration banding stations where these Neotropical migrants can be recaptured).

The rate of band encounter through shooting of birds declined strongly over time, but this could be attributed, at least in part, to a decline in hunting of small birds. However, rates of encounter due to being killed by vehicles, cats, or by striking human structures might have been expected to increase over time, given that these hazards are all becoming more, rather than less, common. That these rates also have declined, in combination with the decline in bander reports of birds banded elsewhere, suggests again that banded birds are now less likely to be found at all.

If species with different migratory habits are still being banded in similar proportions (as shown in Table 2), then what other explanations might there

Table 3. Encounter rates for focal species (Appendix 1), by "how obtained" category.				
How Obtained (see Methods)	Decade			
	1955-65	1966-75	1976-85	1986-95
Shot	1.59	1.67	0.18	0.09
Found dead (no other information)	4.17	2.26	1.06	0.58
Caught by or due to cat	0.57	0.29	0.16	0.07
Caught due to strike with motor vehicle, or found on highway	0.34	0.29	0.14	0.08
Caught due to strike with wires, towers, or other stationary object	0.34	0.31	0.27	0.11
Retrapped in different 10' block, ≤50 km from banding site	0.81	0.20	0.08	0.13
Retrapped in different 10' block, >50 km from banding site	1.68	0.53	0.28	0.10
Retrapped in same 10' block as banded	6.40	1.77	0.39	0.20
Total Banded	**211,751**	**231,416**	**402,267**	**416,686**

be for birds to be less "findable" than in the past? One possibility is that growing proportions of birds are being banded prior to fledging. Many nestlings die before dispersing from the banding site, so encounter rates should be lower than for birds banded post-fledging. If there was a large shift over time in the proportion of nestlings banded, this could explain some of the decrease in reporting rates. As shown in Table 4, there has indeed been a large increase in the proportion of birds banded as nestlings, from 8% of all bandings to 21%. However, while encounter rates for birds banded pre-fledging are lower than for birds banded after attaining flight, they are not greatly lower. Moreover, encounter rates for both groups have declined over time. Thus, even if a shift in emphasis to banding of nestlings can account for some of the overall decline in encounter rates, there must also be other factors at work.

Table 4. Encounter rates[1] of birds banded pre- and post-fledging (focal species only). Number in parentheses is the proportion of bands used on this age group.				
	Decade			
	1955-65	1966-75	1976-85	1986-95
Banding pre-fledging	7.34 (7.9)	3.64 (14.6)	1.84 (16.3)	1.30 (21.1)
Banding post-fledging	11.31 (92.1)	7.48 (85.4)	2.84 (83.7)	1.45 (78.9)
[1] See note for Table 1.				

CONCLUSIONS

Results from this analysis did not provide satisfactory answers as to why band encounter rates declined between 1955 and 1995 for small landbirds banded in Canada. Decline in the rate of recapture by other banders supports the conclusion that banded birds are now, in general, less available than in the past to be encountered, but does not provide sufficient evidence in itself. (While it seems unlikely that banders have changed their rate of reporting recaptured birds that were banded elsewhere, this possibility should perhaps be checked.) The only factor identified that might contribute to declining "findability" of birds was an increase in the proportion of bands used on nestlings, and this could only have had a small effect.

Because decline in encounter rates could not be attributed clearly to a reduction in the availability of banded birds to be encountered, it is quite possible that there has indeed been a decline in the rate at which found birds are reported to authorities. Multiple causes can be suggested (e.g.,reduced public consciousness of banding, growing public apathy, increased squeamishness about handling dead birds). The only way to be certain whether low reporting is a problem is to conduct a study aimed specifically at answering that question, using techniques such as telephone surveys or reward bands. This may be a good time to undertake such a study, as there have been changes made to band design that are intended to increase encounter rates. New bands have an 1-800 number printed on them (a change known to have increased reporting rate for waterfowl). While band sizes 1A and smaller have the reporting information on the inside (a design known to reduce reporting rate; Hussell et al. 1993), an instruction has been added to the outside to "open," both in English and Spanish. It would be valuable to have good information on reporting rates to determine whether additional publicity could make any difference in boosting the very low encounter rates characteristic of small land birds.

ACKNOWLEDGMENTS

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Great Gray Owl by George West

Appendix 1. Commonly banded species used for detailed analysis of encounter rates show numbers banded by decade/encounter rate (N/1000 banded, excluding birds recaptured in the same 10' block as where banded).

	Decade			
	1955-65	**1966-75**	**1976-85**	**1986-95**
Northern Flicker *Colaptes auratus*	2343/10.67	1328/5.27	2879/1.74	1897/4.22
Blue Jay *Cyanocitta cristata*	3461/17.91	7166/12.28	6883/11.48	9497/5.69
Purple Martin *Progne subis*	2053/6.33	1646/13.37	7319/3.01	6597/3.49
Tree Swallow *Tachycineta bicolor*	6081/6.41	24,736/3.32	46,595/1.85	81,668/1.96
Bank Swallow *Riparia riparia*	17,081/3.63	6052/0.66	14,260/0.42	3723/0.00
Barn Swallow *Hirundo rustica*	5192/2.89	4101/1.71	6252/0.64	3017/0.00
Black-capped Chickadee *Poecile atricapillus*	7103/7.18	5413/1.85	16,550/1.57	32,127/1.21
House Wren *Troglodytes aedon*	901/2.22	885/1.13	3413/0.00	8166/0.24
Veery *Catharus fuscescens*	1195/1.67	1470/0.68	4010/0.50	3321/1.51
Gray-cheeked Thrush *Catharus minimus*	2420/0.00	1411/0.00	1923/0.52	2336/0.86
Swainson's Thrush *Catharus ustulatus*	6900/0.43	5842/0.51	15,132/0.46	11,170/0.09
Hermit Thrush *Catharus guttatus*	3141/0.00	2904/0.69	7197/0.42	9125/0.33
American Robin *Turdus migratorius*	7397/19.47	5187/13.69	8835/4.30	9410/4.14
Gray Catbird *Dumetella carolinensis*	4019/6.22	2254/1.77	6930/1.44	7497/1.33
Brown Thrasher *Toxostoma rufum*	1343/3.72	1166/9.43	1458/4.80	1158/0.86
European Starling *Sturnus vulgaris*	8227/34.89	8904/20.78	8934/10.41	3795/6.32
Cedar Waxwing *Bombycilla cedrorum*	1499/3.34	913/4.38	6197/2.10	6315/1.74
Yellow Warbler *Dendroica petechia*	3610/1.66	4294/0.93	23,131/0.48	32,584/0.80
Yellow-rumped Warbler *Dendroica coronata*	9983/1.00	10,496/0.86	23,635/0.38	31,392/0.41
Chipping Sparrow *Spizella passerina*	3525/2.55	1484/2.70	5255/0.95	9689/0.93
Savannah Sparrow *Passerculus sandwichensis*	4668/1.07	3375/1.19	7132/0.42	8705/0.80
Fox Sparrow *Passerella iliaca*	1673/0.00	1377/3.63	1288/0.00	2161/0.46
Song Sparrow *Melospiza melodia*	13,365/3.44	6837/2.19	16,649/0.48	25,498/0.75
White-throated Sparrow *Zonotrichia albicollisaa*	29,303/1.23	17,328/1.90	36,307/0.55	29,614/0.81
White-crowned Sparrow *Zonotrichia leucophrys*	10,111/1.58	4459/0.45	7558/0.53	9843/0.30
Snow Bunting *Plectrophenax nivalis*	1008/0.99	833/4.80	11,415/1.66	5770/0.69
Northern Cardinal *Cardinalis cardinalis*	1625/21.54	998/16.03	876/4.57	1501/4.00
Rose-breasted Grosbeak *Pheucticus ludovicianus*	977/3.07	2028/4.93	5264/1.71	3121/2.24
Red-winged Blackbird *Agelaius phoeniceus*	11,683/10.36	28,961/9.67	22,562/3.72	15,275/1.90
Common Grackle *Quiscalus quiscula*	10,175/51.30	11,256/39.09	6323/21.03	8835/9.96
Brown-headed Cowbird *Molothrus ater*	9627/5.51	34,246/7.88	7064/5.10	10,672/3.09
Baltimore Oriole *Icterus galbula*	1309/3.82	1340/3.73	6425/1.09	3908/1.02
Purple Finch *Carpodacus purpureus*	4745/5.27	7921/5.68	13,169/2.81	8938/3.36
Evening Grosbeak *Coccothraustes vespertinus*	17,655/31.95	10,209/22.24	32,940/7.20	8311/11.31
House Sparrow *Passer domesticus*	837/8.36	2656/2.26	10,070/2.58	1239/3.23