Synchronous Fluctuations in Christmas Bird Counts of Common Redpolls and Piñon Jays

CARL E. BOCK
Department of Environmental, Population, and Organismic Biology, University of Colorado, Boulder, Colorado 80309 USA

Bock and Lepthien (1976) described synchronous southward eruptions of eight North American boreal seed-eating bird species, based upon an analysis of Christmas Bird Count (CBC) data. These findings were confirmed by an analysis of banding data for two of the species—Common Redpoll (*Carduelis flammea*) and Purple Finch (*Carpodacus purpureus*; Kennard 1976, 1977). Between 1962 and 1971, synchronous eruptions of the eight species occurred in the winters of 1963–1964, 1965–1966, 1968–1969, 1969–1970, and 1971–1972. Available evidence suggests that these eruptions were triggered by widespread seed-crop reductions among high-latitude tree species—especially spruce (*Picea*) and birch (*Betula*). Inspection of our 1962–1971 CBC data bank indicated that only the Piñon Jay (*Gymnorhinus cyanocephalus*) among 616 additional species fluctuated in a manner strongly resembling that of the boreal birds.

In Table 1, mean numbers of Piñon Jays counted per party-hour over the 10-yr period for which I have computerized CBC data are compared to the equivalent numbers of Common Redpolls—the species that showed the boreal-bird eruption pattern most strongly (Bock and Lepthien 1976). The Pearson product-moment correlation between jay and redpoll numbers was 0.908 ($P \cong 0.0003$); the nonparametric Spearman rank correlation for the two data sets was 0.720 ($P \cong 0.01$).

Piñon pines (*Pinus edulis* and *P. monophylla*) produce sporadically abundant cone crops, and Piñon Jays are known to move opportunistically in search of them (Balda and Bateman 1972, Ligon 1978, Forcella 1980). If Piñon Jays "erupted" in the high years 1963–1964, 1965–1966, 1968–1969, 1969–1970, and 1971–1972 (Table 1), then they should have been detected on more CBC's in those 5 yr than in the other 5. I tested this by determining the number of counts in each year that reported at least one Piñon Jay, adjusting these data to 1962 levels to compensate for the overall increase in CBC's each successive year. Results showed that Piñon Jays were detected on significantly more counts in eruption years ($\bar{x} = 17.6$, SD = 2.06) than in noneruption years ($\bar{x} = 13.0$, SD = 3.86; $t = 2.34$, $P < 0.05$).

One interpretation of these results is that some common environmental factor affected movements and/or population sizes of the two species between 1962 and 1971. Because both species are dependent upon irregularly available tree seeds, it is tempting to speculate that piñon pine cone crops fluctuated in synchrony with seed crops of more boreal tree species during this period.

Results of this study also could be due to some artifact of CBC data, but Piñon Jays and Common Redpolls concentrate in winter in very different parts of North America, and it does not seem possible that CBC observers could be influencing one another between these regions. Certain nationwide weather patterns might be influencing both CBC observers and the birds, but this should have resulted in synchrony between redpoll numbers and counts of a great many species. No such pattern is apparent in CBC data.

The synchrony in fluctuations of redpoll and Piñon Jay numbers could be due to chance, but it is very difficult to calculate such a probability exactly because of the small sample size involved ($n = 10$). Spearman rank correlation almost certainly is an unrealistically conservative estimate in the present case ($P \cong 0.01$), because it gives much weight to rank differences between pairs of values that actually differ very little in their absolute positions in the two data sets (Table 1). Neither variable differs significantly from a normal distribution, so use of the parametric r is justified ($P \cong 0.0003$). Small sample size, however, makes tests for normality comparatively weak.

There are 616 species in our CBC data bank not considered to be boreal tree-seed-eating birds. It seems probable that one or two would show such a strong correlation with redpoll numbers by chance alone. The probability that it would occur by chance between redpolls and another notoriously vagrant tree-seed predator seems very slight, although such a possibility cannot be be discounted. If the relationship between jays and redpolls is real, and if it

TABLE 1. Mean number of Common Redpolls and Piñon Jays counted per party-hour per year on mainland U.S. and Canadian Christmas Bird Counts between 1962–1963 and 1971–1972 (n = 8,129).

Year (fall)	Common Redpolls	Piñon Jays
1962	0.82	0.09
1963	2.48	0.29
1964	0.40	0.15
1965	3.03	0.35
1966	0.28	0.09
1967	0.23	0.13
1968	3.42	0.33
1969	3.57	0.28
1970	0.15	0.15
1971	2.55	0.22

is due to fluctuations of their food supplies, the relationship suggests that geographic and interspecific synchrony among tree-seed crops may be much more widespread than previously suspected.

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Literature Cited

Balda, R. P., & G. C. Bateman. 1972. The breeding biology of the Piñon Jay. Living Bird 11: 5–42.

Bock, C. E., & L. W. Lepthien. 1976. Synchronous eruptions of boreal seed-eating birds. Amer. Natur. 110: 559–571.

Forcella, F. 1980. Cone predation by piñon cone beetle (*Conopthorus edulis*; Scolytidae): dependence on frequency and magnitude of cone production. Amer. Natur. 116: 594–598.

Kennard, J. H. 1976. A biennial rhythm in the winter distribution of the Common Redpoll. Bird-Banding 47: 231–237.

———. 1977. Biennial rhythm in Purple Finch migration. Bird-Banding 48: 155–157.

Ligon, J. D. 1978. Reproductive interdependence of Piñon Jays and piñon pines. Ecol. Monogr. 48: 111–126.

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Mortality of Duckling Attributed to Separation from Mother and Subsequent Protracted Exposure to Low Ambient Temperature

Norman R. Seymour[1]
Faculty of Agriculture, Macdonald College of McGill University, Sainte Anne de Bellevue, Québec H9X 1C0, Canada

On 17 May 1981 I was observing the breeding behavior of dabbling ducks on the St. Lawrence River near Lancaster, Ontario. A female Mallard (*Anas platyrhynchos*) and her nine 1–2-day-old ducklings were feeding as they slowly moved along the marshy edge of St. Francis Island. At 1130, when they reached the point closest to Hamiltons Island (ca. 0.3 km away), the female called and swam into open water, followed by eight of the ducklings. The ducklings clustered together and stayed within 1 m of the female during the entire crossing; the female called frequently and kept her head close to her body. The shoreline where the female reached Hamiltons Island was rocky; to the south the shore remained rocky, but a cattail marsh was approximately 300 m to the north. The female (followed closely by the brood) swam to within 5 m of shore and then followed the shore to the marsh. She took the brood to shore, where I lost sight of them.

The ninth duckling left St. Francis Island at the same place about 5 min after the others and remained about 100 m behind them. It presumably saw the others depart, because it followed the same trajectory. The wind was blowing at 12–15 km/h from the northwest and 0.5-m-high waves of short interval buffetted the duckling. It reached Hamiltons Island about 8–10 min after the others; by this time, however, the brood presumably was out of sight of the lone duckling. It stayed there approximately 45 min but then swam to about 30 m offshore. It remained there in water 2 m deep, swimming in circles with its head continually dipping down. Within 60 min of separation from the female, it was dead.

Temperatures on this day were the lowest since 1944, and that night they were 0°C or below. Nighttime temperatures had dipped to 2°C for the two nights before this incident, and they were to 0°C for the two nights thereafter; wind velocity reached a steady 35–40 km/h the day after. When I first saw the brood, air temperature under bright sun was approximately 4°C and water temperature was approximately 3°C. This duckling appeared healthy and was dry when retrieved. It swam strongly, despite the wind from the northwest and a 10–12 km/h current flowing north between the two islands; it reached the island at exactly the same location as the female. Presumably the duckling was cold and could have conserved or even gained body heat had it gone to shore and sat on the stones in the sun. Periodic brooding by the female could potentially have provided an additional source of heat, which may have been why she took the young to shore as soon as she reached the marsh. The relatively short (about 5 min), but critically timed, separation from the female was apparently enough for the duckling to become lost and subsequently to succumb to exposure.

Dabbling ducks in this habitat nest on islands and move their newly hatched broods to marshy areas associated with islands. They frequently move broods between islands, presumably to new feeding areas. Movements of up to 2 km are common in Mallards, Black Ducks (*A. rubripes*), American Wigeon

[1] Present address: Department of Biology, Saint Francis Xavier University, Antigonish, Nova Scotia B2G 1C0, Canada.