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The Co-operative Breeding Bird Survey in Canada, 1979

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Introduction

The Breeding Bird Survey (BBS) began in Canada in 1966. It provides annual information on the status of North American birds, especially songbirds, during the breeding season. It enables us to note modifications of the breeding ranges and populations trends, which may be attributable to a variety of factors.

Erskine (1978) described the methods used for the survey and to analyze the data. Each year during June and the first week of July, which is the peak of the breeding season for most songbirds, volunteers survey the same (ideally) predetermined routes. The routes are 40 km long and the observer stops every 0.8 km and notes each bird in the area. The surveys start ½ h before dawn and usually take 4 h to complete. To analyze trends in bird populations, data from routes surveyed in 1979 were compared with 1978 data from the same routes, if available, under the following conditions. The observer was the same in both years, the routes were surveyed on approximately the same date, after 1 June and before 7 July, and the weather was favourable in both years.

The BBS relies on a network of enthusiastic volunteers who are willing to do the roadside surveys. In any given year as many as 500 people may be involved as either observers or assistants. The dependence of the BBS on volunteers rather than on paid professionals is one of the strong points of the technique. However, there are some limitations to BBS as a method for monitoring trends in songbird numbers (Erskine 1978). Suitable roads must be available and thus much of northern Canada remains uncensused. The routes are surveyed only once each year and the repeatability of results remains untested and somewhat uncertain in most areas. Because surveys follow roadways there is likely to be an over-representation of species preferring "edge" rather than "pure" habitats. This effect will likely vary with the habitat being surveyed and the quality of the road.

Despite these limitations the BBS appears to be the most practical option for measuring continental trends in songbird numbers because of the vast area which must be covered and the relative paucity of competent bird watchers.

Results and discussion

Coverage

Figure 1 shows the distribution by degree-blocks of surveys made in 1979, and compares it to previous coverage. Table 1 shows the numbers of routes surveyed in each of the last seven years and the total number of different routes surveyed since the survey began in 1966. In the Maritimes, in southern Quebec and Ontario, and in British Columbia there are usually two routes per degree-block. In other areas there is usually only one route; therefore, the coverage in those areas is less complete than Figure 1 might suggest.

The pattern of coverage in 1979 was similar to that in previous years. The total number of routes surveyed is only slightly greater than the number surveyed in 1978 and overall coverage remains low. New routes were added in Newfoundland, New Brunswick, Quebec, Ontario and Saskatchewan. For the third consecutive year the Yukon was not surveyed and the new route in Newfoundland was the only one reported for that province.

Of a total of 229 routes surveyed throughout the country, only 62% (143) were comparable for 1978-79. Of the 86 non-comparable routes, 14% lacked observations in 1978 and 51% were eliminated due to observer changes, 6% due to poor weather, 8% due to a failure of the observer to adhere to the rules and 15% for a combination of reasons.

The percentage of comparable routes is down appreciably from past years. This is discouraging as it affects the confidence that we have in the data. In the southern Ontario and Quebec region approximately 74% of routes surveyed were comparable. In all other regions this figure ranged between 48 and 64%. However, because an observer change was the main reason surveys were not comparable between 1978 and 1979, we can expect an increase in comparability next year.

Grouping of routes for analysis

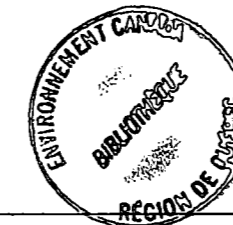
The regional groupings used in 1978 were used again in 1979. Tables 2-7 give the 40 species detected in greatest numbers in each region. Table 8 gives the 10 species recorded in greatest numbers along the route surveyed in Newfoundland. Table 9 lists the species most frequently detected in the two routes surveyed in northern British Columbia.

Changes observed

Tables 10-15 show changes in indices of abundance between 1978 and 1979 for those species reported in the last seven years (Freemark *et al.* 1979, Finney *et al.* 1978, Erskine 1974, 1975, 1976, 1977). As in the past two years, more species significantly decreased in numbers than increased. A total of 12 increases versus 25 decreases were noted (Tables 10-15).

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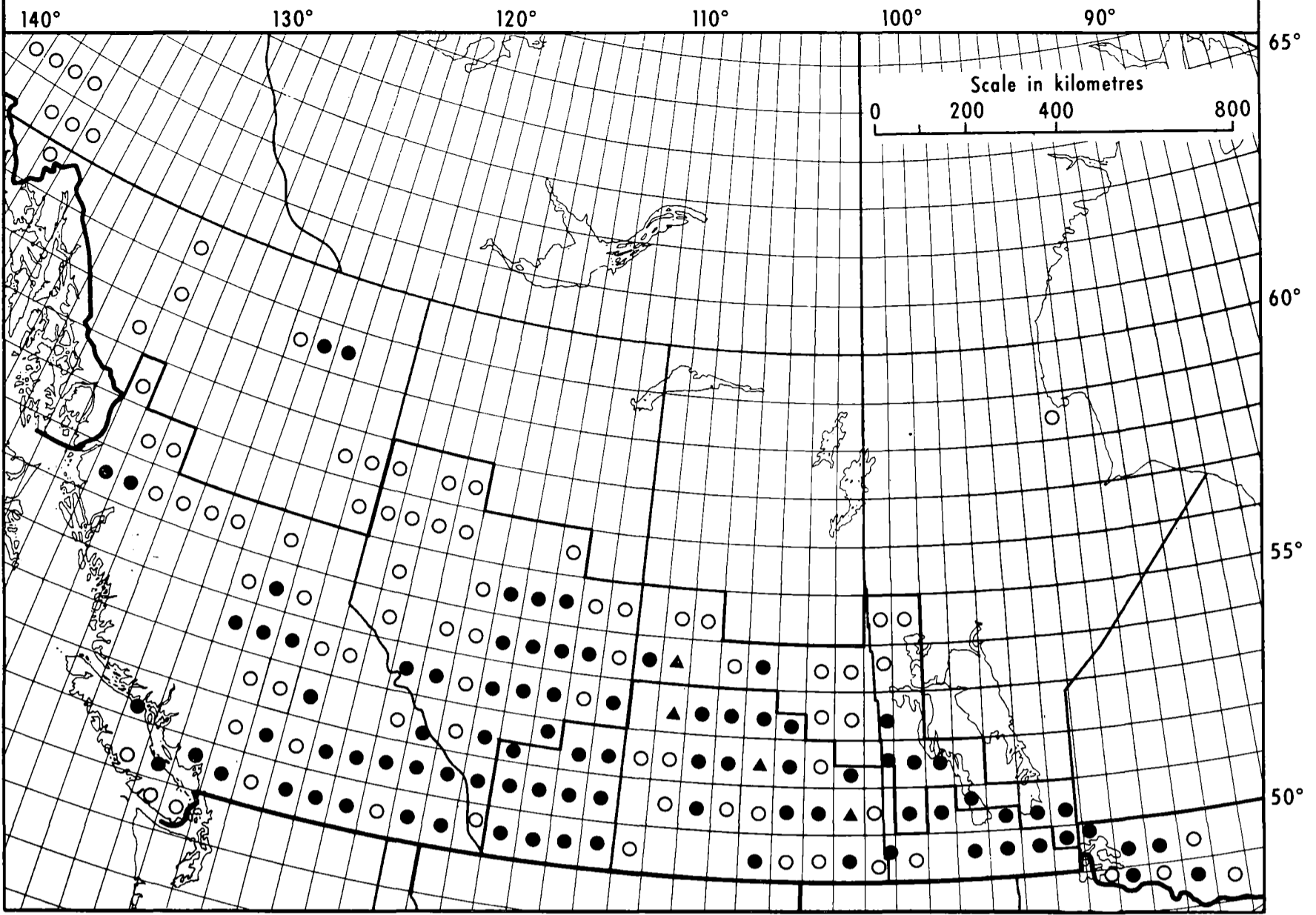
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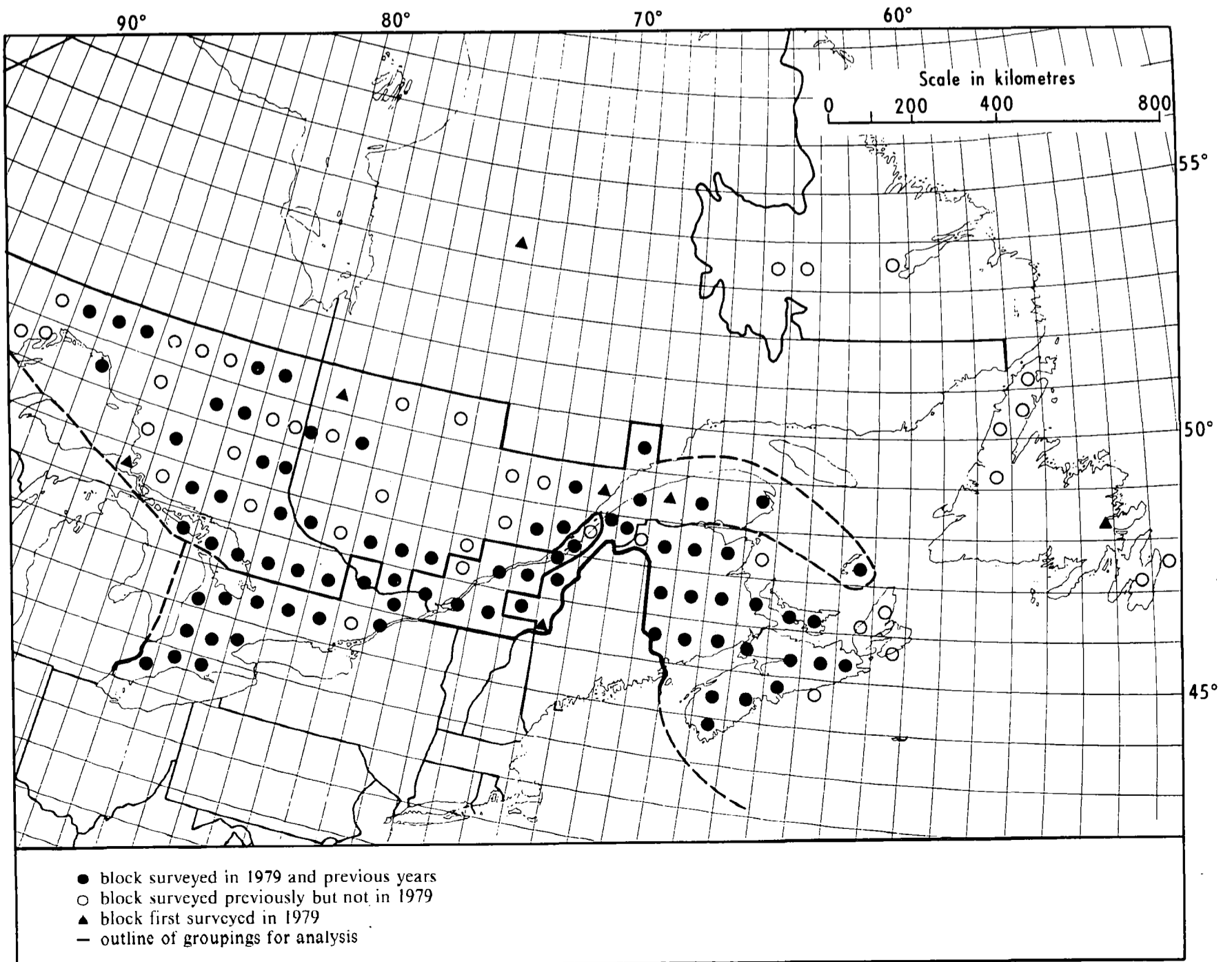
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Figure 1
 Extent of coverage in 1979 and additional coverage in
 1966-78 Breeding Bird Survey



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Maritime provinces

In the Maritimes, four of the species reported to have declined to dramatically low levels in the 1978 survey (Freemark *et al.* 1979), the Least Flycatcher, Veery, American Goldfinch and Dark-eyed Junco, showed non-significant increases in the 1979 survey. However, the weighted mean number of birds per route (Table 10) for the Common Snipe, the White-throated Sparrow and the Song Sparrow continued to decline, significantly for the last two species.

The Common Snipe has been decreasing steadily since 1974 and there may be cause for some concern for this game species. The decline of the Song Sparrow is made the more intriguing because it is down in every region except British Columbia. In the central Prairies the decline is statistically significant. It is not too surprising that the Song Sparrows of British Columbia show a different pattern, because they are a separate race.

Also of interest is the continued and statistically significant decline of the Common Flicker. The Yellow-bellied Sapsucker, Winter Wren and Ruby-crowned Kinglet, all of which declined dramatically after the hard winter of 1976-77, have not yet recovered from that setback and the sapsucker and the wren have continued their decline. The Nashville Warbler registered another significant population decline following that between 1977 and 1978.

The Bank Swallow, Blue Jay, Common Raven and Brown-headed Cowbird also showed significant decreases, while significant increases were recorded for the Swainson's Thrush and American Redstart.

Fewer routes were surveyed in the Maritimes in 1979 (down three from 1978). Only 23 routes were comparable in 1978-79, 10 fewer than in 1977-78 and the least number yet recorded for this region.

Central Ontario and Quebec

In central Ontario and Quebec, numbers of Rose-breasted Grosbeak decreased significantly between 1978 and 1979 after increasing significantly in the previous year.

The increase in the index of Winter Wrens in this region is interesting in light of its continued low levels in the Maritimes. The regional index for Ruby-crowned Kinglet indicates no significant increase since its decline in 1977. Common Grackle, American Goldfinch, Yellow-bellied Sapsucker and House Sparrow, which declined significantly between 1977 and 1978 to record low levels, showed no significant change between 1978 and 1979.

Southern Ontario and Quebec

In southern Ontario and southern Quebec, Common Yellow-throat, Vesper Sparrow and Brown-headed Cowbird significantly decreased. The decrease for the Vesper Sparrow follows a significant increase in the preceding year. No species increased significantly. Among those species which declined significantly be-

tween 1977 and 1978, none returned to their 1977 levels. Of the eight species affected, roughly equal numbers showed marginal recovery, no change and continued decline. Northern Oriole remained at its relatively high levels. Common Flicker continues to decline, although in no pair of years has the decline been statistically significant. Blue Jay remains at relatively low numbers.

Southern Prairie Provinces

In the southern Prairie Provinces, the BBS recorded significant increases for four species while six species showed significant declines. Among these, the increases in the indices for the Sora and Ring-billed Gull, plus the decrease for the Blue-winged Teal, are consistent with the erratic results which the BBS produces for these species. For the other two species showing significant increases, House Wren and Warbling Vireo, non-significant increases were reported in all other regions where they frequently occur. The significant decline reported for Black-billed Magpie and Western Meadowlark was matched in the central Prairie region to the north. The decline of flicker corresponded to a trend evident throughout much of Canada, while the reduction of numbers of Killdeer also was reported in British Columbia. For the second consecutive year Lark Buntings were not recorded on any of the comparable routes and thus an index value could not be recorded. Results for this species are also highly erratic.

Central Prairie Provinces

In the central Prairie Provinces region, eight species decreased significantly. The index numbers for Lesser Scaup and Franklin's Gull continued their steady downward trend although the BBS results are not highly reliable for these species. Significant decreases were also noted for Tree Swallows, Black-billed Magpies, Western Meadowlarks, Red-winged Blackbirds, Chipping Sparrows and Song Sparrows.

Index numbers for species of Fringillids increased significantly: the Pine Siskin index increased six-fold (the BBS results for this species are characteristically erratic) and the Dark-eyed Junco rose to its 1976 level. House Sparrow and American Goldfinch remained at low levels after significant declines in 1978. Common Flicker showed some decline, matching a pattern seen in the Maritimes, southern Ontario and Quebec, and British Columbia.

British Columbia

In British Columbia, seven species showed a significant decrease: Killdeer, Common Crow, Winter Wren, Varied Thrush, Golden-crowned Kinglet, Red-eyed Vireo, and Yellow Warbler. Non-significant but continuous declines were noted for Common Flicker, Trail's Flycatcher and Brewer's Blackbird, and House Sparrow continued to register low numbers. The only two significant increases were for Pine Siskin and the Rufous-sided Towhee.

Conclusions

The results of the 1979 BBS suggest that there are three species in steady and widespread decline across Canada: the eastern race of the Song Sparrow, the Common Flicker and the American Goldfinch. There are no species for which a similar upward trend is notable.

The number of routes surveyed continues to be low and the number of routes lost for trend analyses due to lack of comparability was disappointing. Observers are urged to pay strict attention to the rules established for the survey.

In 1980 CWS and the U.S. Fish and Wildlife Service will be initiating a three-year assessment of the BBS in North America. The assessment will include an examination of the data collection methods to determine what biases are introduced because of the technique employed, a review of the statistical analysis procedures, and a review of possible additional ways of monitoring the status of non-game birds. We encourage our observers or any other interested people to write to us with their views of the effectiveness and efficiency of the BBS.

Acknowledgements

We thank the observers and their assistants and the regional co-ordinators, who encouraged people to join the BBS. This marks the first year that the data have been analyzed by computer in Canada and many people helped with the programming. These include G. E. J. Smith, Steve Wendt, B. Nagpal, E. Borrowets and W. Mortimer.

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Table 1
Number of routes completed in the Breeding Bird Survey, Canada, 1973-79, compared to all routes surveyed in 1966 through 1979

Province	Total routes surveyed 1966-79	No. routes surveyed*						
		1973	1974	1975	1976	1977	1978	1979
Newfoundland	11	2	4	6	4	2	3	1
Prince Edward Island	4	4	4	4	3	4	4	3
Nova Scotia	24	20	19	17	14	19	17	18
New Brunswick	28	22	21	16	18	19	19	16
Quebec	53	24	21	24	21	20	36	41
Ontario	73	55	58	61	65	63	56	53
Manitoba	19	13	14	13	13	16	16	15
Saskatchewan	36	28	19	19	20	21	18	19
Alberta	47	36	31	33	29	21	24	27
British Columbia	79	38	53	50	42	34	34	36
Yukon	8	5	7	5	6	0	0	0
Total	382	247	251	248	235	219	227	229

*The figures in bold type represent the greatest number of routes surveyed in one year for each province. Four routes were also surveyed in PEI each year from 1967-69; 23 routes, in NS in 1972; 24 routes, in NB in 1971 and 1972; 33 routes, in Quebec in 1970.

Table 2
The 40 species recorded in greatest numbers in the Breeding Bird Survey, Maritime Provinces, 1979; 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 685 birds noted per route

Species	Mean no. per route	% of 37 routes
American Robin	48.1	97
Starling	41.0	95
Common Crow	35.7	95
White-throated Sparrow	31.8	97
Song Sparrow	24.4	97
Common Yellowthroat	23.2	97
American Redstart	22.8	97
Herring Gull	21.9	51
Red-eyed Vireo	20.7	95
Barn Swallow	20.4	95
Bobolink	19.9	86
Double-cr. Cormorant	17.6	30
Swainson's Thrush	17.0	92
Red-winged Blackbird	16.7	89
Common Grackle	15.1	89
Tree Swallow	14.5	97
House Sparrow	14.4	89
Ovenbird	13.8	95
Magnolia Warbler	12.6	89
Alder Flycatcher	12.5	86
Bank Swallow	11.8	57
Yellow Warbler	11.8	89
Veery	10.5	78
Chipping Sparrow	9.9	84
Dark-eyed Junco	8.9	86
Hermit Thrush	8.7	81
American Goldfinch	8.5	84
Savannah Sparrow	8.5	81
Common Raven	7.2	89
Ruby-crowned Kinglet	6.5	78
Black-th. Green Warbler	5.9	76
Gt. Black-backed Gull	5.8	46
Chestnut-sided Warbler	5.8	81
Black-&-white Warbler	5.8	84
Evening Grosbeak	5.7	54
Tennessee Warbler	5.6	59
Northern Parula Warbler	5.4	76
Purple Finch	5.3	81
Yellow-rumped Warbler	5.2	81
Rose-breasted Grosbeak	4.8	73

Table 3
The 40 species recorded in greatest numbers in the Breeding Bird Survey, central Ontario and central Quebec, 1979; the mean number of each per route; and the percentage of routes on which they were found. Fifty-eight routes were surveyed, with a mean of 702 birds per route

Species	Mean no. per route	% of 58 routes
White-throated Sparrow	42.3	98
American Robin	36.2	98
Starling	33.6	81
Red-eyed Vireo	28.9	93
Common Crow	26.4	95
Herring Gull	26.2	50
Red-winged Blackbird	26.1	90
Swainson's Thrush	21.5	81
Veery	18.9	81
Ovenbird	18.8	90
Barn Swallow	16.6	76
Ring-billed Gull	16.1	12
Savannah Sparrow	15.8	76
Common Grackle	15.7	86
Common Yellowthroat	15.7	98
Chipping Sparrow	15.1	93
Common Eider	14.6	5
Tree Swallow	14.0	95
Bobolink	13.9	60
Song Sparrow	13.7	88
Chestnut-sided Warbler	12.7	86
Evening Grosbeak	10.8	67
American Redstart	10.3	90
Nashville Warbler	9.9	84
Cedar Waxwing	9.6	79
Mourning Warbler	9.0	84
Bank Swallow	8.7	41
Tennessee Warbler	8.6	52
Alder Flycatcher	8.3	84
Common Raven	8.3	84
Brown-headed Cowbird	7.7	67
Least Flycatcher	7.5	91
Rose-breasted Grosbeak	6.1	67
Yellow-rumped Warbler	5.7	83
Killdeer	5.6	76
Hermit Thrush	5.4	84
Ruby-crowned Kinglet	5.4	69
Dark-eyed Junco	5.3	57
Cliff Swallow	5.0	41
Purple Finch	4.8	78

Table 4

The 40 species recorded in greatest numbers in the Breeding Bird Survey, southern Ontario and southern Quebec, 1979; the mean number of each per route; and the percentage of routes on which they were found. Thirty-six routes were surveyed, with a mean of 1090 birds noted per route

Species	Mean no. per route	% of 36 routes
Red-winged Blackbird	178.5	100
Starling	114.0	100
House Sparrow	69.5	100
Common Grackle	60.7	100
Savannah Sparrow	53.4	100
Bobolink	52.5	100
American Robin	49.1	100
Barn Swallow	44.6	100
Common Crow	41.7	100
Song Sparrow	31.7	100
Bank Swallow	28.4	67
Killdeer	19.6	100
Ring-billed Gull	19.3	42
Eastern Meadowlark	19.3	97
Brown-headed Cowbird	18.6	97
Rock Dove	17.8	97
Mourning Dove	17.4	94
American Goldfinch	16.3	100
Tree Swallow	13.3	94
Chipping Sparrow	12.8	100
Common Yellowthroat	11.7	92
Eastern Kingbird	11.1	97
Northern Oriole	11.0	89
Cedar Waxwing	8.6	97
Yellow Warbler	8.3	97
Vesper Sparrow	7.8	89
White-throated Sparrow	7.6	67
Red-eyed Vireo	7.4	86
Rose-breasted Grosbeak	7.1	89
Veery	6.6	69
Horned Lark	6.4	78
Warbling Vireo	5.4	81
Purple Martin	5.3	28
Gt. Crested Flycatcher	5.1	86
Gray Catbird	4.9	94
Herring Gull	4.5	17
Blue Jay	4.4	86
House Wren	4.4	86
Cliff Swallow	4.2	50
Common Flicker	4.1	100

Table 5

The 40 species recorded in greatest numbers in the Breeding Bird Survey, southern Prairie Provinces, 1979; the mean number of each per route; and the percentage of routes on which they were found. Thirty-three routes were surveyed, with a mean of 871 birds per route

Species	Mean no. per route	% of 33 routes
Red-winged Blackbird	91.7	100
Horned Lark	81.6	100
House Sparrow	60.4	100
Western Meadowlark	46.7	100
Common Crow	38.1	100
Mallard	35.7	85
Brown-headed Cowbird	27.5	97
Ring-billed Gull	26.9	61
Clay-colored Sparrow	24.0	97
Yellow-head. Blackbird	23.2	82
Brewer's Blackbird	22.6	94
Vesper Sparrow	21.3	94
Savannah Sparrow	21.1	97
Starling	21.0	91
Cliff Swallow	19.8	36
Franklin's Gull	19.3	39
Chestnut-col. Longspur	17.7	42
Killdeer	14.2	100
Barn Swallow	14.2	100
House Wren	13.7	76
Mourning Dove	13.1	88
Pintail	12.9	82
Black-billed Magpie	9.0	94
Rock Dove	7.8	79
Canada Goose	7.5	24
Blue-winged Teal	7.2	76
Lesser Scaup	7.1	61
Marbled Godwit	6.8	73
Warbling Vireo	6.8	67
American Robin	5.9	97
Song Sparrow	5.8	55
American Coot	5.5	61
Northern Oriole	5.4	79
Eastern Kingbird	5.2	91
Willet	5.2	70
Common Grackle	5.1	64
Northern Shoveler	4.7	67
Canvasback	4.2	39
American Wigeon	4.2	67
Unident. Gull	4.0	6

Table 6

The 40 species recorded in the greatest numbers in the Breeding Bird Survey, central Prairie Provinces region, 1979; the mean number of each per route; and the percentage of routes on which they were found. Thirty routes were surveyed with a mean of 675 birds noted per route

Species	Mean no. per route	% of 30 routes
Red-winged Blackbird	46.9	90
Common Crow	38.6	90
Clay-colored Sparrow	35.5	83
Cliff Swallow	26.7	30
Starling	24.1	77
Brewer's Blackbird	21.1	77
Savannah Sparrow	19.4	83
American Robin	17.9	120
Red-eyed Vireo	17.5	87
Mallard	17.1	77
Song Sparrow	16.7	80
Brown-headed Cowbird	16.3	87
Vesper Sparrow	15.5	73
House Wren	14.9	80
Barn Swallow	13.9	87
Black-billed Magpie	12.3	80
Least Flycatcher	11.8	90
House Sparrow	11.6	80
Chipping Sparrow	11.5	73
Yellow Warbler	10.8	93
Western Meadowlark	10.6	57
Common Snipe	10.1	80
White-throated Sparrow	9.0	60
Black Tern	8.1	57
Killdeer	7.5	80
Warbling Vireo	7.4	73
Northern Oriole	7.3	70
Tree Swallow	7.1	83
Mourning Dove	7.1	67
Franklin's Gull	6.6	40
Pine Siskin	6.5	27
Common Yellowthroat	6.5	77
American Goldfinch	6.0	73
Blue-winged Teal	5.9	50
Yellow-head. Blackbird	5.7	37
Alder Flycatcher	5.6	67
American Coot	5.4	40
Ring-billed Gull	4.7	43
Pintail	4.6	50
Swainson's Thrush	4.5	30

Table 7

The 40 species recorded in greatest numbers in the Breeding Bird Survey, British Columbia (west of Rocky Mountains), 1979; the mean number of each per route; and the percentage of routes on which they were found. Thirty-four routes were surveyed, with a mean of 682 birds noted per route

Species	Mean no. per route	% of 34 routes
American Robin	65.9	118
Starling	59.7	82
Swainson's Thrush	29.7	100
Pine Siskin	25.5	97
Northwestern Crow	24.4	32
Common Crow	21.4	68
Barn Swallow	18.6	97
Dark-eyed Junco	16.5	88
Chipping Sparrow	15.8	88
Glaucous-winged Gull	15.8	26
Brewer's Blackbird	14.3	76
Song Sparrow	13.2	94
Brown-headed Cowbird	10.7	82
Red-eyed Vireo	10.0	76
Violet-green Swallow	9.9	71
Canada Goose	9.8	26
Chestnut-bkd. Chickadee	9.8	38
Black-capped Chickadee	9.7	76
Common Raven	9.4	97
Western Meadowlark	9.2	47
Red-winged Blackbird	8.9	68
Yellow-rumped Warbler	8.7	85
Orange-crowned Warbler	8.7	82
Red Crossbill	8.1	56
Tree Swallow	7.6	82
MacGillivray's Warbler	7.4	62
Yellow Warbler	7.2	88
Warbling Vireo	6.9	91
Cliff Swallow	6.8	50
Rufous-sided Towhee	6.6	47
Dusky Flycatcher	6.4	56
Mallard	5.7	50
Common Flicker	5.6	82
House Sparrow	5.5	32
Bank Swallow	5.4	24
American Goldfinch	5.4	41
Rock Dove	5.0	18
Western Tanager	4.9	74
Veery	4.9	53
Cedar Waxwing	4.7	68

Table 8

The 10 species recorded in the greatest numbers in the Breeding Bird Survey, Terra Nova National Park, Newfoundland, 1979. A total of 580 birds was noted on the one route surveyed

Species	Number
White-throated Sparrow	86
Yellow-rumped Warbler	73
American Robin	38
Blackpoll Warbler	35
Yellow-bel. Flycatcher	33
Lincoln's Sparrow	31
Northern Waterthrush	23
Ruby-crowned Kinglet	20
Common Crow	19
Tennessee Warbler	15

Table 9

The 10 species recorded in greatest numbers in the Breeding Bird Survey, northern British Columbia, 1979; the mean number per route; and the number of routes on which they were found. Two routes were surveyed with a mean of 222 birds noted per route

Species	Mean no. per route	No. of routes
Chipping Sparrow	31	2
Swainson's Thrush	27	2
Lincoln's Sparrow	25	2
White-throated Sparrow	17	2
Alder Flycatcher	14	2
Red-eyed Vireo	11	2
White-winged Crossbill	9	2
Pine Siskin	8	2
Tennessee Warbler	7	2
Dark-eyed Junco	7	2

Table 10

Changes in bird populations for 23 comparable routes, Breeding Bird Survey, Maritimes, 1978-79

Species	Weighted mean no. of birds per route		% change (bold) with 95% confidence limits		
	1978	1979			
Common Snipe	4.49	3.49	-53	-22	9
Herring Gull	17.32	21.08	-58	22	102
*Common Flicker	2.67	1.99	-51	-25	0
Yellow-bel. Sapsucker	3.03	1.90	-82	-37	8
Alder Flycatcher	13.43	11.64	-28	-13	2
Least Flycatcher	2.72	4.40	-5	62	129
Tree Swallow	10.72	13.61	-1	27	55
*Bank Swallow	13.35	8.50	-60	-36	-12
Barn Swallow	16.25	19.41	-7	19	45
*Blue Jay	5.34	3.14	-69	-41	-14
*Common Raven	9.87	6.51	-51	-34	-17
Common Crow	42.10	34.56	-36	-18	0
Winter Wren	1.18	1.16	-40	-2	36
American Robin	47.73	46.30	-19	-3	13
Hermit Thrush	7.02	7.18	-29	2	34
*Swainson's Thrush	12.75	14.80	1	16	31
Veery	9.23	10.59	-10	15	40
Ruby-crowned Kinglet	5.11	4.80	-39	-6	27
Starling	41.31	40.58	-27	-2	24
Red-eyed Vireo	24.96	23.83	-19	-5	10
*Nashville Warbler	4.17	2.39	-64	-43	-21
Yellow Warbler	15.47	13.69	-28	-12	5
Magnolia Warbler	12.02	11.37	-21	-5	11
Black-th. Green Warbler	3.05	4.13	-1	35	72
Chestnut-sided Warbler	6.18	6.66	-17	8	32
Ovenbird	12.28	13.64	-4	11	26
Common Yellowthroat	26.11	24.68	-19	-5	8
*American Redstart	18.31	26.05	7	42	77
House Sparrow	20.43	16.58	-46	-19	9
Bobolink	21.02	20.90	-22	-1	21
Red-winged Blackbird	23.25	20.99	-37	-10	18
Common Grackle	17.09	17.77	-35	4	43
*Brown-headed Cowbird	5.44	3.55	-54	-35	-16
Evening Grosbeak	3.88	4.90	-32	26	84
Purple Finch	4.90	4.76	-38	-3	33
American Goldfinch	6.62	8.09	-21	22	65
Savannah Sparrow	10.30	8.73	-51	-15	20
Dark-eyed Junco	6.88	7.25	-26	5	37
Chipping Sparrow	9.92	10.91	-16	10	36
*White-throated Sparrow	34.58	30.58	-20	-12	-4
*Song Sparrow	29.53	24.10	-32	-18	-5

*Change greater than 95% significant.

Table 11
Changes in bird populations for 33 comparable routes,
Breeding Bird Survey, central Ontario and central Quebec,
1978-79

Species	Weighted mean no. of birds per route		% change (bold) with 95% confidence limits		
	1978	1979			
Killdeer	4.73	5.45	-8	15	39
Herring Gull	25.28	22.94	-53	-9	35
Common Flicker	2.23	2.72	-30	22	73
Yellow-bel. Sapsucker	2.18	2.63	-57	20	98
Alder Flycatcher	8.91	10.23	-12	15	42
Least Flycatcher	8.19	7.34	-28	-10	7
Tree Swallow	13.41	12.07	-28	-10	8
Bank Swallow	9.22	5.75	-94	-38	19
Barn Swallow	10.91	12.06	-28	11	49
Blue Jay	2.17	2.74	-34	27	87
Common Raven	5.46	7.29	-31	33	98
Common Crow	21.27	22.51	-15	6	27
*Winter Wren	3.10	5.20	19	68	117
American Robin	35.57	33.28	-19	-6	6
Hermit Thrush	5.70	5.50	-44	-3	37
Swainson's Thrush	23.86	24.58	-18	3	24
Veery	17.78	17.28	-24	-3	18
Ruby-crowned Kinglet	5.50	7.64	-11	39	89
Cedar Waxwing	7.03	8.97	-67	28	122
Starling	28.48	32.78	-34	15	64
Red-eyed Vireo	27.93	27.17	-19	-3	14
Nashville Warbler	10.51	11.05	-32	5	43
Yellow Warbler	3.11	3.44	-21	11	42
Magnolia Warbler	5.64	5.19	-40	-8	24
Yellow-rumped Warbler	6.04	6.21	-29	3	35
Chestnut-sided Warbler	14.03	13.87	-19	-1	17
Ovenbird	18.10	20.37	-5	13	30
Mourning Warbler	9.19	10.21	-1	11	23
Common Yellowthroat	14.86	15.80	-9	6	22
American Redstart	9.39	11.22	-2	20	41
House Sparrow	4.32	3.56	-46	-18	11
Bobolink	14.48	14.69	-34	1	37
Red-winged Blackbird	19.23	20.35	-16	6	28
Common Grackle	12.64	12.33	-41	-2	36
Brown-headed Cowbird	8.67	8.27	-33	-5	23
*Rose-breasted Grosbeak	8.59	6.53	-40	-24	-8
Evening Grosbeak	11.50	12.07	-54	5	64
American Goldfinch	4.15	4.11	-45	-1	43
Savannah Sparrow	13.71	12.89	-21	-6	9
Dark-eyed Junco	3.53	3.68	-39	4	47
Chipping Sparrow	12.74	12.40	-20	-3	15
White-throated Sparrow	50.56	48.71	-15	-4	7
Song Sparrow	12.70	11.59	-26	-9	8

*Change greater than 95% significant.

Table 12
Changes in bird populations for 27 comparable routes,
Breeding Bird Survey, southern Ontario and southern
Quebec, 1978-79

Species	Weighted mean no. of birds per route		% change (bold) with 95% confidence limits		
	1978	1979			
Killdeer	19.99	17.55	-25	-12	1
Rock Dove	21.41	15.41	-58	-28	2
Mourning Dove	14.31	16.33	-4	14	32
Common Flicker	4.40	3.74	-40	-15	10
Eastern Kingbird	9.99	10.22	-18	2	23
Gt. Crested Flycatcher	3.82	4.76	-5	25	55
Eastern Wood Pewee	4.17	4.11	-34	-1	31
Horned Lark	5.56	5.78	-10	4	18
Tree Swallow	12.29	11.56	-40	-6	28
Bank Swallow	26.42	20.11	-62	-24	14
Barn Swallow	37.20	41.84	-8	12	33
Purple Martin	2.75	4.61	-14	67	149
Blue Jay	4.74	4.40	-36	-7	21
Common Crow	56.42	47.15	-36	-16	4
House Wren	3.52	4.11	-29	17	62
Gray Catbird	4.96	4.22	-33	-15	3
Brown Thrasher	3.74	3.69	-55	-1	53
American Robin	47.01	47.77	-8	2	12
Veery	7.47	7.55	-30	1	32
Cedar Waxwing	5.68	7.89	-22	39	100
Starling	118.61	109.44	-29	-8	14
Red-eyed Vireo	8.15	7.06	-28	-13	1
Warbling Vireo	3.89	4.58	-13	18	49
Yellow Warbler	8.14	7.48	-27	-8	11
*Common Yellowthroat	13.76	11.45	-29	-17	-4
House Sparrow	61.09	66.41	-13	9	30
Bobolink	49.47	46.75	-23	-5	12
Eastern Meadowlark	19.71	17.45	-28	-11	5
Red-winged Blackbird	154.30	156.15	-9	1	12
Northern Oriole	10.94	10.47	-24	-4	16
Common Grackle	67.74	58.92	-29	-13	2
*Brown-headed Cowbird	27.97	19.23	-57	-31	-6
Rose-breasted Grosbeak	7.18	7.32	-25	2	30
American Goldfinch	12.84	14.79	-11	15	42
Savannah Sparrow	46.38	48.83	-6	5	17
*Vesper Sparrow	9.17	7.10	-31	-23	-14
Chipping Sparrow	12.02	12.19	-13	1	16
White-throated Sparrow	8.24	8.26	-32	0	33
Song Sparrow	30.64	28.52	-20	-7	6

*Change greater than 95% significant.

Table 13
Changes in bird populations for 20 comparable routes,
Breeding Bird Survey, southern Prairies, 1978-79

Species	Weighted mean no. of birds per route		% change (bold) with 95% confidence limits		
	1978	1979			
Mallard	27.37	37.37	-43	37	116
Pintail	9.78	9.67	-75	-1	73
*Blue-winged Teal	8.63	6.27	-51	-27	-4
Northern Shoveler	3.39	4.51	-85	33	151
American Wigeon	6.34	5.06	-81	-20	41
Lesser Scaup	6.56	9.52	-144	45	234
*Sora	2.03	5.13	29	153	277
American Coot	3.55	6.07	-5	71	147
*Killdeer	17.32	14.95	-25	-14	-3
*Ring-billed Gull	13.91	28.61	34	106	177
Franklin's Gull	9.45	20.04	-168	112	392
Black Tern	2.14	3.93	-45	84	212
Rock Dove	11.82	9.84	-81	-17	47
Mourning Dove	14.25	15.91	-32	12	55
*Common Flicker	2.75	1.51	-70	-45	-20
Eastern Kingbird	7.00	6.18	-36	-12	12
Least Flycatcher	3.50	4.04	-16	15	46
Horned Lark	84.42	80.79	-19	-4	10
Tree Swallow	2.57	3.02	-63	17	98
Barn Swallow	15.24	14.46	-27	-5	17
Cliff Swallow	30.75	23.20	-59	-25	10
*Black-billed Magpie	12.91	9.78	-45	-24	-3
Common Crow	44.39	38.80	-29	-13	4
*House Wren	12.60	16.05	1	27	54
*American Robin	7.30	3.72	-66	-49	-32
Starling	23.43	21.59	-66	-8	51
*Warbling Vireo	4.56	7.77	30	70	111
Yellow Warbler	3.86	3.93	-20	2	23
House Sparrow	64.70	56.63	-34	-12	9
Bobolink	4.88	3.44	-63	-30	4
*Western Meadowlark	55.26	41.57	-37	-25	-13
Yellow-head. Blackbird	21.59	27.98	-37	30	96
Red-winged Blackbird	112.59	103.78	-24	-8	8
Brewer's Blackbird	26.61	26.40	-30	-1	28
Common Grackle	4.79	6.45	-29	35	98
Brown-headed Cowbird	32.52	29.53	-43	-9	25
American Goldfinch	4.08	3.38	-55	-17	21
Lark Bunting	0†	0.30	—	—	—
Savannah Sparrow	25.71	24.87	-19	-3	12
Vesper Sparrow	17.28	21.65	-1	25	51
Clay-colored Sparrow	23.99	22.49	-18	-6	5
Song Sparrow	6.48	5.05	-45	-22	0
Chestnut-col. Longspur	22.55	22.50	-26	0	26

*Change greater than 95% significant.
†None seen on comparable routes.

Table 14
Changes in bird populations for 17 comparable routes,
Breeding Bird Survey, central Prairies, 1978-79

Species	Weighted mean no. of birds per route		% change (bold) with 95% confidence limits		
	1978	1979			
Mallard	22.14	20.30	-48	-8	32
Pintail	1.84	2.34	-87	27	141
Blue-winged Teal	4.61	5.88	-19	28	74
Northern Shoveler	0.87	1.94	-38	123	285
*Lesser Scaup	7.24	5.35	-51	-26	-1
American Coot	6.50	8.06	-5	24	53
Killdeer	6.68	6.24	-38	-7	25
Common Snipe	8.98	9.95	-30	11	51
*Franklin's Gull	18.11	5.47	-110	-70	-30
Black Tern	7.78	6.45	-49	-17	15
Common Flicker	1.89	1.39	-68	-27	14
Alder Flycatcher	6.27	5.62	-40	-10	20
Least Flycatcher	10.46	10.39	-21	-1	19
Western Wood Pewee	3.48	4.42	-63	27	117
*Tree Swallow	11.07	6.39	-77	-42	-8
Barn Swallow	15.65	13.85	-30	-11	7
*Black-billed Magpie	16.51	10.96	-65	-34	-3
Common Crow	38.48	39.85	-16	4	23
House Wren	14.13	15.34	-15	9	32
American Robin	10.67	16.67	-19	56	131
Starling	24.36	16.95	-66	-30	5
Red-eyed Vireo	22.06	20.01	-30	-9	11
Warbling Vireo	4.85	6.76	-19	39	98
Yellow Warbler	9.11	10.67	-11	17	45
Common Yellowthroat	9.68	7.86	-38	-19	0
House Sparrow	17.10	13.29	-67	-22	23
*Western Meadowlark	5.98	4.22	-48	-29	-11
*Red-winged Blackbird	54.22	44.36	-29	-18	-8
Northern Oriole	5.80	6.28	-52	8	69
Brewer's Blackbird	27.51	22.21	-49	-19	10
Brown-headed Cowbird	12.48	14.20	-18	14	45
*Pine Siskin	0.80	4.94	213	519	826
American Goldfinch	6.39	5.08	-55	-20	14
Savannah Sparrow	15.59	16.40	-18	5	28
Vesper Sparrow	12.00	11.54	-21	-4	14
*Dark-eyed Junco	3.79	4.40	1	16	31
*Chipping Sparrow	8.14	6.63	-35	-19	-2
Clay-colored Sparrow	36.25	34.95	-18	-4	11
White-throated Sparrow	7.64	9.26	-20	21	63
*Song Sparrow	26.51	21.63	-27	-18	-10

*Change greater than 95% significant.

Table 15
Changes in bird populations for 23 comparable routes,
Breeding Bird Survey, British Columbia, 1978-79

Species	Weighted mean no. of birds per route		% change (bold) with 95% confidence limits		
	1978	1979			
*Killdeer	4.52	2.08	-78	-54	-29
Rufous Hummingbird	1.36	1.55	-67	13	93
Common Flicker	7.00	6.47	-42	-8	27
Yellow-bel. Sapsucker	3.71	3.07	-64	-17	29
Traill's Flycatcher †	4.47	4.36	-36	-2	31
Western Wood Pewee	6.74	6.27	-31	-7	17
Violet-green Swallow	9.65	9.35	-44	-3	38
Tree Swallow	8.01	8.28	-43	3	50
Rough-winged Swallow	6.08	5.54	-47	-9	29
Barn Swallow	17.25	17.32	-45	0	46
Cliff Swallow	9.05	7.28	-79	-20	40
Common Raven	9.52	11.12	-10	17	43
*Common Crow	30.53	24.51	-38	-20	-1
Black-capped Chickadee	7.94	10.39	-30	31	92
Chestnut-bkd. Chickadee	3.92	4.56	-27	16	60
*Winter Wren	4.97	2.20	-78	-56	-33
American Robin	43.71	43.06	-34	-1	31
*Varied Thrush	4.80	2.89	-73	-40	-7
Swainson's Thrush	24.86	27.59	-15	11	37
*Golden-crowned Kinglet	4.82	2.21	-71	-54	-38
Ruby-crowned Kinglet	5.02	5.05	-30	1	31
Cedar Waxwing	2.29	4.28	-18	87	192
Starling	41.36	57.48	-45	39	123
*Red-eyed Vireo	12.97	10.89	-32	-16	0
Warbling Vireo	6.35	6.74	-30	6	42
Orange-crowned Warbler	6.67	6.52	-27	-2	22
*Yellow Warbler	8.82	6.05	-57	-31	-5
Yellow-rumped Warbler	9.77	8.90	-28	-9	11
MacGillivray's Warbler	5.89	5.69	-45	-3	38
Wilson's Warbler	1.71	1.26	-72	-27	18
House Sparrow	5.26	5.15	-33	-2	29
Western Meadowlark	10.16	9.66	-20	-5	10
Red-winged Blackbird	8.63	9.66	-12	12	35
Brewer's Blackbird	13.66	11.31	-46	-17	12
Brown-headed Cowbird	6.89	10.19	-2	48	99
Western Tanager	6.07	4.62	-49	-24	1
*Pine Siskin	6.04	25.24	47	318	590
American Goldfinch	5.13	4.42	-44	-14	16
*Rufous-sided Towhee	3.74	4.74	8	27	45
Savannah Sparrow	5.67	4.92	-34	-13	8
Dark-eyed Junco	16.12	18.72	-25	16	57
Chipping Sparrow	19.59	19.13	-15	-2	11
Song Sparrow	11.01	12.41	-9	13	35

*Change greater than 95% significant.

†Alder and Willow Flycatchers.