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### The co-operative Breeding Bird Survey in Canada, 1972

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#### Introduction

The Breeding Bird Survey is a co-operative attempt to detect and measure year-to-year changes in numbers of birds (chiefly land birds). Bird numbers vary in response to man's pollution and alteration of the landscape as well as to weather and other natural changes in the environment. We hope that measuring changes in bird numbers will help us understand how to maintain environments healthy for man as well as for birds. The results obtained so far — since 1966 in the Maritimes and 1968 in other settled areas of Canada — do not suggest conspicuous changes other than those correlated with annual weather fluctuations. This survey, co-ordinated by the United States Fish and Wildlife Service and the Canadian Wildlife Service, depends on the co-operation of volunteer observers throughout these countries. We hope that their efforts will continue to show that the myth of sustained growth, euphemistically referred to as progress, has not completely destroyed our country as a place for living things.

#### Results

##### Coverage

The distribution of degree blocks in which surveys were made in 1972 and the areas where former coverage was not repeated, are shown in Figure 1. Table 1 gives the number of routes surveyed each year by provinces.

##### Grouping of routes for analysis

The groupings used in past years have been maintained (Fig. 1). The 20 species most frequently reported in the five parts of Canada for which surveys are available (Maritimes, central Ontario and Quebec, southern Ontario and Quebec, the Prairie Provinces, and British Columbia) are listed in Tables 2 to 6.

##### Changes observed

Analyses were continued for the first four regions. The number of routes surveyed annually in British Columbia is still too small to allow meaningful comparisons. Summaries of the comparisons between 1971 and 1972 are given in Tables 7 to 10. Annual index numbers, showing the year-to-year fluctuations in numbers, are given for the Maritimes (1966-72) and southern Quebec and Ontario (1968-72) in Tables 11 and 12; only three years of comparisons are available for the other two regions, where too few surveys were made before 1970.

#### Discussion

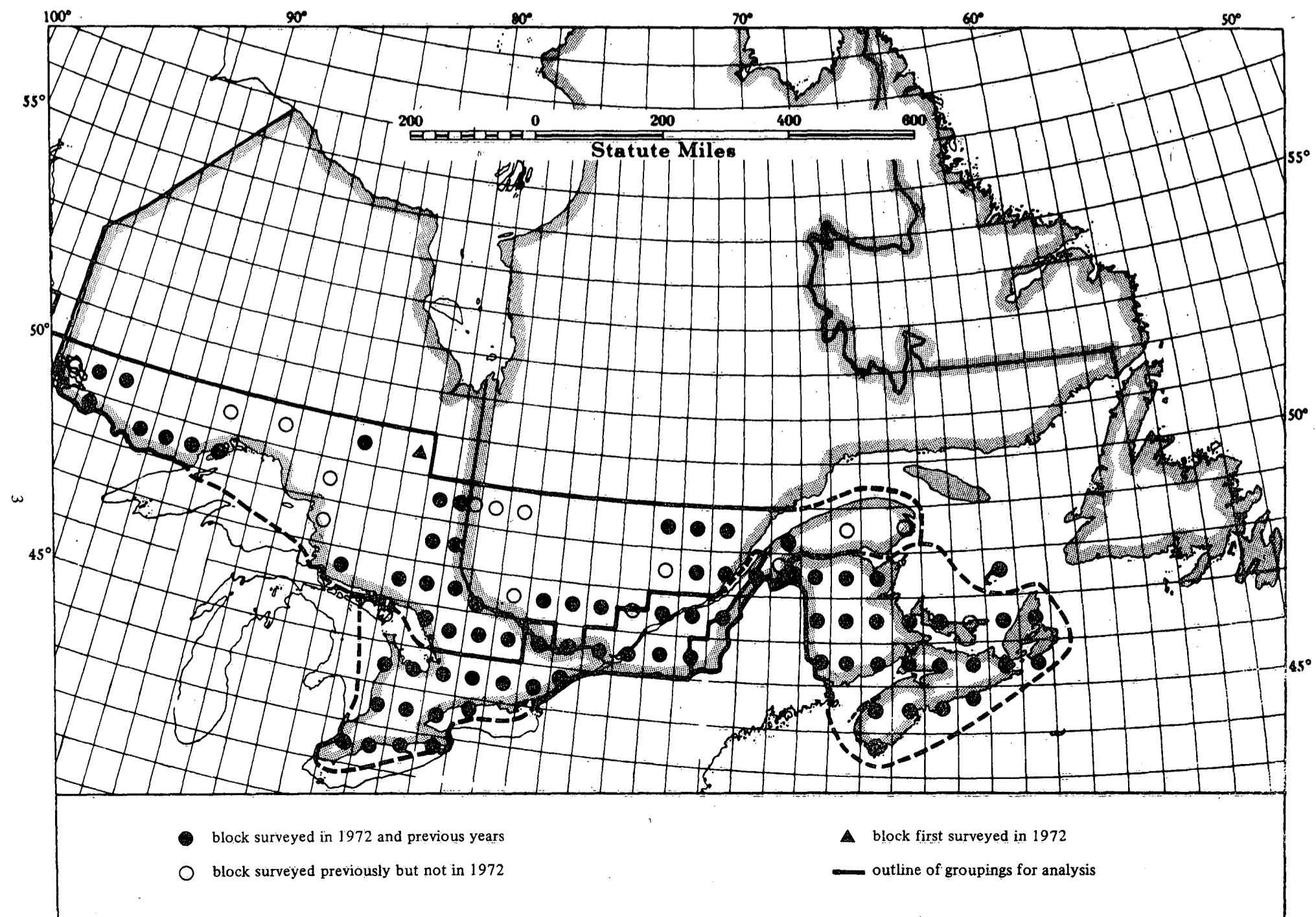
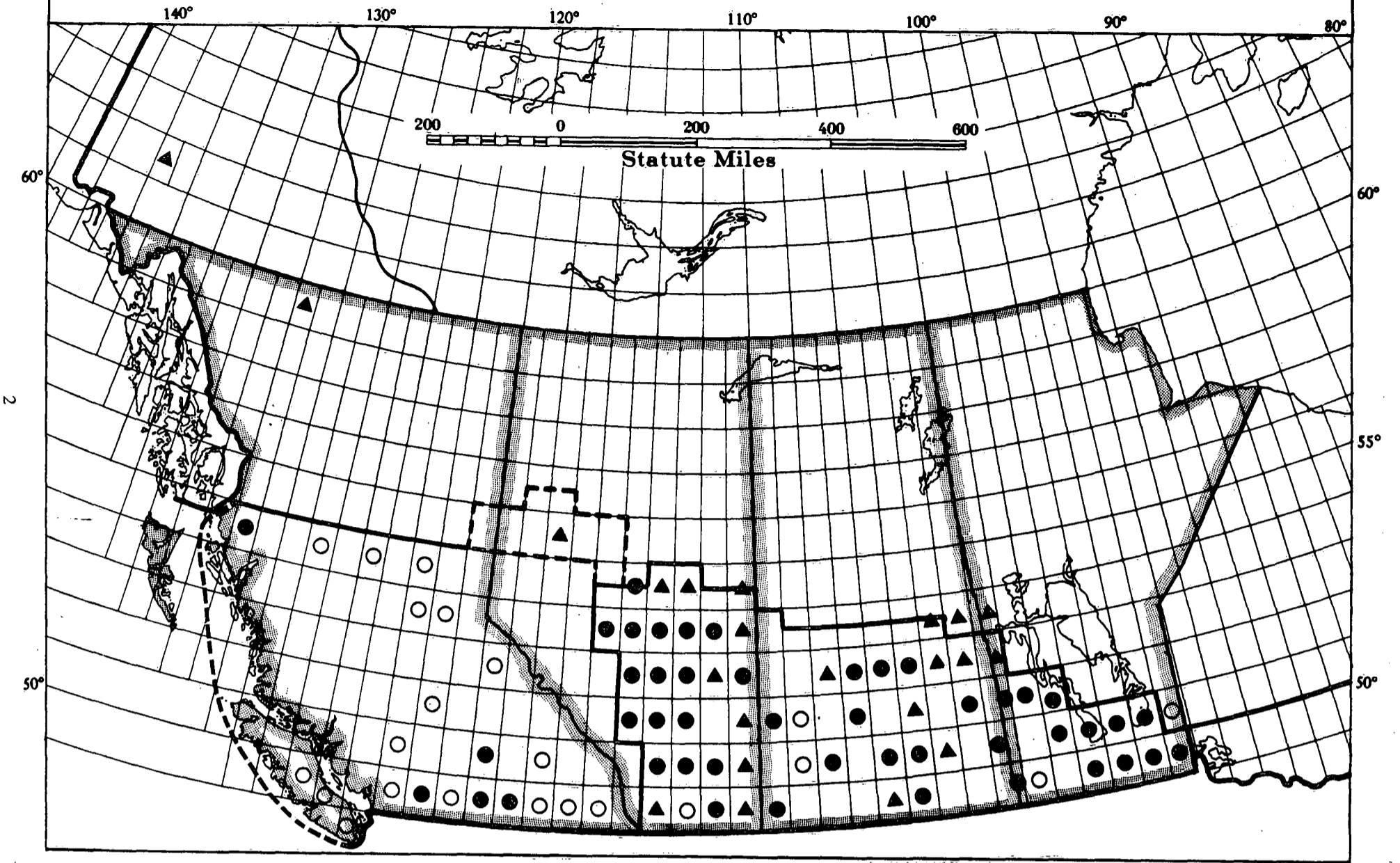
##### Coverage

The total number of routes surveyed in each province (Table 1) is an indication of the effort put forth. However, not all surveys are equally helpful for establishing changes in numbers; comparisons are made only for routes surveyed in successive years under comparable conditions — same observer, dates within two weeks of each other, good weather, and careful observance of survey rules. We always hope that at least 90 per cent of the routes within a region will be repeated in successive years, with about 70 per cent or more receiving comparable coverage. This standard was achieved in 1972 in three regions, but in the central Ontario — central Quebec region only 31 of 43 routes surveyed in 1971 were repeated, and only 19 of these were comparable. The observers were changed on 11 of the 12 rejected routes, although in at least five cases the same observers could have done the surveys in both years. Observer changes also led to at least three routes being rejected from comparisons in the Prairie region. We can hardly afford to lose so many comparisons in regions where only about 30 routes were surveyed in both years.

Coverage in the Maritimes has been excellent, although neither route in eastern Prince Edward Island has been covered in recent years. At least five different persons (in seven years) have served as co-ordinator for the Quebec surveys, which partly accounts for the fluctuating coverage there. A number of previously surveyed routes missed in 1972 are close to major population centres, particularly nos. 11, 17, 18, 20, 24, and 38. Their coverage would make our samples for these regions much more representative. Only four routes in southern Ontario were missed in 1972, two being in the Algonquin Park region. Three routes in south-western Manitoba, including two near Brandon, have not been done recently. Coverage in the southern half of Saskatchewan, though improving, still leaves a number of easily accessible routes untouched. The recent increase was partly owing to previous observers undertaking second routes, but also to the four new observers added in 1972. The tremendous efforts of Alberta's new co-ordinator resulted in almost complete coverage of the prairie and parkland routes there, including 10 routes surveyed for the first time. Efforts to increase the coverage in British Columbia have, in the past, been rather half-hearted, owing to our doubts that the data could be used in year-to-year comparisons. This doubt now seems to be unfounded, and we are pressing for increased efforts there; if 25 or more routes are surveyed annually, starting in 1973, we can hope to begin the British Columbia comparisons in 1974. Two routes, in northern British Columbia and Yukon Territory, were surveyed by a visiting scientist from the United States. These far northern forest surveys detected very few birds, which suggests that our efforts should be concentrated in more southern areas, for the present.



Figure 1  
 Extent of coverage in 1972, and additional coverage in  
 1966-71, Breeding Bird Survey, with outlines of groupings  
 used in analysis



● block surveyed in 1972 and previous years  
 ○ block surveyed previously but not in 1972

▲ block first surveyed in 1972  
 — outline of groupings for analysis

#### Grouping of routes for analysis

Except for southern Ontario and southern Quebec, which are largely agricultural, the groupings used (Fig. 1) are based on the need for samples large enough for analysis more than on the uniformity of the areas sampled. The Maritimes form a compact area, and their heterogeneity is on a very fine scale. Most routes contain examples of several different habitats, although forests predominate. Except for a few routes in the Alberta parklands, nearly all routes surveyed in the Prairie Provinces show a predominance of open country, even though the region extends through nearly 20 degrees of longitude compared to 14 for southern Ontario and Québec, and 9 for the Maritimes.

The central Ontario and Quebec region extends through 31 degrees of longitude, from the Manitoba border to the Gaspé peninsula, with habitats as diverse as rich broad-leaved forests near Georgian Bay, humid boreal forest in the Laurentides Park, poor farmland in the Clay Belt, and even some prairie-edge shrubland near Lake of the Woods. Ideally this region should be broken into several sections, but the number of routes surveyed annually does not allow separate analysis of these subsamples. However, many species occur in all parts of this region, since most birds are tied only to a broad type; for example, Red-eyed Vireos are found abundantly in southern maple woods and in poplar stands farther north, since both are predominantly broad-leaved forest habitats. With this example in mind, we have taken a fresh look at southern British Columbia, where the diverse habitats had earlier discouraged formation of a large grouping. Here too, despite the habitat variations between humid Coast Forest, open ponderosa pine forest in the dry southern interior, and boreal spruce, pine, and poplar forests from the Cariboo northwards, many of the bird species are common throughout. There is thus no insuperable objection to combining routes from all the southern half of British Columbia in one region, which spans only 15 degrees in longitude and 6 in latitude. Inclusion of routes in the mountains and forests of western Alberta in this region would assist in securing an adequate sample. Results of the only survey in the Peace River district suggest that this area belongs with the other Alberta parkland routes, but more data are needed.

Finally, we have received a few enquiries about routes in Newfoundland. We have not encouraged this idea, since there seems no prospect that surveys made there could suffice for separate analysis. Inclusion of Newfoundland routes with the Maritimes would greatly increase the heterogeneity of that well-surveyed region. Newfoundland habitats and bird faunas probably have more in common with those of the Gaspé peninsula and the Lake St. John area in eastern Quebec than with the Maritimes, but few people would advocate combining Newfoundland surveys with those of that distant region. Unless the results can be used locally, we believe that the effort in Newfoundland would be better spent on other projects, such as nest records, individual species studies, or census plots.

#### Changes observed

The sampling and analysis procedures of the Breeding Bird Survey in Canada have been critically examined by the Bio-

metrics Section of CWS. They concluded that the sampling was adequate, given the problems of finding suitable observers in many areas, but that the analysis previously used did not take full advantage of the stratification included in the sampling plan. Accordingly, all past analyses, as well as the 1971-72 comparisons here reported for the first time, have been reworked using a procedure adapted for this purpose by John Smith (outlined in Appendix 1). The results for the past years do not differ sufficiently from those previously published to warrant repetition in full. However, the index numbers for all years, with indications of significant changes, are given for the Maritimes (7 years data) (Table 11) and for southern Ontario and Quebec (5 years data) (Table 12). Similar tables will be included in subsequent reports for the other regions, once five or more years data are available.

The number of changes shown to be significant by the new procedure is markedly greater than before, averaging about six species per year per region. At the 95 per cent probability level, about two species per year per region (1 in 20) might show this degree of change by chance. In most years, the numbers of species showing significant increases and decreases were approximately equal. The conspicuous exceptions were in the Maritimes in 1967 - 8 decreases vs. 1 increase, and in central Ontario and Quebec both in 1971 - 1 decrease vs. 8 increases, and 1972 - 7 decreases vs. 2 increases. Unusually wet, cold weather was certainly involved in the years and areas when decreases predominated. The groups affected in the Maritimes were insectivorous forest species or early-nesting birds. The insectivorous species were all back to their 1966 index levels by 1969 or 1970, but the other species - Raven, Crow, and Song Sparrow - have not yet regained this level. The Song Sparrow sustained another significant decrease in 1972 and is now at its lowest index to date.

No species yet shows a decrease sustained throughout the period of surveys (where 5 or more years data are available). Flicker, Grackle, and Junco in the Maritimes showed their two lowest indexes in the past two years, as did Veery in southern Ontario and Quebec. The apparent increase in Evening Grosbeaks from 1966 to 1971 in the Maritimes was perhaps reversed in 1972. Other species showing their two highest indexes in the last two years included, in the Maritimes, Snipe; Nashville, Magnolia, and Chestnut-sided Warblers, and Redstart; Red-winged Blackbird; and Purple Finch; and in southern Ontario and Quebec, Mourning Dove, Robin, Warbling Vireo, Bobolink, Red-winged Blackbird, and Vesper Sparrow.

However, sustained increases in the indices are less likely to represent real changes, as well as being less alarming, than decreases, since the method of comparison involves a tendency towards increase which will have to be allowed for in long-term trend analyses. Nearly all observers detect more birds in their second and subsequent years of surveying routes than in the first year, if they had no previous experience with the method. Deterioration (in hearing or sight) among older observers is much more gradual. Whenever an observer is replaced, that route is omitted from comparisons in that year, but will usually show increases in the following year, unless it was taken over by a previously experienced

observer. Although this change, of perhaps only one or two per cent per year, can be neglected in year-to-year comparisons (after the first year of surveys in a region), it will accumulate over 10 years to give an index level 10 to 20 per cent higher than at the start. This problem, with other aspects of long-term trend analysis of these data, is being studied by the CWS Biometrics Section.

The year 1972 was characterized by cold, wet weather in most parts of the northern hemisphere, including Canada. The Breeding Bird Survey documented a number of apparent changes in response to this, particularly in central Ontario and Quebec where two surveys made on June 10, 1972, experienced below-freezing weather throughout! However, suggestions have been made (B.T.O. News, No. 54, 1972; H.R. Ouellet, pers. comm.) that much of the apparent decrease was in song only, that the birds were present and breeding successfully but silently. One obvious exception to this was the decrease in Purple Martins in southern Ontario and Quebec, which has been shown (American Birds, 26(5), 1972) to have been real. For the others, 1973 will give a better indication.

Inevitably, a number of changes found to be significant are real only for the area sampled, since the species are not uniformly or randomly distributed. This is obvious with water birds, which make up a relatively large proportion of those analysed in the Prairie Provinces, and with flocking birds such as gulls, swallows, blackbirds, and Evening Grosbeaks. The method is applicable mainly to solitary-nesting land birds, which includes most of our song birds as well as a number of other groups.

#### Acknowledgements

Again in 1972, our volunteer helpers carried out most of these surveys, and their enthusiasm has ensured the continuance of this project. Without trend data such as are being derived from these surveys, we have no sound base upon which to recommend management plans to ensure the continued well-being of our bird populations. We thank everyone who has helped with these surveys at any time, including John Smith, who devised the analysis method, and Carol Ann Lowrey, who spent many hours recalculating all the data from past years. The regional co-ordinators earned special thanks for organizing coverage, and in many cases carrying out one or several surveys themselves. Their addresses are given below.

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Québec 7

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1815 Altona Road,  
Pickering

Manitoba  
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#### Appendix 1: Statistical analysis of yearly changes

Formation of the estimate of change and its standard error. The sample design is stratified random, as described in Robbins and Van Velzen (1967). Degree blocks are the strata, with randomly chosen routes within each. In some coastal areas where degree blocks consist mainly of water, two or more were combined to form a single stratum. Several routes were chosen within each degree block but, as will be discussed later, in some areas very few are covered in the survey.

To measure the change in a particular species between two successive years, the following quantity was used:

$$R = (\bar{Y} - \bar{X}) / \bar{X} \text{ where}$$

$\bar{X}$  = mean no. of birds/route in the 1st year, and

$\bar{Y}$  = mean no. of birds/route in the 2nd year.

Hence  $100 \times R$  is the percentage increase in the number of birds observed in the second year over that in the first. The means,  $\bar{X}$  and  $\bar{Y}$ , are averages of the birds observed on each route weighted according to the area the route represents, i.e.,

$$\bar{X} = (1/A) \sum_i \sum_j a_{ij} X_{ij}$$

$$\bar{Y} = (1/A) \sum_i \sum_j a_{ij} Y_{ij} \text{ where}$$

$$\bar{X}_{ij} = \text{no. of birds observed on the } j\text{th route in the } i\text{th degree block in the 1st year}$$

$$\bar{Y}_{ij} = \text{no. of birds observed on the } j\text{th route in the } i\text{th degree block in the 2nd year}$$

$$a_{ij} = \text{area represented by (also called the 'weight') the } j\text{th route in the } i\text{th degree block, and}$$

$$A = \sum_i \sum_j a_{ij}$$

Since the routes are randomly chosen within strata,  $a_{ij}$  is the same for all routes within a given stratum, i.e.,  $a_{ij} = a$  (area of the  $i$ th stratum) / (number of routes in the  $i$ th stratum).

The variance of  $R$  is estimated by using the variance formula of a ratio (see Kendall and Stuart, 1963:232).

$$\text{var } R = (\bar{Y}/\bar{X})^2 [( \text{var } \bar{Y} ) / \bar{Y}^2 + ( \text{var } \bar{X} ) / \bar{X}^2 - 2 \text{cov}(\bar{X}, \bar{Y}) / \bar{X}\bar{Y}] \text{ where}$$

$$\text{var } \bar{X} = (1/A^2) \sum_i a_i^2 (\sum_j X_{ij}^2 - n_i \bar{X}_i^2) / [n_i(n_i - 1)]$$

$$\text{var } \bar{Y} = (1/A^2) \sum_i a_i^2 (\sum_j Y_{ij}^2 - n_i \bar{Y}_i^2) / [n_i(n_i - 1)]$$

$$\text{cov}(\bar{X}, \bar{Y}) = (1/A^2) \sum_i a_i^2 (\sum_j X_{ij} Y_{ij} - n_i \bar{X}_i \bar{Y}_i) / [n_i(n_i - 1)]$$

$n_i$  = no. of comparable routes in the  $i$ th stratum

$$\bar{X}_i = \sum_j X_{ij} / n_i$$

$$\bar{Y}_i = \sum_j Y_{ij} / n_i$$

These are the variance and covariance formulae for weighted means in a stratified random sample (see Cochran, 1963: chapter 5).

Modifications required by noncoverage or incomparability of routes

In many cases, especially in the Prairies and central Ontario and Quebec, there are one or no routes in a stratum which are comparable between the two successive years for which we wish to measure the change. In this case the variance expressions given above are invalid. To circumvent this problem several strata are 'collapsed' to form one larger stratum in which there are at least two comparable routes.

Then,  $\text{var } R$  is calculated as though all the comparable routes ( $n_i$  of them) were chosen at random within the large stratum. This will generally tend to overestimate the variance. To minimize this effect, strata were combined which were as similar as possible with respect to breeding bird habitat. On the prairies where routes are very sparse, degree blocks were collapsed into strata roughly following ecological boundaries. Further, in comparing different pairs of years, strata may be

collapsed into different groups depending upon which routes are comparable.

There are practical limitations to collapsing strata. For example, two routes might be in one degree block (each with a weight of 1/2 degree block), while in a collapsed stratum 3 routes might represent 21 degree blocks (each with a weight of 7 degree blocks). In this case the large weight of the latter routes completely overshadows the small weight of the former and leads to a large variance. To reduce this effect it was arbitrarily decided to set a maximum weight of 2.5 degree blocks for a route even though this meant some of the degree blocks were not accounted for. This leads to a bias, but is probably the lesser of two evils.

#### Confidence limits

The 95 per cent limits given for  $R$  are two standard deviations on each side of the estimate. This tacitly assumes that  $R$  is normally distributed. This is a reasonable approximation in view of the fact that the coefficients of variation of  $\bar{X}$  and  $\bar{Y}$  are generally much less than one and  $\bar{X}$  and  $\bar{Y}$  are themselves approximately normal.

#### References

- Cochran, W.G. 1963. Sampling Techniques, 2nd ed. John Wiley and Sons, Inc., New York.
- Kendall, M.G., and A. Stuart. 1963. The Advance Theory of Statistics. Vol. I. Hafner Publishing Co., New York.
- Robbins, C.S., and W.J. Van Velzen, 1967. The Breeding Bird Survey 1966. U.S. Dept. Int. Fish Wildl. Serv., Bur. Sport Fish. Wildl. Spec. Sci. Rep. - Wildl. No. 102.

Table 1

Number of Breeding Bird Survey routes completed in each province, 1966-72, excluding duplicate coverages and non-random routes. No surveys have been made in Newfoundland in any year

Province	Number of routes surveyed						
	1966	1967	1968	1969	1970	1971	1972
P.E.I.	2	4	4	4	3	2	2
N.S.	16	20	20	20	20	21	23
N.B.	15	19	22	23	23	24	24
Que.	3	7	17	20	33	25	28
Ont.		4	41	40	47	53	47
Man.		11	11	12	11	11	14
Sask.			3	6	11	13	20
Alta.			5	7	11	17	27
B.C.			16	16	17	12	8
Yukon Territory							1
Total	36	65	139	148	176	178	194

Table 2

The 20 species recorded in greatest numbers in the Breeding Bird Survey, Maritime Provinces, 1972; the mean number of each per route; and the percentage of routes on which they were found. Forty-nine routes were surveyed, with a mean of 897 birds noted per route.

Species	Mean number per route	% of 49 routes
Robin	62.8	100
White-throated Sparrow	58.9	100
Herring Gull	46.3	65
Starling	46.2	94
Evening Grosbeak	38.7	61
Common Crow	36.3	96
Song Sparrow	29.6	100
Common Grackle	28.2	98
Barn Swallow	26.4	100
Swainson's Thrush	23.8	94
Yellowthroat	23.7	100
Red-winged Blackbird	23.6	100
Bank Swallow	18.7	76
Ruby-crowned Kinglet	18.3	92
American Redstart	18.2	92
Magnolia Warbler	18.2	84
Bobolink	18.0	84
Tree Swallow	17.9	100
Traill's Flycatcher	16.4	98
House Sparrow	16.2	82

Table 3

The 20 species recorded in greatest numbers in the Breeding Bird Survey, central Ontario and central Quebec, 1972; the mean number of each per route; and the percentage of routes on which they were found. Thirty-eight routes were surveyed, with a mean of 698 noted per route

Species	Mean number per route	% of 38 routes
White-throated Sparrow	58.7	100
Starling	45.7	92
Robin	32.0	100
Red-eyed Vireo	29.4	97
Veery	28.4	73
Common Crow	27.8	100
Song Sparrow	24.5	97
Ovenbird	22.2	97
Red-winged Blackbird	20.1	84
Yellowthroat	18.6	97
Savannah Sparrow	18.5	81
Swainson's Thrush	15.7	81
Chestnut-sided Warbler	15.4	89
Barn Swallow	14.7	78
Chipping Sparrow	14.7	97
Bank Swallow	13.6	51
Common Grackle	13.5	89
Bobolink	12.3	57
Tree Swallow	12.0	95
Nashville Warbler	10.7	84

**Table 4**

The 20 species recorded in greatest numbers in the Breeding Bird Survey, southern Ontario and southern Quebec, 1972; the mean number of each per route; and the percentage of routes on which they were found. Thirty-seven routes were surveyed, with a mean of 1165 birds noted per route

Species	Mean number per route	% of 37 routes
Red-winged Blackbird	187.7	100
Starling	155.8	100
Common Grackle	93.4	100
House Sparrow	70.3	100
Robin	58.0	100
Savannah Sparrow	55.5	100
Common Crow	49.6	100
Bobolink	46.5	100
Song Sparrow	40.0	100
Barn Swallow	36.7	100
Eastern Meadowlark	28.9	95
Brown-headed Cowbird	25.0	100
American Goldfinch	21.7	100
Bank Swallow	21.3	59
Killdeer	18.6	100
Chipping Sparrow	17.2	97
Rock Dove	15.8	81
Mourning Dove	13.0	84
Tree Swallow	12.0	92
Yellowthroat	10.1	92

**Table 5**

The 20 species recorded in greatest numbers in the Breeding Bird Survey, Prairie Provinces, 1972; the mean number of each per route; and the percentage of routes on which they were found. Sixty-one routes were surveyed, with a mean of 852 birds noted per route.

Species	Mean number per route	% of 61 routes
Red-winged Blackbird	76.4	100
Franklin's Gull	53.3	59
Common Crow	43.4	97
Western Meadowlark	43.0	88
House Sparrow	40.8	97
Horned Lark	39.8	77
Mallard	33.6	84
Clay-coloured Sparrow	29.5	97
Brewer's Blackbird	26.5	98
Starling	23.0	82
Savannah Sparrow	21.9	95
Song Sparrow	19.6	85
Cliff Swallow	17.8	33
Brown-headed Cowbird	17.6	84
Vesper Sparrow	17.0	85
Barn Swallow	15.6	97
Black-billed Magpie	15.2	95
Yellow-headed Blackbird	13.8	49
House Wren	13.1	82
Lark Bunting	12.5	21

**Table 6**

The 20 species recorded in greatest numbers in the Breeding Bird Survey, British Columbia and Yukon Territory, 1972; the mean number of each per route; and the percentage of routes on which they were found. Nine routes were surveyed, with a mean of 638 birds noted per route

Species	Mean number per route	% of 9 routes
Starling	75.4	67
Robin	50.7	100
Brewer's Blackbird	41.1	67
Swainson's Thrush	31.0	89
Crows*	27.0	78
Pine Siskin	19.2	78
Brown-headed Cowbird	18.5	67
Red-winged Blackbird	16.1	78
Barn Swallow	15.4	67
Red-eyed Vireo	14.9	67
Juncost†	14.4	100
Chipping Sparrow	14.4	67
Tree Swallow	12.4	89
Violet-green Swallow	11.2	56
Yellow Warbler	9.7	78
Black Swift	9.7	22
Audubon's Warbler	9.0	67
American Goldfinch	9.0	44
Cliff Swallow	8.3	56
MacGillivray's Warbler	8.1	67

\* The Common Crow and the North-western Crow are combined here.

† The Slate-colored Junco and the Oregon Junco are combined here.

**Table 7**  
Changes in bird population samples for 41 comparable routes, Breeding Bird Survey, Maritimes, 1971-72

Species	Weighted mean number of birds per route		% change ( <i>italics</i> ) with 95% confidence limits		
	1971	1972			
Common Snipe	5.38	4.94	- 42	- 8	+ 26
Herring Gull	38.96	62.54	- 65	+60	+185
Yellow-shafted Flicker*	3.43	1.69	- 63	-51	- 39
Yellow-bellied Sapsucker*	8.13	5.55	- 57	-32	- 7
Trail's Flycatcher	17.49	16.97	- 17	- 3	+ 11
Least Flycatcher	4.94	4.80	- 24	- 3	+ 18
Tree Swallow	21.29	19.14	- 33	-10	+ 13
Bank Swallow	24.91	18.15	- 65	-27	+ 11
Barn Swallow	23.37	25.74	- 5	+10	+ 25
Blue Jay	5.23	4.05	- 67	-22	+ 23
Common Raven	9.26	9.19	- 30	- 1	+ 28
Common Crow	34.83	39.16	- 7	+12	+ 31
Winter Wren	4.86	4.99	- 21	+ 3	+ 27
Robin	64.26	60.29	- 13	- 6	+ 1
Hermit Thrush	8.93	8.99	- 24	+ 1	+ 26
Swainson's Thrush	17.90	21.23	- 17	+19	+ 55
Veery	5.25	5.86	- 20	+11	+ 42
Ruby-crowned Kinglet *	14.30	16.58	+ 2	+16	+ 30
Starling	43.80	43.53	- 16	- 1	+ 14
Red-eyed Vireo*	11.35	13.99	+ 4	+23	+ 42
Nashville Warbler	7.33	7.63	- 14	+ 4	+ 22
Yellow Warbler	10.91	12.67	- 1	+16	+ 33
Magnolia Warbler	17.18	17.66	- 11	+ 3	+ 17
Black-throated Green Warbler*	5.91	7.14	+ 6	+21	+ 36
Chestnut-sided Warbler	6.95	8.40	- 2	+21	+ 44
Ovenbird*	8.68	11.51	+ 15	+33	+ 51
Yellowthroat	22.12	22.05	- 10	0	+ 10
American Redstart	17.97	17.98	- 23	0	+ 23
House Sparrow	16.89	15.43	- 29	- 9	+ 11
Bobolink*	11.33	14.55	+ 6	+28	+ 50
Red-winged Blackbird*	17.68	21.02	+ 3	+19	+ 35
Common Grackle	25.84	27.95	- 3	+ 8	+ 19
Brown-headed Cowbird	6.01	5.53	- 36	- 8	+ 20
Evening Grosbeak	17.66	15.98	- 46	- 9	+ 28
Purple Finch	10.44	8.95	- 34	-14	+ 6
American Goldfinch	14.48	13.22	- 34	- 9	+ 16
Savannah Sparrow	12.70	12.82	- 22	+ 1	+ 24
Slate-coloured Junco	12.96	13.53	- 11	+ 4	+ 19
Chipping Sparrow	7.64	7.91	- 33	+ 3	+ 39
White-throated Sparrow	52.74	56.45	- 2	+ 7	+ 16
Song Sparrow*	31.07	26.83	- 22	-14	- 6

\*Change at least 95 per cent significant.

**Table 8**  
Changes in bird population samples for 19 comparable routes, Breeding Bird Survey, central Ontario and central Quebec, 1971-72

Species	Weighted mean number of birds per route		% change ( <i>italics</i> ) with 95% confidence limits		
	1971	1972			
Killdeer	4.78	5.97	- 34	+25	+ 84
Herring Gull*	18.09	4.27	-100	-76	- 50
Yellow-shafted Flicker	3.91	4.58	- 21	+17	+ 56
Yellow-bellied Sapsucker*	4.37	2.30	- 77	-47	- 18
Trail's Flycatcher*	13.03	8.09	- 50	-38	- 26
Least Flycatcher	10.65	10.49	- 18	- 1	+ 15
Tree Swallow	12.28	11.36	- 33	- 7	+ 18
Bank Swallow	8.21	15.12	- 37	+84	+205
Barn Swallow	12.67	13.65	- 32	+ 8	+ 47
Blue Jay*	5.54	3.61	- 61	-35	- 9
Common Raven	5.82	3.35	-100	-42	+ 23
Common Crow	28.88	33.07	- 14	+15	+ 43
Winter Wren	8.52	7.81	- 29	- 8	+ 12
Robin	28.37	30.46	- 13	+ 7	+ 28
Hermit Thrush	9.42	8.29	- 49	-12	+ 24
Swainson's Thrush	19.54	20.03	- 31	+ 3	+ 36
Veery	25.62	25.66	- 32	0	+ 33
Ruby-crowned Kinglet	10.41	13.01	- 30	+25	+ 80
Cedar Waxwing*	6.05	3.70	- 70	-39	- 8
Starling	45.33	53.53	- 13	+18	+ 49
Red-eyed Vireo	39.15	33.89	- 31	-13	+ 4
Nashville Warbler	16.65	14.17	- 48	-15	+ 18
Yellow Warbler*	5.58	3.40	- 67	-39	- 11
Magnolia Warbler*	8.35	6.64	- 37	-21	- 4
Myrtle Warbler	4.79	4.46	- 77	- 7	+ 63
Chestnut-sided Warbler*	15.62	11.73	- 41	-25	- 9
Ovenbird	20.95	18.99	- 21	- 9	+ 3
Mourning Warbler	10.31	10.52	- 22	+ 2	+ 26
Yellowthroat	21.53	19.27	- 23	-10	+ 2
American Redstart	7.74	6.70	- 45	-13	+ 18
House Sparrow*	7.93	12.08	+ 10	+52	+ 95
Bobolink	16.79	15.80	- 32	- 6	+ 21
Red-winged Blackbird	19.84	20.59	- 16	+ 4	+ 23
Common Grackle	9.83	9.41	- 35	- 4	+ 27
Brown-headed Cowbird	10.80	10.15	- 38	- 6	+ 26
Rose-breasted Grosbeak	5.66	5.11	- 51	-10	+ 32
Evening Grosbeak*	13.81	6.73	- 80	-51	- 23
American Goldfinch*	14.87	8.31	- 66	-44	- 22
Savannah Sparrow*	15.11	22.37	+ 19	+48	+ 77
Slate-coloured Junco	4.63	6.98	- 36	+50	+137
Chipping Sparrow	9.51	11.97	- 4	+26	+ 56
White-throated Sparrow	57.63	59.08	- 18	+ 3	+ 23
Song Sparrow	22.89	23.69	- 17	+ 3	+ 24

\*Change at least 95 per cent significant.



**Table 9**  
Changes in bird population samples for 25 comparable routes, Breeding Bird Survey, southern Ontario and southern Quebec, 1971-72

Species	Weighted mean number of birds per route		% change ( <i>italics</i> ) with 95% confidence limits		
	1971	1972			
Killdeer	17.25	18.35	- 13	+ 6	+ 26
Rock Dove	17.29	17.95	- 54	+ 4	+ 62
Mourning Dove	12.79	14.24	- 18	+11	+ 41
Yellow-shafted Flicker	5.73	5.99	- 29	+ 5	+ 39
Eastern Kingbird	7.58	8.00	- 18	+ 6	+ 29
Great Crested Flycatcher	5.51	5.40	- 26	- 2	+ 22
Eastern Wood Pewee	4.13	4.33	- 31	+ 5	+ 41
Horned Lark	5.53	4.94	- 47	-11	+ 25
Tree Swallow	8.38	11.21	- 16	+34	+ 83
Bank Swallow	35.67	26.20	- 65	-27	+ 12
Barn Swallow	33.41	33.11	- 16	- 1	+ 14
Purple Martin*	8.21	5.13	- 63	-37	- 12
Blue Jay*	6.19	4.26	- 58	-31	- 4
Common Crow	52.68	49.11	- 25	- 7	+ 12
House Wren	4.10	4.95	- 3	+21	+ 44
Catbird	4.59	4.01	- 42	-13	+ 16
Brown Thrasher	6.47	4.66	- 61	-28	+ 6
Robin	57.52	60.66	- 4	+ 5	+ 14
Veery	4.11	3.73	- 31	- 9	+ 13
Cedar Waxwing*	7.61	4.52	- 69	-41	- 12
Starling	148.23	166.09	- 13	+12	+ 37
Red-eyed Vireo	5.52	5.10	- 44	- 8	+ 29
Warbling Vireo	4.97	4.79	- 32	- 4	+ 24
Yellow Warbler*	9.21	6.52	- 55	-29	- 3
Yellowthroat	8.86	8.82	- 16	0	+ 15
House Sparrow	63.35	69.89	- 4	+10	+ 25
Bobolink	53.31	51.38	- 19	- 4	+ 12
Eastern Meadowlark	30.33	33.09	- 16	+ 9	+ 34
Red-winged Blackbird	142.79	198.93	- 2	+39	+ 81
Baltimore Oriole*	11.52	8.86	- 38	-23	- 8
Common Grackle	113.68	103.63	- 31	- 9	+ 13
Brown-headed Cowbird	25.90	23.98	- 25	- 7	+ 10
Rose-breasted Grosbeak	4.40	5.06	- 17	+15	+ 47
American Goldfinch	24.26	21.01	- 45	-13	+ 18
Savannah Sparrow	42.80	51.59	+ 2	+21	+ 39
Vesper Sparrow	8.84	8.97	- 21	+ 1	+ 24
Chipping Sparrow*	12.46	15.82	+ 7	+27	+ 47
White-throated Sparrow*	4.83	6.13	+ 3	+27	+ 50
Song Sparrow*	42.57	38.05	- 22	-11	0

\*Change at least 95 per cent significant.

**Table 10**  
Changes in bird population samples for 29 comparable routes, Breeding Bird Survey, Prairie Provinces, 1971-72

Species	Weighted mean number of birds per route		% change ( <i>italics</i> ) with 95% confidence limits		
	1971	1972			
Mallard	29.35	26.27	- 37	-10	+ 16
Pintail*	11.41	7.14	- 68	-37	- 7
Blue-winged Teal	9.33	7.54	- 55	-19	+ 16
Shoveler	3.94	8.40	-100	+113	+401
American Widgeon	5.20	5.77	- 77	+11	+100
Lesser Scaup	7.46	5.75	-100	-23	+ 65
Sora	4.37	6.36	- 43	+46	+134
American Coot*	17.41	8.69	- 86	-50	- 14
Killdeer	12.48	12.41	- 16	- 1	+ 15
Ring-billed Gull	7.11	6.51	- 54	- 8	+ 37
Franklin's Gull	20.96	66.23	- 65	+216	+497
Black Tern	11.61	11.33	- 32	- 2	+ 28
Rock Dove	8.27	7.42	- 52	-10	+ 31
Mourning Dove	8.65	8.63	- 26	0	+ 26
Yellow-shafted Flicker	3.14	2.93	- 37	- 7	+ 24
Eastern Kingbird	6.00	5.99	- 26	0	+ 25
Least Flycatcher	6.61	6.04	- 31	- 9	+ 14
Horned Lark	51.49	48.68	- 24	- 5	+ 14
Tree Swallow*	3.36	6.32	+ 27	+88	+150
Barn Swallow*	11.81	16.24	+ 11	+38	+ 65
Cliff Swallow	17.69	24.92	-100	+41	+209
Black-billed Magpie	13.59	16.68	- 9	+23	+ 55
Common Crow*	49.73	43.36	- 24	-13	- 1
House Wren	14.00	14.26	- 25	+ 2	+ 28
Robin	12.11	14.76	- 3	+22	+ 47
Starling	30.63	22.91	- 71	-25	+ 20
Red-eyed Vireo	4.80	5.26	- 25	+ 9	+ 43
Warbling Vireo	4.41	3.88	- 40	-12	+ 16
Yellow Warbler	8.44	7.41	- 30	-12	+ 5
Yellowthroat	3.81	3.40	- 27	-11	+ 5
House Sparrow*	37.89	46.65	+ 4	+23	+ 42
Western Meadowlark	42.88	41.27	- 18	- 4	+ 10
Yellow-headed Blackbird*	13.88	10.10	- 51	-27	- 4
Red-winged Blackbird*	77.02	90.82	+ 7	+18	+ 29
Baltimore Oriole	3.61	3.41	- 35	- 6	+ 24
Brewer's Blackbird	26.57	27.57	- 36	+ 4	+ 44
Brown-headed Cowbird	18.68	17.37	- 27	- 7	+ 13
American Goldfinch	6.17	6.30	- 34	+ 2	+ 38
Savannah Sparrow*	14.93	21.73	+ 22	+46	+ 69
Vesper Sparrow	15.17	15.39	- 19	+ 1	+ 22
Clay-coloured Sparrow	25.88	29.26	- 5	+13	+ 31
Song Sparrow	16.06	17.41	- 14	+ 8	+ 31

\*Change at least 95 per cent significant.

**Table 11**  
Trends in index numbers for bird populations, Maritimes, from Breeding Bird Survey, based on 1970 index of 100

Species	1966	1967	Index number for				
			1968	1969	1970	1971	1972
Common Snipe	53	97	108	* 79	100	124	114
Herring Gull	48	52	41	40	100	* 46	74
Yellow-shafted Flicker	116	100	101	91	100	86	* 42
Yellow-bellied Sapsucker	92	103	96	* 128	* 100	149	* 101
Traill's Flycatcher	89	100	122	* 145	* 100	123	119
Least Flycatcher	164	* 110	90	130	* 100	127	123
Tree Swallow	134	118	99	109	100	131	118
Bank Swallow	125	154	128	114	100	160	117
Barn Swallow	85	99	84	96	100	83	92
Blue Jay	68	71	* 169	* 105	100	114	89
Common Raven	185	* 113	101	87	100	121	120
Common Crow	123	* 96	102	116	100	101	113
Winter Wren	102	127	122	111	100	123	127
Robin	101	101	99	98	100	100	94
Hermit Thrush	72	88	85	76	* 100	102	103
Swainson's Thrush	88	91	100	114	100	97	115
Veery	132	107	91	103	100	117	130
Ruby-crowned Kinglet	149	* 115	* 97	101	100	116	* 135
Starling	113	88	99	94	100	96	95
Red-eyed Vireo	99	* 78	91	115	100	109	* 134
Nashville Warbler	76	65	55	* 89	100	112	117
Yellow Warbler	117	97	99	115	100	104	121
Magnolia Warbler	91	* 72	79	79	* 100	106	109
Black-throated Green Warbler	104	* 73	88	93	100	* 77	* 93
Chestnut-sided Warbler	88	64	66	89	100	109	132
Ovenbird	62	67	65	78	* 100	91	* 121
Yellowthroat	98	101	97	93	100	102	102
American Redstart	86	72	79	86	100	113	113
House Sparrow	68	75	71	85	100	77	70
Bobolink	87	98	* 118	128	* 100	103	* 132
Red-winged Blackbird	78	75	80	89	100	107	* 127
Common Grackle	147	116	118	112	100	88	95
Brown-headed Cowbird	71	88	98	133	100	82	75
Evening Grosbeak	15	21	24	35	* 100	180	164
Purple Finch	48	* 100	105	* 85	100	142	122
American Goldfinch	120	177	* 129	115	100	113	103
Savannah Sparrow	87	94	102	89	100	89	90
Slated-coloured Junco	130	137	108	99	100	83	86
Chipping Sparrow	96	113	106	105	100	106	109
White-throated Sparrow	82	98	* 90	95	100	* 90	96
Song Sparrow	149	* 97	104	108	100	100	* 86

\*The index change between these years was at least 95 per cent significant.

**Table 12**  
Trends in index numbers for bird populations, southern Ontario and southern Quebec, from Breeding Bird Survey, based on 1970 index of 100

Species	1968	1969	Index number for			
			1970	1971	1972	
Killdeer	102	93	100	105	111	
Rock Dove	156	122	100	112	117	
Mourning Dove	93	88	100	108	120	
Yellow-shafted Flicker	132	98	100	104	109	
Eastern Kingbird	98	95	100	94	100	
Great Crested Flycatcher	91	88	100	101	99	
Eastern Wood Pewee	93	83	100	87	91	
Horned Lark	106	114	100	100	89	
Tree Swallow	109	95	100	89	119	
Bank Swallow	58	102	100	127	93	
Barn Swallow	71	80	100	93	92	
Purple Martin	111	93	100	146	* 92	
Blue Jay	107	* 145	100	* 152	* 105	
Common Crow	98	100	100	114	106	
House Wren	85	63	* 100	95	115	
Catbird	69	84	100	93	81	
Brown Thrasher	74	81	100	135	97	
Robin	103	102	100	112	118	
Veery	91	84	100	* 80	73	
Cedar Waxwing	48	95	100	162	* 96	
Starling	95	100	100	102	114	
Red-eyed Vireo	75	88	100	99	91	
Warbling Vireo	70	76	100	143	137	
Yellow Warbler	92	* 110	100	102	* 72	
Yellowthroat	83	67	* 100	81	81	
House Sparrow	112	* 130	* 100	96	105	
Bobolink	83	96	100	* 119	114	
Eastern Meadowlark	107	115	100	108	118	
Red-winged Blackbird	83	97	100	111	154	
Baltimore Oriole	95	93	100	115	* 89	
Common Grackle	107	139	* 100	116	105	
Brown-headed Cowbird	93	91	100	106	99	
Rose-breasted Grosbeak	109	98	100	113	130	
American Goldfinch	172	* 98	100	107	93	
Savannah Sparrow	94	106	100	105	* 126	
Vester Sparrow	84	91	100	* 121	122	
Chipping Sparrow	109	* 83	100	94	* 119	
White-throated Sparrow	82	78	* 100	104	* 132	
Song Sparrow	104	98	100	107	96	

\*The index change between these years was at least 95 per cent significant.



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