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RECAPTURES OF REDPOLLS: MOVEMENTS OF AN IRRUPTIVE SPECIES

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Some species of birds occur irregularly in portions of their range. Familiar examples are Bohemian Waxwings (*Bombycilla garrulus*); northern owls, particularly Northern Hawk-Owl (*Surnia ulula*), Great Gray (*Strix nebulosa*), and Boreal (*Aegolius funereus*) owls; and several species of cardueline finches, including Pine Grosbeak (*Pinicola enucleator*), Pine Siskin (*Carduelis pinus*), and crossbills (*Loxia*). A review of "invasion" (irruptive) movements of birds can be found in Svardson (1957).

The irruptive behavior of redpolls, particularly the Common Redpoll (*Carduelis flammea*) has received much attention. Bock and Lepthien (1976) found that boreal finches, including redpolls, irrupted synchronously into much of the United States and southern Canada. Kennard (1976), and Bock and Lepthien (1976) found a biennial pattern of redpoll irruption from banding and Christmas Bird Count data. These authors related invasions of redpolls to the lack of production of birch (*Betula* spp.) seeds in more northern portions of the birds' winter range. Newton (1972) found that redpolls may also curtail their usual northern migration by up to several hundred kilometers to breed in more southern areas if good crops of spruce (*Picea* spp.) seeds are encountered.

The analysis of movements of individuals of irruptive species has rarely been reported. This study represents such an analysis of movements of Common and Hoary (*C. hornemanni*) redpolls based on banding and recovery data. Most banding and subsequent recovery of redpolls occurs within their winter range. The data base for my study was thus biased by the lack of breeding season data. Evidence from the literature provides some information to infer the effects of the irruptive behavior of redpolls on their breeding distribution.

METHODS

Summaries of all redpoll recovery data up to 1978 were obtained from the Bird Banding Laboratory. Of the 404 recoveries recorded, only 106 represented birds banded one winter and recaptured during a subsequent winter. These 106 records provide the basis for the results presented. Three summer recoveries of winter banded redpolls are described but not included in the analyses.

For comparison I subjectively divided the winter range into a northern region (including Canada and Alaska) and a southern region (comprising the remaining states used by redpolls). Because of their biennial pattern of winter range distribution (Kennard 1976), redpolls should occur in the north every year (as a migrant if not wintering) but only during alternate years in the south. Reference to invasion years refers to those years during which redpolls occur in the southern region.

My first comparison was of time between banding and recapture, to verify the existence of a biennial pattern of invasion. The recovery information was then tabulated as to "distance" between banding and recovery locations. For convenience the locations were summarized within the following three classes (all recovery locations are relative to banding location): (1) same location (within .5 degrees latitude and longitude), (2) same state or province, and (3) different state or province.

The American Ornithologists' Union (1957) regards Hoary and Common redpolls as separate species; however, there is not universal acceptance of this division. Salomonson (1950), Williamson (1961), and Troy (1980) consider them conspecific. For the purpose of this report I refer to all as redpolls. I believe the conclusions apply to both forms.

RESULTS

Within the southern region, most redpoll recaptures occurred two years after the initial banding (Fig. 1). A small peak in recaptures occurred four years after banding, confirming the expected pattern of alternate year recoveries. In the northern region the incidence of recapture steadily decreased with time from banding. Actual recapture frequencies are presented in Table 1. The distribution of recaptures, 1, 2, and 3 or more years after banding, for the two regions are significantly different ($\chi^2_{(2)} = 13.57$; $P < .005$).

Table 2 shows the distribution of recaptures relative to banding locations. A statistical treatment of these data is inappropriate as the area comprised by units such as states is variable and the probability of capture at various distances cannot be assumed to change in proportion to distance from banding site due to the clustering of banding (recapture) stations. It is, however, evident that the proportion of birds recaptured in the same area as they were banded is markedly lower in the southern region. Many birds were recaptured at great distances from their banding locations, frequently more than 2000 km distant. A selection of the net displacements is shown in Fig. 2. Most of the displacement between successive wintering areas is east-west rather than north-south, indicating actual shifts in wintering areas rather than an artifact caused by the analysis of movements of migrant birds or movement in response to different severity of weather among years.

DISCUSSION

It is remarkable that some redpolls return to their original (winter) banding location after having wintered elsewhere during an intervening year. Although birds wintering in the northern region have much greater fidelity than birds wintering farther south, the absolute return rates are very low in both areas. For example, in the northern region (Fairbanks, Alaska) L. Peyton and G. C. West (pers. comm.) have had returns of only 16 of the 5200 (.31%) redpolls they have banded. Whereas, in the southern region (New Hampshire), J. Kennard (pers. comm.) had no returns from over 1800 banded redpolls.

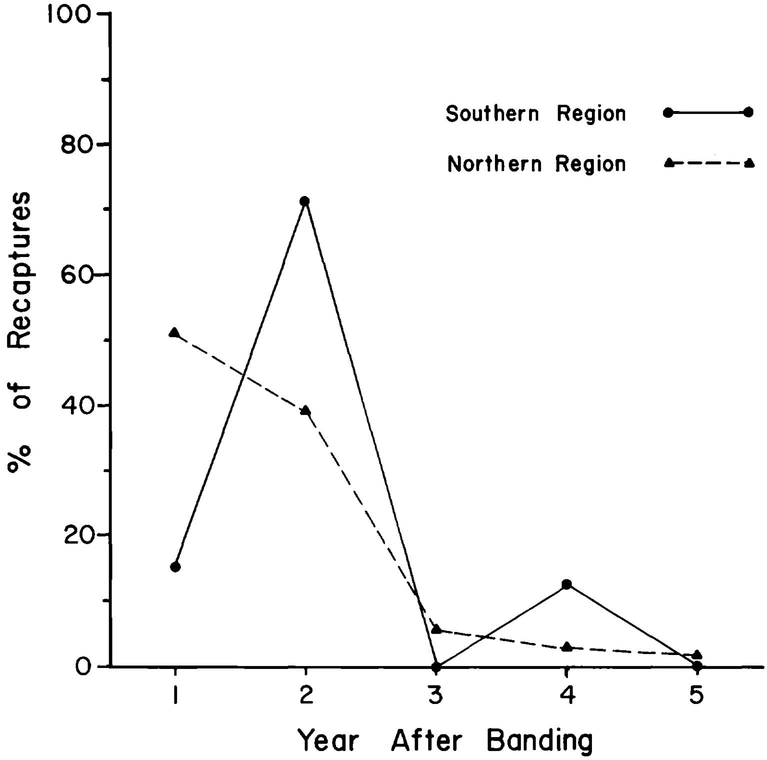

FIGURE 1. Percentage of recaptures by year after banding of wintering redpolls. n = 67 recaptures in northern region; 39 recaptures in southern region.

It is also of interest that some of the invasion redpolls banded in the northern United States have been captured in Alaska during the summer. Kennard (1976) could not demonstrate a biennial pattern of movements in Alaska, but data presented in Fig. 2 suggest that birds from all over the continent may participate in incursions into southern areas.

The wide-ranging winter movements and potentially large interannual movements suggest that redpolls may summer in different areas

TABLE 1. Time interval between banding and recapture for wintering redpolls.

	Years between captures				
	1	2	3	4	5
Southern region	6	28	0	5	0
Northern region	34	26	4	2	1
Total	40	54	4	7	1

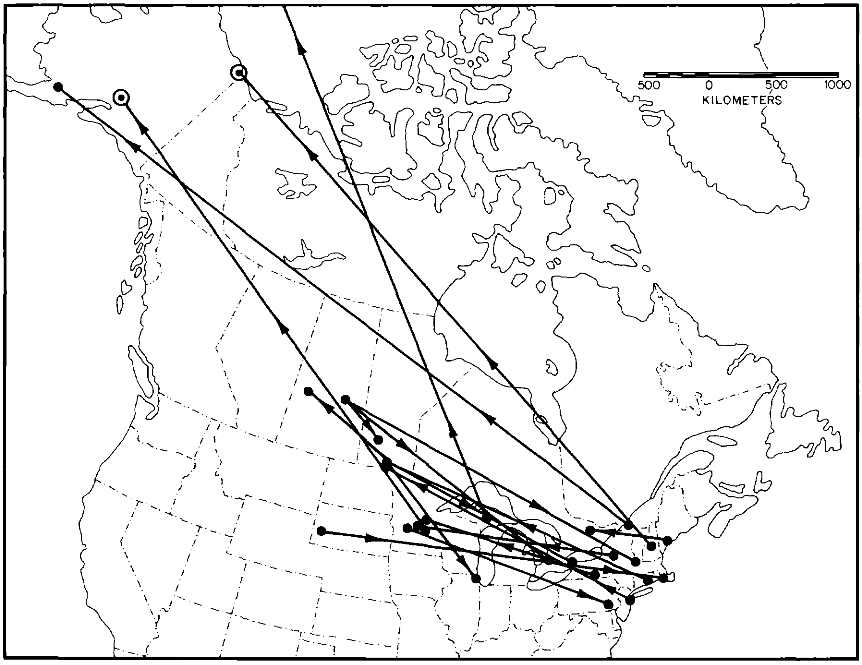

FIGURE 2. Points of banding and subsequent recapture of selected redpolls. All captures except for the two represented by circled points in Alaska are winter (or early spring) records. The point at the terminus of the line directed off the top of the map is at 59°30′N, 144°24′E, near Okhotsk, Khabarovsk Kray, Russian Soviet Federal Socialist Republic, USSR.

each year. Direct evidence of redpolls breeding in different areas in consecutive years is rare (and unexpected considering that most of their breeding range is not visited by biologists). Newton (1972) mentions recoveries of breeding season redpolls at locations 280 and 550 km from the original banding sites. Indirect evidence also supports the lack of breeding site fidelity in redpolls. Shields and Peyton (University of Alaska, pers. comm.) found the return rate of redpolls to be among the lowest (<1%) of breeding passerines at the Akulik-Inglutalik River delta in western Alaska. Similarly, a low return rate can be inferred from

TABLE 2. Comparison of locality of banding and place of recapture of redpolls during subsequent winters.

Place of recapture	Southern region	Northern region
Same location	5	56
Same state or province	6	2
Different state or province	26	10

changes in population densities documented by breeding bird studies. Enemar and Nyström (1981) found redpoll densities to vary between 2 and 90 territories/km^2 over 19 summers in Swedish Lapland. Changes between years were so great that immigration must have occurred. Large among-year fluctuations in redpoll breeding densities have also been recorded in Norway (Moksnes 1973), Finland (Antikainen et al. 1980), and Manitoba (Jehl and Smith 1970).

As a consequence of their wide-ranging habits and low levels of site tenacity, geographic variation would be unexpected. The amount of geographic variation in morphological features is commonly reflected in the number of described subspecies. In general, arctic and subarctic passerines are not well-differentiated into component subspecies. Almost all possess at least eastern and western subspecies, but some (e.g., Fox Sparrow (*Passerella iliaca*)) comprise many. Redpolls are among the least differentiated species occurring in the northern nearctic. In the absence of extensive gene flow among regions, one would hypothesize that enough geographic differentiation would have occurred to warrant subspecific recognition. Gene flow among redpolls appears to be extensive and may even extend beyond continental boundaries as exemplified by the Michigan to USSR record illustrated in Fig. 2.

SUMMARY

Redpolls exhibit a biennial pattern of invasion into the southern portion of their winter range, but show little fidelity to specific wintering areas. A higher incidence of return occurs in northern areas, but a substantial number of returns occur at distant locations. The overall return rate for redpolls is low. Perhaps because of their erratic winter movements, the return rate of redpolls to summer breeding localities is also low. The mixing of redpolls on a continent-wide (or perhaps even wider) basis appears to have prevented population differentiation, or disrupted any previously existing differences.

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