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Timing of Completion of Skull Pneumatization of the Purple Finch and the Common Redpoll

Robert P. Yunick

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Introduction

By examining the changing proportion of pneumatized skulls through the course of a winter invasion of Purple Finches *(Carpodacus purpureus)*, I was able to estimate the time of completion of the pneumatization process. These data were compared with similar earlier data on the Pine Siskin *(Carduelis pinus)* (Yunick, 1977). A review of some similar mid-winter data on the Common Redpoll *(Carduelis flammea)* was made also.

Methods

Purple Finches were captured and banded at my home station in Schenectady New York, during one of this species' erratic invasions in January — May 1977. The skulls of the birds were examined by moistening the feathers of the crown with water and viewing through the skin. The birds were classed as either SCP (skull completely pneumatized) or SIP (skull incompletely pneumatized). The data were gathered by monthly thirds and are given in Table 1.

Because the 1977 data on the Purple Finch showed some incompleteness of pneumatization beyond the projected completion date, a population of mostly breeding birds was examined in 1978 at a banding station at Jenny Lake near Corinth, New York, 52 km north of the Schenectady station. These data are presented in Table 2.

Similarly, Common Redpolls were examined at Schenectady during the invasion of January — April 1978. The examination was discontinued at the end of March when it was apparent that the pneumatization process was complete. These data are summarized in Table 3.

Discussion

Purple Finch — The data in Table 1 were plotted in Figure 1 and predict (using ± 2 SD's of the regression line) completion of pneumatization by early March (Period 13). The regression line and the completion date fit very closely those of the Pine Siskin (see Figure 1B in Yunick, 1977). In that case the declining number of immature Pine Siskins with skulls not yet completely pneumatized was represented by the equation:

Immature Percent = 105.1 − 9.10(Banding Period)

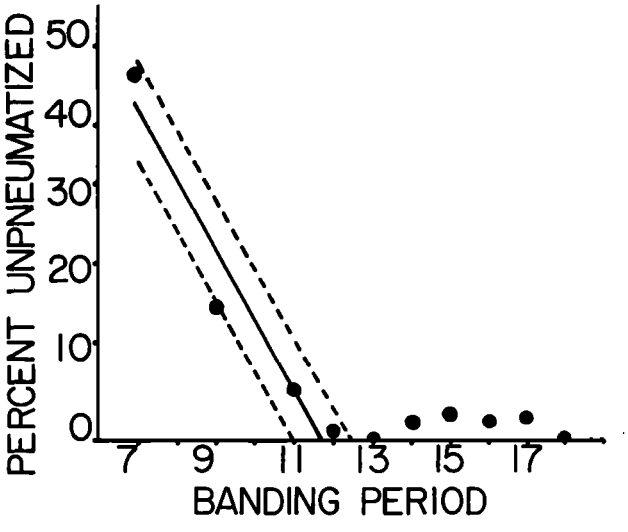

Figure 1. Timing of completion of skull pneumatization in the Purple Finch. The solid line is a least squares fit of the data for Periods 7—12 in Table 1, and the dotted lines are ±2 SD. The line fits the equation: Immature Percentage = 104.1 − 8.88(Banding Period). IP = 0 at Period 11.7. SD = ±6.2.

Banding Period refers to the particular monthly third beginning with 1 — 10 November as BP1 and numbering these periods consecutively thereafter. Also for the Pine Siskin, IP = 0 at Period 11.6. In the case of the Purple Finch, the equation is:

IP = 104.1 − 8.88(BP)

And IP = 0 at Period 11.7.

The particular Purple Finch invasion which was monitored did not begin early enough to allow determination of the onset of completion of pneumatization. However, if the species follows closely the timing of the Pine Siskin, as suggested by the agreement of the regression lines, then the onset would be expected in mid-November.

Continued examination of Purple Finch skulls beyond the projected completion date showed that approximately two percent of the birds handled continued to exhibit incomplete pneumatization. In order to attempt to ascertain whether these individuals were either birds that were tardy in meeting the completion schedule, or birds that remained permanently incompletely pneumatized, a summering population was examined. The results from those birds are given in Table 2.

Even into summer, this species continued to exhibit incomplete pneumatization. The majority of the individuals with incomplete pneumatization were SYM birds captured between 25 June and 16 July at which time they were a little over one year old. One bird caught on 1 July was an ASYM bird which had to be at least two years old at the time of capture.

The size of the unpneumatized windows varied from one to six mm. Only two birds showed symmetrical positioning of the unpneumatized windows. The remaining six birds had only a single window in one of the front quadrants of the skull.

The summer average of 2.1 percent of birds having unpneumatized skulls (bottom of Table 2) compares closely with the March — April average of 1.9 percent in Table 1. While it cannot be unequivocally ascertained with the data at hand whether the presence of a small percentage of birds with unpneumatized skulls is caused by delay in completion or persistence of incompletion, the latter alternative seems more likely, but the possibility of both alternatives being operative cannot be ruled out. It is not apparent why none of the 111 recognized females showed no incompleteness of pneumatization. It is possible that, because of the lack of symmetry in the tiny remaining windows, a few unpneumatized skulls could have been overlooked during examination.

Table 1. Distribution of skull pneumatization in the Purple Finch in Winter/Spring 1977

Banding period	Period designation[1]	Number banded SCP[2]	SIP[3]	Total	Percent SIP
1-10 Jan.	7	15	13	28	46.4
11-20 Jan.	8	—	—	—	—
21-30 Jan.	9	144	29	173	16.8
1-10 Feb.	10	—	—	—	—
11-20 Feb.	11	184	12	196	6.1
21-28 Feb.	12	141	1	142	0.7
1-10 Mar.	13	64	0	64	0.0
11-20 Mar.	14	83	2	85	2.3
21-31 Mar.	15	150	5	155	3.2
1-10 Apr.	16	208	5	213	2.3
11-20 Apr.	17	71	2	73	2.7
21-30 Apr.	18	154	0	154	0.0

[1]Each monthly third was numbered consecutively beginning with 1-10 November.

[2]SCP—Skull completely pneumatized

[3]SIP—Skull incompletely pneumatized

Table 2. Distribution of skull pneumatization in the Purple Finch in Spring/Summer 1978

Banding period	Number banded/Returned[1] ASYM SCP	SIP	AHYU SCP	SIP	SYM SCP	SIP	AHYF SCP	SIP	Total SCP	SIP	Percent SIP
April	51	0	21	1					72	1	1.4
May	78	0	69	0	6	0	3	0	156	0	0.0
June	19	0	1	0	13	5	12	0	45	5	10.0
July/August	32	1	11	0	16	2	96	0	155	3	1.9
Total	180	1	102	1	35	7	111	0	428	9	2.1

[1]The age/sex classes are as follows:

ASYM— After-second-year male (rose colored)

AHYU— After-hatching-year unknown (brown colored with no external sex-determining characteristics

SYM — Second-year male (brown colored with a cloacal protuberance)

AHYF— After-hatching-year female (brown colored with a brood patch)

Table 3. Distribution of skull pneumatization in the Common Redpoll in Winter/Spring 1978

Banding period	Period designation	Number banded SCP	SIP	Total	Percent SIP
1-10 Feb.	10	19	0	19	0.0
11-20 Feb.	11	199	2	201	1.0
21-28 Feb.	12	290	2	292	0.7
1-10 Mar.	13	163	0	163	0.0
11-20 Mar.	14	171	0	271	0.0
21-31 Mar.	15	366	0	366	0.0

Common Redpoll — Unlike the Pine Siskin and the Purple Finch which showed similar timing of completion of pneumatization in early March, the Common Redpoll completed the process earlier. Among the February — March captures in Table 3, only 4 out of 1312 captures were incompletely pneumatized. Among them, all of the birds which were incompletely pneumatized showed very

small V-shaped windows typical of the last stages of pneumatization.

Thus, the exact timing of this completion was not ascertained, but it must have occurred prior to or at the beginning of February. This places the completion date at least one month ahead of that of the Pine Siskin and the Purple Finch. The completion of pneumatization in all of the 700 March bandings indicates that, unlike the Purple Finch, this species completes the process without individual stragglers exhibiting small windows for months afterward.

Conclusions

An examination of skull condition of the Purple Finch in winter and summer indicated that skull pneumatization is complete for most individuals by late February — early March. A small percentage of individuals — about two percent — exhibit incomplete pneumatization well past this projected completion date to an age of over one year and, in at least one case, to an age of at least two years. The projected timing and rate of completion matches closely that of the Pine Siskin. The Common Redpoll, however, showed completion of pneumatization at some time prior to February and, unlike the Purple Finch, showed no incompleteness in the process beyond February.

Literature cited

Yunick, R.P. 1977. Timing of Completion of Skull Pneumatization in the Pine Siskin. *Bird-Banding*, 48:69-71.

1527 Myron St., Schenectady, NY 12309.

New releases

Waterfowl of North America. Paul A. Johnsgard. Indiana Univ. Press, Bloomington, IN 1978. 640 pp. $27.50.

This new book on waterfowl contains data on all of the nearly 60 species of ducks, geese, and swans known to breed in North America. For each species the distribution, weights, and measurements, information on identification in the field, *criteria for determining age and sex*, and North American subspecies are given.

Each species description also includes detailed accounts of preferred habitat, food, ecology, migratory movements, sociality, age at maturity, nest location, clutch size, incubation and fledging periods, pairing and flocking behavior, and copulatory, nesting, brooding, and postbreeding behavior. Preliminary chapters deal with migration and distribution patterns, hunting and recreational values, and an introduction to waterfowl biology in general.

Illustrated with 64 line drawings, 32 color photographs, 96 black and white photographs, and range maps for all breeding species.

Cavity-Nesting Birds of North American Forests. Agriculture Handbook No. 511. Virgil E. Scott, Keith E. Evans, David R. Patton, Charles P. Stone. Illustrated by Arthur Singer. Forest Service, U.S. Dept. of Agriculture. 1977. 112 pp. $2.75.

Why leave a gnarled, dead tree standing in the forest? It might be a safety or a fire hazard. Or, it could be ground into chips for paper pulp or make someone a good supply of firewood. According to a new Dept. of Agriculture Handbook, however, it is environmentally important to leave some dead trees in the forest for the birds—specifically, birds that nest in holes or cavities.

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The book summarizes what is currently known about the habitat requirements of 85 bird species dependent on cavities for rearing their young. It is illustrated with color drawings prepared by Arthur Singer for *A Guide to Field Identification: Birds of North America*, by Robbins, Bruun, and Zim.

The handbook is co-authored by wildlife biologists Virgil Scott and Charles Stone of the Fish & Wildlife Service, U.S. Dept. of Interior, and Keith Evans and David Patton of the Forest Service, U.S. Dept. of Agriculture.

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