A BIENNIAL RHYTHM IN THE WINTER DISTRIBUTION OF THE COMMON REDPOLL

By John H. Kennard

In the winter of 1974, a tremendous flight of Common Redpolls (*Acanthis flammea*) occurred into New England where many feeders were crowded with them. This wave carried through New England to the south shore of Long Island where thousands were seen.

Reviewing my notes from previous years it appeared that these flights into New England occurred only in even-numbered years. In order to determine where these birds were in the odd-numbered winters, I requested and obtained from the Bird Banding Laboratory a complete print-out of all the Common Redpolls banded in North America each year from 1955 through 1972. These statistics were rearranged according to areas corresponding to the flyways as defined in the BBL Manual, with New England and Atlantic in Flyway #1, Inland in #2, West in #3 and Pacific in #4. From 1955 through 1972, 79,844 birds were banded: in the nine even-numbered years, 66,177, but in the nine odd-number years only 13,677 (Table 1).

Apparently a larger incursion into the United States occurs every even-numbered year because, with the exception of 1968, each even-numbered year had more banded birds than the preceding odd-numbered one. The only odd-numbered year to break this rhythm was 1969, which was followed by the record breaking incursion of 1970. In 1970, 19,843 were banded, but in 1971 only 505 of which 320 were in Wisconsin. In 1972, they reappeared in tremendous numbers when 19,547 were banded. The detailed statistics for 1973 were not yet available, but the total banded was only 361. The total for 1974 will probably be the largest on record.

The extent of the southward migration varied from year to year. In some years they appeared to concentrate in northern New England; in others, they overflew this area and concentrated in New Jersey and Pennsylvania. Some years more occurred in the Northeast, and in others, more in the Michigan-Wisconsin area. In 1955, only 38 were banded in all of the United States and of these 35 were banded in Missouri, the only Common Redpolls banded in that state during the entire period.

State-by-state data are too voluminous and insufficiently important to reproduce here because they can be profoundly influenced by changes in banding activity. For example, an apparent shift in the population from Saskatchewan to Manitoba can be accounted for by the activity of a single bander, LeRoy T. Simmons of Winnipeg who banded 5,446 redpolls in the single winter of 1970!

Alaska is apparently the only place where significant numbers of breeding birds have been banded, and these are difficult to follow because of a lack of active banders in the Canadian far west and the northwestern United States.

Dr. C. Stuart Houston, of Saskatoon, Sask. has kindly furnished me with the Christmas counts from that area. The even-numbered

TABLE 1
Common Redpolls banded by year and region

Year	Region or Flyway					Total		
	Northeast	Atlantic	Inland	West	Pacific	U.S.	Canada	Total
1955	0	0	38	0	0	38	1,377	1,415
1956	1,479	993	48	0	0	2,520	665	3,185
1957	3	2	5	90	5	105	707	812
1958	377	287	64	134	0	862	709	1,571
1959	0	5	29	0	7	41	352	393
1960	5,879	7,193	674	32	0	13,778	699	14,477
1961	3	0	3	7	0	13	656	669
1962	1,086	655	16	295	1	2,053	426	2,479
1963	2	19	157	2	0	180	567	747
1964	83	9	581	126	0	799	1,619	2,418
1965	0	14	137	117	0	268	308	576
1966	1	382	308	276	1	968	1,396	2,364
1967	1	1	313	7	0	322	229	551
1968	2	1	213	30	0	246	47	293
1969	1,486	257	1,042	1,660	5	4,450	3,549	7,999
1970	2,735	793	9,646	1,051	0	14,225	5,618	19,843
1971	0	16	352	19	0	387	118	505
1972	772	3,644	12,480	1	0	16,897	2,650	19,547
Totals	13,909	14,271	26,106	3,847	19	58,152	21,692	79,844

years (1956-72) total 2,680, and the odd-numbered ones, preceding the even-numbered winters in the United States, total 9,156. The Christmas count numbers were high in every odd-numbered year until 1967, when only 22 were seen, preceding the very low winter of 1968 in the United States. In 1968, the only even-numbered year over 500, 1,492 were counted; this preceded the exceptional odd-numbered incursion into the United States in 1969.

A. J. Erskine, Migratory Bird Populations, Canadian Wildlife Service, in Ottawa, states that the Christmas counts at Fort Smith, N.W.T. show Common Redpolls "only in the same years as did Saskatoon." Although at 60° N, this location is still in boreal forest, south of the subarctic tundra and taiga, where Mr. Erskine states "we have no regular observers." Thus the Christmas counts in this area forecast not only the number of Common Redpolls to be banded in the midwestern United States, but even in New England. I believe this indicates that the factors involved must be continent-wide, at least from the Atlantic to the Rocky Mountains.

Dr. William S. Brooks, Ripon College, compiled the Christmas counts on this species from *Audubon Field Notes*, for 1946 through 1967, and writes: "The data showed a neat 2-year cycle for most of the time."

To find an explanation for the biennial rhythm demonstrated above, I searched for some rhythmic variation in the weather and in the food supply.

In relation to rhythmic variations in the weather patterns, Gargett (1965) has documented a 26-month cycle in the temperature trends, and a 32-month cycle in the precipitation in the Toronto area. R. A. Treidl, Superintendent, Forest Meteorology Section, Environment Canada, at Downsview, Ontario writes: "It would seem plausible that there exists a similar variation in the seed crop of the yellow birch which in turn might influence the migration patterns of the Common Redpoll. . . . There can be no doubt about the reality of the 26 month temperature oscillation, which is more pronounced in the southern regions than in the higher latitudes of our country." This 26-month cycle could influence the Common Redpoll migration, if in phase with another factor, such as causing the heavier winters of 1972 and 1974, but a 26-month-temperature cycle does not seem to provide a complete explanation.

Therefore, we must search for an explanation in the food supply of these birds. A.J. Erskin writes: "Redpolls are very closely tied to buds, fruits and seeds of birches,—the German name for redpoll is Birkenzeisig (*Birch Siskin*)—and birches only set seed every second year (approximately). In years when no birch seed is available in the northern areas where this species breeds, it moves south, the numbers reaching southern Ontario and New England varying with the natural food crops farther north."

R. C. Clement (1968) states that in winter the birds that stay northward are largely dependent on the seeds of the amentiferous birches, alders, and willows and "The southward incursions of redpolls in some years are almost certainly related to conditions—

whether deep snows, ice storms, or actual failure of the catkin crop—that reduce the availability of food in their breeding grounds, but our knowledge of conditions in the subarctic is still too scanty to permit correlations."

Dr. George C. West, at the University of Alaska, writes: "We certainly have no evidence on the breeding ground that there is any seasonal fluctuation in numbers of birds produced, although this has not been specifically studied. Likewise, crops of alder and birch seed which are extensively used by redpolls during fall and winter months do not fluctuate greatly at this latitude, although they may farther south. . . . There are vast expanses of territory in Canada where these birds can winter where there are no banders."

Thomas M. Kron (1975) studying the winter bird populations in subarctic taiga near Fairbanks states: "The density of redpolls during late winter was three times their breeding density" and notes that taiga redpoll populations might change with birch seed crops.

Dr. Ralph B. Williams, of Juneau, Alaska, who has banded more Common Redpolls than anyone else on the Pacific Coast, writes that he has seen no evidence of a biennial rhythm, either in the occurrence of Common Redpolls, or in the production of amentiferous seed in that area. He notes that there were large numbers of Common Redpolls from 3 March to 22 April 1961, and again from 12 February to 22 April 1974 and that "heavy snowfalls and marked accumulation of snow at all elevations may have been a factor in the concentration of the birds in this area." He does not know whether these birds were from central Alaska or the Canadian taiga.

Dr. Joseph R. Jehl writes that the population of breeding redpolls at Churchill, Man. was greater in the summers of 1964 and 1966, than in 1965 and 1967. This might indicate that the large numbers of birds that spent the winters of 1964 and 1966 in the United States and southern Canada were more successful in surviving the winter and returning to the breeding ground than those that wintered in the north in 1965 and 1967.

Dr. B. S. P. Wang of the Forest Tree Seed Center, Petawawa Forest Experiment Station, Chalk River, Ontario, writes: "I concur with you in your hypothesis that their migration in large numbers must be associated to food avilability (i.e. coincide with the good seed years of tree species such as birches and willows). With perhaps the exception of the north, good crops of birches occur every 1 to 2 years. The fruiting habits of trees in the north may be different from the south. The intervals of good seed years may be longer."

Armand Corriveau, research scientist at the Laurentian Forest Research Centre, Quebec, states that an exceptionally large crop of seed of the Yellow Birch occurred in 1967. This affected the trees and there was a relative crop failure in 1968 and 1969. Gross and Harden (1968) showed that 1967 was a very good year for Red and Sugar maples, Black and White spruces, and Balsam

Fir, as well as Yellow Birch. In 1967, the Yellow Birch total seed measured was eight times as great as in 1966, which had been considered a good year. They quote an average of about 1,300,000 seeds per acre for the Yellow Birch, found 3,500,000 in 1966, and 29,000,000 in 1967, in the Sault Ste. Marie area of Ontario. This might well have stopped the southward migration of the Common Redpolls in 1967, whereas the crop failure in 1968 and 1969, contributed to pushing these birds farther south. W.L. Sippell, of the Great Lakes Forest Research Center at Sault Ste. Marie, has confirmed the above data on Yellow Birch.

Harry C. Lumsden, research scientist, Fish and Wildlife Research Branch, Ministry of Natural Resources at Maple, Ontario, writes: "Most of the information on birch seed crops refers to yellow birch, because of its commercial importance. Harvey A. Anderson has told me that yellow birch fruited heavily in Algonquin Park in 1950, 1953, 1956, 1960, 1963, 1967, 1970, and 1974. He thinks that white birch seed a little every year, but some trees fruit heavily in alternate years."

The Yellow Birch fruits in the fall, the seeds remaining on the trees and being distributed over the snow in the winter, thus forming a food supply for Common Redpolls. Usually a much smaller crop occurs in the year following heavy seeding. Therefore, these birds should stop in the Yellow Birch area in the winters following the falls of heavy seeding. If we take the five years (1956, 1960, 1963, 1967, and 1970) common to both Anderson's observations and to Table 1, and add the total number of Common Redpolls banded in the United States those winters preceding the falls of heavy seeding, we obtain 31,025, but for the five winters following the falls of heavy seeding, only 1,550 (Table 2). For the

TABLE 2

Common Redpolls banded in selected years

1956	2,520	1957	105	1958	862
1960	13,778	1961	13	1962	2,053
1963	180	1964	799	1965	268
1967	322	1968	246	1969	4,450
1970	14,225	1971	387	1971	16,897
	31,025		1,550		24,530

succeeding winters, following the falls of compensatory low seed production, the figure increases to 24,530. This seems to indicate that the pattern of heavy seed production in the Yellow Birch may extend well beyond Algonquin Park, and that in years of heavy seed production the southward migration of the Common Redpoll is arrested in the Yellow Birch area, and that in the years of poor Yellow Birch seed production, the redpolls are pushed farther south.

Carl H. Tubbs, project leader, North Central Forest Experiment Station, U.S.D.A. Marquette, Michigan, sent me data on the seeding of various trees in the Lakes Region (United States side), and included tables from Rudolph (1962) and Godman and Mattson (1976) with summaries of the heavy seeding years in that area. These correlate poorly with the data from Algonquin Park and with the basic biennial rhythm with which we are concerned. They show "bumper crops" of Yellow Birch seed in the fall of 1959 and 1971, and in the following winters (1960 and 1972) there were relatively more Common Redpolls in this area (Minnesota, Wisconsin, and Michigan) than in other parts of the midwest, indicating that those birds coming south tend to congregate in the areas containing most abundant food.

Dr. F. C. Cooch, Chief, Population and Surveys Division, Canadian Wildlife Service in Ottawa, reports that they have no data on seeding of subarctic birch and willow, but that the winters of 1972 and 1974 were unusually severe, and "consequently many birds were forced south because food that was normally available to them was covered by a considerable amount of snow" and "the distribution of this bird is generally restricted by snowfall in winter." This is undoubtedly true and may be a factor in increasing the volume of birds migrating south, but how did the birds passing through Fort Smith in December know how much snow would fall on the taiga in February and March?

SUMMARY

I have demonstrated that there is a definite biennial rhythm in the cyclic migration of the Common Redpoll in North America. This rhythm has existed for at least 20 years. These birds migrate south from their breeding grounds in the subarctic taiga every odd-numbered autumn. This may be due to a biennial cycle in the seed production of birches and other amentiferous trees. Although a 26-month cycle in temperature and a 32-month cycle in precipitation have been demonstrated, these do not appear to be closely correlated to the migration of redpolls. A 3-4 year cycle in the seed production of Yellow Birches shows a definite correlation, because in the winters following the heavy seeding of Yellow Birches southward migration of these birds is arrested in this area. Winters of heavy snowfall in the north probably contribute to the southward migration.

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