

NOTES ON PLUMAGES, MOLTS, AND AGE VARIATION OF THE RED CROSSBILL

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The extent of the invasion by Red Crossbills (*Loxia curvirostra*) of much of the United States in the winter of 1950-51 has been outlined in Audubon Field Notes (5, 1951:191-240). In northeastern Kansas the invasion was one of the largest on record. Crossbills were first noted on November 1 at Lawrence, Douglas County (Tordoff, Condor, 53, 1951:261). Flocks of up to 50 individuals became common by the end of November; they remained common until the middle of April, 1951. A few small flocks of five to ten birds still were in Lawrence at least as late as May 15.

I collected a total of 40 crossbills one mile east of Lawrence, on dates ranging from November 1 to April 15. Of these, 34 (25 males and 9 females) were preserved as study skins. Although this paper is not primarily of a taxonomic nature, certain nomenclatural matters are pertinent. The material studied included four subspecies as follows:

Loxia curvirostra sikkensis.—One male, wing 79.4 mm., depth of bill 8.7 mm., November 1 (Tordoff, *loc. cit.*); one female, wing 78, depth of bill 8.3, March 8. One other male, wing 84, depth of bill 8.8, taken on January 15, is intermediate between *sikkensis* and *L. c. bendirei*.

Loxia curvirostra bendirei and *L. c. benti*.—It is impossible to assign trinomials accurately to every specimen in a collection of vagrant crossbills which includes these intergrading subspecies. Griscom's monograph (Proc. Boston Soc. Nat. Hist., 41, 1937:77-210) of the Red Crossbill illustrates the difficulties involved in identifying vagrant specimens. Griscom (p. 129), in his original description of *benti*, gives a wing length of 93.0-98 mm. for males. On page 139, in a table of measurements of adult males, the range in wing length of specimens identified by him as *benti* is 91-100 mm. The latter range probably includes intergrades with other races. For *bendirei*, Griscom lists wing lengths of 86.5 to 94 mm. No other dimensions give any more clear-cut separation. Color is useful for most examples, but intergradation and individual variation in color rule out the feasibility of identifying all vagrant specimens to subspecies on this basis. Griscom, however, pointed out that his study, although based on large series, suffered from a lack of specimens known to be breeding birds.

In the present series, at least two males from Lawrence are characteristic of *bendirei* in both size and color. The majority of the series of 34 skins are clearly referable to *benti*, but several are more or less intermediate between the two subspecies just named. In the remarks below, except where otherwise noted, I refer to *benti*-like birds.

Loxia curvirostra stricklandi.—By Griscom's criteria, two males, taken on December 27 and January 15, approach this subspecies. Both are deep red in color and measure, respectively, wing 95 and 98, culmen 19.3 and 20.9, depth of bill 11.5 and 11.7. They might equally well be called *L. c. grinnelli*. *L. c. stricklandi* has been reported but once for Kansas; *grinnelli* has never been reported from the state.

COLOR OF FIRST-WINTER MALE PLUMAGE

The extensive literature on crossbills in eastern North America and the Old World indicates that ordinarily the first-winter males are less red than the older males. These first-winter males are described usually as resembling the females, but with green and red interspersed in the plumage. Mottled males and those of an orangish cast are frequently called immatures. I have no evidence as to the validity of this interpretation as applied to the plumages of male crossbills in eastern North America and the Old World. In birds of western North American races (at least in *benti*), however, as shown by the series at hand, the body plumage of immature males is not less red than in adult males.

In many of the specimens which I collected in November and December, 1950, the skull was incompletely ossified. By the middle of January, 1951, cranial ossification seemed to be complete in all specimens collected. McCabe and McCabe (Condor, 35, 1933:136) pointed out that the single-layered condition of the roof of the cranium, usually characteristic of immaturity in other passerines, is retained in many adult Red

Crossbills. They caution that "*thinness and transparency*, not singleness [of the roof of the braincase], are the criteria" that should be used to determine age in Red Crossbills. My determinations of age, as based on condition of the skull, are corroborated by characteristics of plumage also useful in age determination. These characteristics concern the color of the edgings of certain flight feathers not replaced in the postjuvinal molt. New World authors usually have neglected these plumage characteristics, even though Witherby, *et al.* (The handbook of British birds, 1, 1938:97) pointed out that first-winter males differ from adults in that the "*Wing- and tail-feathers are fringed greenish instead of pinkish*" in the young birds. Furthermore, the unworn primary coverts in young males are buffy-tipped. The present series shows that a few of the tail feathers frequently are replaced in the postjuvinal molt, but this does not affect the problem of age determination.

All the males which I judged to be young on the basis of both cranial ossification and edging of the flight feathers are fully as red as are birds judged to be adult on the same basis. The brightest bird of the entire series of 25 males is a first-winter bird. In the 40 other males of western races (mostly *benti*) in the University of Kansas Museum, there seems to be no significant difference in color of body plumage between first-winter males and adults. On the basis of the edging of the flight feathers, some mottled males are judged to be young birds and others adults.

It seems, therefore, that the first-winter male plumage of *L. c. benti*, and perhaps that of other western subspecies, differs markedly in color from the corresponding plumage of eastern North American and Old World subspecies. More conclusive proof would be furnished by specimens in postjuvinal molt in which all the incoming feathers were red. I have seen no specimens of *benti* in the postjuvinal molt.

AGE VARIATION IN SIZE

Griscom (*op. cit.*:138) stated that he used measurements of only "*fully adult* males . . . excluding all specimens in any way immature." Since Griscom may have been unaware that the western races (*benti*, at least) differ from the eastern races in first-winter plumage, he may have inadvertently included young birds in his measurements of "*fully adult* males" of the western subspecies. I decided to test the series of *benti* at hand to ascertain whether the young males differ significantly from the adults in wing length, tail length, length of culmen, and depth of bill at base. The series taken in 1950-51 contained nine adult males and 11 immature males. However, in the series from Lawrence identified by Griscom as *benti*, I found 11 adults to only six immatures. Furthermore, my series showed the adults to average larger than the young in all measurements, but in the series identified by Griscom, the adults average actually smaller than the immatures. Among the specimens from Lawrence identified by Griscom as *bendirei*, I found eight immature males to only three adults, and again the immatures average larger than the adults. I see no significant differences in color between the last two series. The conclusion that Griscom identified two age classes as two subspecies seems inescapable. His "*benti*" series seems to include adult males of *benti* (most likely, on the basis of color, from Colorado) and large immatures, possibly intergrades between *benti* and *stricklandi* (presumably from the southern Rocky Mountains). Griscom's series of "*bendirei*" seems to be made up of immatures of *benti* (probably from Colorado) and a few adult males of *bendirei*.

In order to eliminate as much sample bias as possible, all specimens of the present series, except those clearly referable to either *sitkensis* or *stricklandi*, were utilized in the statistical treatment of the material. Therefore, the measurements below pertain mainly to *benti*, but those of a few adults are more as in *bendirei*.

Wing length (chord), see also figure 1.—Immatures, mean (M) with standard error, 91.4 ± 0.5 ; standard deviation (S.D.), 2.4; 25 individuals. Adults, M, 93.2 ± 0.5 ; S.D., 2.5; 24 individuals.

Tail length.—Immatures, M, 53.6 ± 0.4 ; S.D., 1.9; 25 individuals. Adults, M, 54.0 ± 0.5 ; S.D., 2.5; 24 individuals.

Length of culmen.—Immatures, M, 18.3 ± 0.2 ; S.D., 0.9; 25 individuals. Adults, M, 18.7 ± 0.2 ; S.D., 0.8; 24 individuals.

Depth of bill.—Immatures, M, 10.3 ± 0.1 ; S.D., 0.4; 23 individuals. Adults, M, 10.5 ± 0.1 ; S.D., 0.4; 21 individuals.

The figures given here would be of no particular significance if they applied only to vagrant specimens. However, the rather considerable difference, especially in wing length and bill measurements, between adult males and first-winter males suggests that

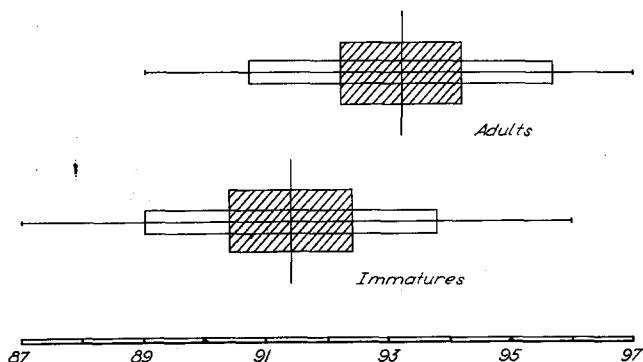


Fig. 1. Comparison of wing length of adult and first-winter Red Crossbills (*Loxia curvirostra benti*). Horizontal line represents observed range; vertical line marks mean; narrow rectangle, one standard deviation each side of mean; shaded rectangle, twice the standard error each side of mean. Scale in millimeters.

refinement of series into these age categories is highly desirable in future systematic work with Red Crossbills. If this refinement were applied to breeding birds, I am confident that subspecies separable mainly by small differences in size would be more easily and clearly defined.

PRENUPTIAL MOLT

In literature that I have examined there is no mention of any prenuptial molt in the Red Crossbill. Thirteen of my series of 34 crossbills were taken on or after February 25, 1951. All 13 show evidence of molt on the head, and especially on the chin and throat. The molt was more extensive in some birds than in others, but its extent points to a definite prenuptial molt, like that of some other members of the Carduelinae. The time of year in which crossbills undergo any given molt cannot be stated with certainty because of the erratic nature of their breeding cycle. Still, it seems inescapable that, because of its limited amount, the molt mentioned above is actually a prenuptial molt. I do not know whether this molt occurs in races other than *benti*.

It is remarkable that the new feathers attained by the prenuptial molt in the males of my series are all grayish- or yellowish-green. As a result, the males taken in March and April can be distinguished from those taken earlier by the interspersation of yellowish-green feathers on the crown and sides of the head and, especially, on the chin and throat of the former. In some males, the entire chin and throat, except in the midline, are grayish- or yellowish-green. Microscopic examination shows that the yellow feathers of the molting specimens are fresh and unworn in contrast to the considerably worn

red feathers on nearby areas of the head. Some other specimens in the University of Kansas collection, taken in Kansas in earlier years, show evidences of a prenuptial molt and replacement, in that molt, of red feathers by yellow feathers. However, most of the crossbills collected in former years were taken too early in the winter to show the molt.

One male taken on March 16, 1951, had suffered a seemingly accidental loss and subsequent replacement of all the feathers on the right side of the crown. At the base of the right side of the bill of this bird there is a large scar from an injury. The pertinent fact here is that all the new feathers on the crown are greenish and unworn in sharp contrast to those of the rest of the crown. As far as I can tell, all crossbills which have molted presumably while in Kansas have replaced the old feathers (red in males) with grayish- or yellowish-green feathers.

Red pigment in cardueline finches is seemingly unstable. The literature contains many records of failure of normally red male carduelines of various species to develop red pigment under abnormal circumstances such as captivity and introduction into different climates. Further, male carduelines, especially crossbills, are highly variable in color under normal conditions.

Most authors have ascribed the failure to develop red pigment in captivity to dietary deficiencies. In eastern Kansas, crossbills feed mainly on ornamental pines of species that are utilized for food by crossbills in areas where those pines occur naturally. *Pinus resinosa*, of the northeastern United States, and *Pinus nigra*, of central Europe, were the species most utilized for food by the crossbills which I collected. Perhaps in their native ranges the pines supply whatever is necessary for red pigment formation.

An alternative explanation may lie in the physiology of the crossbills themselves. Possibly the formation of red pigment depends in part on hormonal balance at the time of molt. The failure to develop red pigment at the time of the prenuptial molt is possibly due to hormonal imbalance. If male crossbills in prenuptial molt taken in many geographic areas all show developmental failure of red pigment, the latter possibility would seem the more likely.

SUMMARY

Red Crossbills taken in winter in northeastern Kansas in the 1950-51 invasion represent four subspecies, *Loxia curvirostra sitkensis*, *L. c. bendirei*, *L. c. benti*, and *L. c. stricklandi*. Of these, *L. c. benti* was most numerous.

First-winter birds can be distinguished from adults (up to an undetermined age) by the degree of ossification of the skull, although certain peculiarities of crossbills in this connection must be recognized.

The color of the edging of certain flight feathers not replaced in the postjuvinal molt also serves to separate young males from adults.

First-winter male plumage in *L. c. benti* (and perhaps other western subspecies) differs from the corresponding plumage of eastern North American and Old World subspecies in that in *L. c. benti* the color of the first-winter body plumage is fully as red as in the adult males.

Age variation in size in Red Crossbills is of sufficient magnitude to make necessary the determination of age of specimens in samples used for taxonomic purposes.

L. c. benti, and possibly other subspecies, has a distinct, although limited, prenuptial molt involving the chin, throat, and, to a lesser degree, the rest of the head.

In northeastern Kansas, the feathers attained in the prenuptial molt lack red pigment in the males. Two possible explanations of this developmental failure of red pigment are mentioned.

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