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# Skull pneumatization rates in three invading populations of Black-capped Chickadees

Robert P. Yunick

In a previous paper (Yunick, 1980, Timing of completion of skull pneumatization of the Black-capped Chickadee and the Red-breasted Nuthatch, *N. Amer. Bird Bander* 5:43-46), I determined the timing of completion of skull pneumatization in an invasion population of Black-capped Chickadees (*Parus atricapillus*). Since experience at the same banding station has shown that the composition of winter-invading populations of chickadees is variable, I was interested in testing several years' population variations with the regression method I had used in that paper. In particular, year-to-year variation in the proportion of young to adults was of interest.

When the invasion of 1980-81 occurred, it had an unusually high proportion of immatures. I took the opportunity to assess the possible effect of a change in age composition on the previously predicated completion date of pneumatization, based on the 1977-78 data. When the birds began appearing at my feeders at Jenny Lake near Corinth, Saratoga Co., NY in early November, the group I captured was 85.0 percent hatching year (HY) birds, compared with only 44.4 percent HY birds in the same period during the flight of 1977-78. Using the same methods as in my earlier study, I collected skull pneumatization data on Black-capped Chickadees during November and December 1980 and subjected the data to regression analysis; they are given in Table 1. Also studied are data collected during a third flight in 1978-79 (Table 1).

Analysis of the 1980 data gave the linear equation: Immature percentage =  $131.1 - 16.7$  (Banding Period) with  $SD = 4.7$  and an index of fit of 0.9739. At first glance this equation appears to differ considerably from that obtained from the 1977-78 flight:  $IP = 77.0 - 11.4$  (BP),  $SC = 4.0$ , index = 0.9694. However, while the equation parameters are different because of a difference in the ratio of young to adults in the two samples, the predicted dates of pneumatization completion in both cases are similar, as shown when the data for the two flights were plotted in Figure 1. The completion dates differed by one banding period (one-third of a month), not a significant difference. Using 95-percent confidence limits, completion was predicted to occur by

as late as 21-31 December (BP 8) in the 1977-78 flight, and by 1-10 January (BP 9) in the 1980-81 flight.

The flight of 1978-79 differed in two major respects from the 1977-78 and 1980-81 flights: 1) It occurred immediately following a major flight the previous year, as opposed to the more usual sequence of a flight every two years; and 2) It consisted of a large number (46.3 percent) of returns of previously banded birds. The percentage of HY individuals was 37.5, compared with 15.2 percent in the same period (21-30 November) in 1977 and 45.7 percent in 1980. The regression analysis gave  $IP = 96.5 - 11.5$  (BP),  $SD = 1.6$ , index = 0.9894. Despite the relatively different nature of this 1978-79 flight, the 95-percent confidence limits again predicted completion of pneumatization by 1-10 January (BP 9), as had the 1980-81 results.

Reviewing the actual captures showed that a statistically insignificant number of individuals remain unpneumatized beyond 31 December. Out of the 379 chickadees handled in January for the years 1978-81, four (1.06 percent) had not completed pneumatization; and from 339 similar February handlings, only one (0.29 percent) was not complete. All of the four January captures occurred within the 10-day period predicted by the regression analyses.

The dates of capture for the last cases of incomplete pneumatization in these four banding seasons were: 18 December 1977 (complete when next captured on 31 December); 6 January 1979 (complete when next captured on 24 March); 16 March 1980 (not recaptured); and 1 January 1981 (three individuals, two of which were complete when next captured on 1 and 7 February 1981, respectively). In 1980 there was another incompletely pneumatized individual caught on 2 February which was complete when next captured on 12 April. Other than for possible late breeding and/or slow development, there is no apparent explanation for the occurrence of two such exceptionally late incompletions in early 1980. There was no invasion in the winter of 1979-80 and only 14 chickadees were accounted for in February, and 23 in March.

**Table 1. Skull pneumatization data from the Black-capped Chickadee invasions of 1977-78, 1978-79, and 1980-81.**


Year	Banding Period	Banding Period Designation <sup>1</sup>	Sample Size	Percent SIP <sup>2</sup>
1977	11-20 Oct.	1	20	69.0
	1-10 Nov.	3	9	44.4
	11-20 Nov.	4	23	26.1
	21-30 Nov.	5	33	15.2
	1-10 Dec.	6	21	9.5
	11-20 Dec.	7	38	2.6
	21-31 Dec.	8	42	0.0
1978	21-30 Nov.	5	24	37.5
	1-10 Dec.	6	34	29.4
	21-31 Dec.	8	28	3.6
1980	1-10 Nov.	3	20	85.0
	21-30 Nov.	5	46	45.7
	1-10 Dec.	6	57	22.8
	11-20 Dec.	7	86	13.9
	21-31 Dec.	8	116	2.6

<sup>1</sup> Each banding period (BP) was numbered consecutively from the middle third of October for the purpose of regression analysis.

<sup>2</sup> SIP — Skull incompletely pneumatized.

The observation that five of these seven late specimens had completed pneumatization by the time of their recapture confirms that they were cases of delayed timing and not persistent incompleteness. The fate of the two that were not recaptured could not be determined. To date, the examination of approximately 600 individuals in the January–May period has not produced any confirmed evidence of persistent incompleteness of pneumatization.

## Conclusion

A comparison of the results from three Black-capped Chickadee invasions, each different from the other in population composition, led to similar predictions of completion of skull pneumatization by 21-31 December — 1-10 January, thereby confirming applicability of the method under varying conditions. These regression predictions are also consistent with the observations made on individual chickadees, excluding an occasional, statistically insignificant case of delayed completion. 

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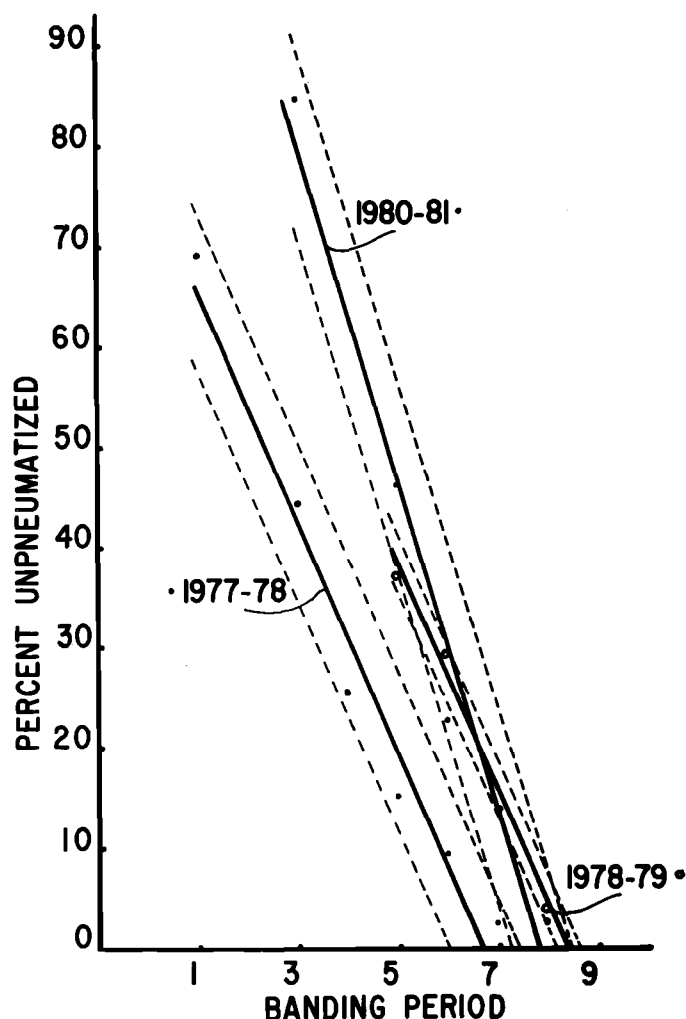


Figure 1. A comparison of the estimated completion dates of skull pneumatization for the Black-capped Chickadee using data from the invasions of 1977-78, 1978-79, and 1980-81 found in Table 1. The heavier line represents the regression line while the finer dashed lines represent  $\pm 2$  SD's of that line.

