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NORTHWARD EXPANSION OF THE WINTERING RANGE OF RICHARDSON'S MERLIN

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Abstract.—The wintering range of Richardson's Merlin (*Falco columbarius richardsonii*) has recently been acknowledged to include the Canadian prairies. An analysis of Christmas Bird Counts over a 27-year period revealed that these Merlin populations have significantly increased in Canadian urban counts, and farther south on United States counts in the more traditional wintering range. The increase in wintering Merlins in the north is coincident with their adoption of these urban centers for breeding purposes. In addition, Merlin numbers in these cities were significantly correlated with Bohemian Waxwing (*Bombycilla garrulus*) numbers, suggesting that increased prey availability may also be important. Banding recoveries of Richardson's Merlin suggest that urban-raised birds are less migratory than 'rural'-raised birds. As urban breeding populations continue to expand, it is likely that their wintering populations will as well.

EXPANSIÓN HACIA EL NORTE DURANTE EL INVIERNO DE *FALCO COLUMBARIUS RICHARDSONII*

Sinopsis.—Las áreas en donde pasa el invierno *Falco columbarius richardsonii* incluyen en la actualidad las praderas canadienses. Un análisis de los conteos navideños desde 1957–1983, reveló que los falcones habían aumentado en número significativamente en áreas urbanas de Canadá y en áreas donde tradicionalmente pasan el invierno estas aves en el sur de los Estados Unidos. El aumento de falcones en Canada, coincide con la utilización, por parte de estas aves, de áreas urbanas para anidar. El incremento poblacional de *Bombycilla garrulus* en estas mismas áreas, sugiere que el aumento en falcones pudiera estar relacionado con un aumento en la disponibilidad de presas. La recaptura de falcones sugiere que las aves de áreas urbanas tienden a migrar menos que las de áreas rurales. Es de esperarse que si las poblaciones urbanas siguen expandiendose, ocurra una expansión similar en las áreas en donde estos falcones pasan el invierno.

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Recently the A.O.U. Check-list (1983) redefined the wintering distribution of the Merlin (*Falco columbarius*), extending its range into the northern Great Plains. This was due to recent changes in the wintering habits of the prairie subspecies, Richardson's Merlin (*F. c. richardsonii*). In fact, the first records of Richardson's Merlin wintering in Alberta and Saskatchewan were in 1922 (W. Rowan, University of Alberta Archives) and 1948 (Roy 1956) respectively. Bent (1938) originally described the wintering range as southern Alberta and Saskatchewan southward through Colorado and New Mexico to Texas and northwestern Mexico. According to the previous A.O.U. Check-list (1957) the subspecies wintered from Wyoming and Colorado through California. Temple (1972) and Trimble (1975) appear to have combined both of these descriptions, resulting in a winter distribution extending from extreme southern Alberta and Saskatchewan southward to the area bounded by eastern California, northwestern Mexico, and central Texas.

Here, we attempt to explain how this range expansion has come about. We present an analysis of wintering population trends of Richardson's Merlin based on a 27-year sample of Christmas Bird Count (hereafter C.B.C.) data. While some workers have questioned the scientific value of such data (Drennan 1981), it is now generally acknowledged that these counts represent useful indicators of certain patterns in avian geographical ecology, and that their general use in describing such patterns is long overdue (Bock and Root 1981, Drennan 1981). For Richardson's Merlin, they presently represent the best data available for examining long-term winter population trends. During the 1970s, concern was expressed over the status of this subspecies of Merlin in particular, in both Canada and the United States (Godfrey 1970, Trimble 1975). The reputed population decline has been attributed to a combination of habitat loss and the use of organochlorine pesticides (Fox 1971, Fyfe et al. 1976, Hodson 1975).

METHODS

The annual C.B.C. published in American Birds from 1957 to 1983 were searched for Merlin sightings. Prior to this period, too few counts were conducted for continuity. The counts were divided into three groups. The first group ($N = 108$ counts) consisted of four major Canadian cities within the northern portion of the wintering range (Calgary and Edmonton, Alberta; Regina and Saskatoon, Saskatchewan). The second group ($N = 845$ counts) consisted of all remaining counts in Saskatchewan, and were considered representative of the 'rural' segment of the Merlin wintering range within the northern Great Plains. This area covers more than two-thirds of the presumed Canadian wintering range. Finally, Merlin sightings were collated for 16 United States centers ($N = 432$ counts). These included Billings, Bozeman, and Helena (eastern Montana), Casper (Wyoming), Black Forest, Boulder, Colorado Springs, Denver, Fort Collins and Longmont (Colorado), Bismarck (North Dakota), Rapid City (South Dakota), Scottsbluff (Nebraska), and Man-

hattan, Wichita, and Halstead-Newton (Kansas). These counts were selected as representative of the southern portion of the wintering range.

In addition, consideration was given to the likelihood of conflict with the known winter ranges of the other two subspecies of the Merlin in North America. Although it is possible that a few individuals of subspecies other than *richardsonii* winter in this area, it is unlikely that they are numerically significant. For example, all 16 C.B.C.s lie well outside the known wintering range of the nominate *columbarius* (Temple 1972, Trimble 1975, but see Servheen 1985), and at most one-half of them lie on the extreme eastern edge of the known wintering range of *suckleyi* (Temple 1972, Trimble 1975). All of the Canadian counts used lie well outside the known wintering ranges of these other subspecies.

The C.B.C. data for Richardson's Merlins in the four Canadian cities were correlated with the respective C.B.C. data for their main winter prey species in these places, the Bohemian Waxwing (*Bombycilla garrulus*), House Sparrow (*Passer domesticus*), and cardueline finch species (Oliphant and McTaggart 1977, Smith 1978, pers. obs.). Counts of Merlins and their prey species were standardized for effort prior to statistical treatment by dividing by party-miles (Bock and Root 1981). As C.B.C. data are rarely normally distributed, nonparametric Spearman rank correlations were used to test for interspecific relationships and overall population trends within species over the 27-year period.

RESULTS

The C.B.C. data we analyzed indicate that some Richardson's Merlin populations have either remained stable or increased significantly over the 27-year period (Fig. 1). For example, while the 'rural' counts from Saskatchewan have shown no overall significant change ($r_s = 0.150$, $P > 0.05$), those of the four Canadian cities ($r_s = 0.685$, $P < 0.001$) and the 16 United States centers ($r_s = 0.519$, $P < 0.01$) have shown significant increases. The reporting frequency for Merlins wintering in Canadian cities was much higher than that found in other areas (Fig. 1). Counts of prey species in the four Canadian cities have also shown changes. Bohemian Waxwings have shown a significant increase ($r_s = 0.519$, $P < 0.01$), House Sparrows a highly significant decrease ($r_s = -0.683$, $P < 0.001$), and cardueline finches have remained unchanged ($r_s = -0.084$, $P > 0.05$). There was no significant correlation between Merlin numbers and those of the House Sparrow ($r_s = -0.301$, NS), or cardueline finches ($r_s = 0.264$, NS), in the four Canadian cities, but a significant correlation was detected between Merlin numbers and Bohemian Waxwing numbers ($r_s = 0.482$, $P = 0.01$, Fig. 1).

DISCUSSION

The establishment of a major wintering population of Richardson's Merlin on the northern Great Plains has only recently been recognized (A.O.U. 1957, 1983). In fact, the range maps of virtually all North American field guides are incorrect in this matter. The C.B.C. data we

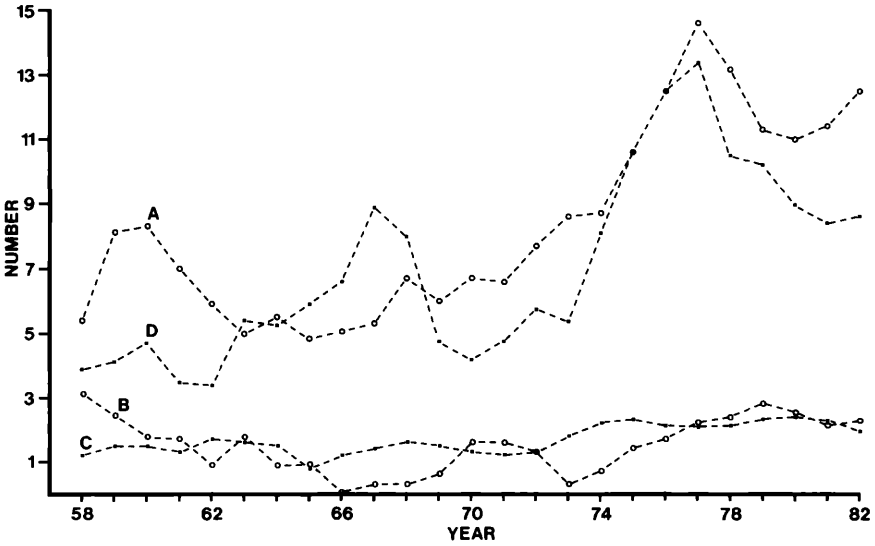

FIGURE 1. Three year running means of Christmas Bird Counts for Richardson's Merlin (no. per 1000 party-miles) in (A) Canadian cities, (B) 'rural' Saskatchewan, (C) U.S. counts, and (D) Bohemian Waxwing (no. per party-mile) in Canadian cities.

have collated show that the numbers of wintering Richardson's Merlin in some areas have increased significantly during the period 1957–1983. This is true of birds in the four Canadian cities and 16 United States counts. Therefore, the increase in Canadian urban centers cannot be explained by a northward shift of the wintering range, but rather by a northward expansion.

The paucity of early reports, in combination with the low numbers seen in Canadian counts during the 1950s and 1960s, suggest that the original delineation of the wintering range was probably correct until recently. The substantial increase of wintering Merlins in Canadian cities during the 1970s (Fig. 1) parallels their increasing breeding densities in these centers (Oliphant and Haug 1985, Smith 1978). This shift to urban nesting probably resulted initially from the appearance of urban-nesting corvids which provided nests for the Merlins (Houston 1977).

Changes in prey availability may have had some influence on the establishment of this northern wintering population. Urban waxwing numbers have been increasing, perhaps in response to the planting of ornamental fruit trees, such as Mountain Ash (*Sorbus* spp.) and crabapple (*Malus* spp.), on which waxwings depend heavily in winter. A similar bird-fruit relationship has been implicated in the recent range expansion of the Northern Mockingbird (*Mimus polyglottos*) in the northeastern United States and Canada (Stiles 1982). The significant correlation between Merlin numbers and waxwing numbers within years, and their parallel increase in these four urban centers (Fig. 1) suggest that in-

creased prey availability may also be partially responsible for the increased overwintering of Merlins.

It is also possible that the increases partly reflect a recovery of Merlin populations following the banning of DDT and other organochlorine insecticides in North America. It is generally accepted that Richardson's Merlin populations declined drastically as a result of their use (Fox 1971, Fyfe et al. 1976, Henny et al. 1976, Houston and Schmidt 1981, Trimble 1975). The direct evidence for changes in breeding populations is, however, limited to the Kindersley area of western Saskatchewan (Fox 1971, Houston and Schmidt 1981). There is no evidence concerning breeding numbers in most other regions through the 1960s. The Kindersley area is noteworthy in that dieldrin was used extensively there for grasshopper control between 1958 and 1964 (Hodson 1975). Population declines of Merlins and other raptors have been attributed more to the extra mortality of adult birds caused by dieldrin and other cyclodienes than to the reduction in breeding success caused by these and other organochlorines (Newton 1979, 1986; Newton et al. 1982).

The differential rates of increase between populations in Canadian cities and other wintering areas (Fig. 1) suggest that urban-raised Merlins are wintering increasingly in such centers. Two lines of evidence support this hypothesis: the proportion of banded birds seen wintering in Saskatoon where a chick-banding program has been in operation since 1971, and the differential distribution of band recoveries of urban- and 'rural'-banded Canadian Merlins. For example, only two out of 60 Merlin sightings in Saskatoon during the winters of 1984/85 and 1985/86 involved unbanded birds. In addition, of 12 Merlin recoveries originally banded in the four Canadian cities, only two were south of the Canada-United States border; ten were north of it. In contrast, of 24 'rural'-banded recoveries, 15 were south of the border; nine to the north. Recoveries from within urban centers were excluded for this comparison, since the higher likelihood of a recovery being made would bias the analysis. This difference in recovery location is significant (Fisher exact test, $P = 0.01$), and supports the suggestion that urban-raised Merlins are less migratory. Since partial migration in other species has been demonstrated to have a genetic basis (Berthold and Querner 1981, Biebach 1983), it is possible that an ever-increasing proportion of urban Merlins will overwinter on their breeding grounds in the future.

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