

PLUMAGES, MOLT, AND RACIAL STATUS OF RED CROSSBILLS IN NORTHERN IDAHO

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Several questions of identity of subspecies and of plumage stages of Red Crossbills have been raised recently by Tordoff (Condor, 54, 1952:200-203). The Red Crossbill (*Loxia curvirostra*) is notoriously variable and current views regarding its variation are mainly based on the monographic study by Griscom (Proc. Bost. Soc. Nat. Hist., 41, 1937:77-210). Tordoff suggests that Griscom has not described accurately the plumage variation that occurs in this species, or at least the variations of some of the subspecies. I can concur with this view. Tordoff has described the plumages of the subspecies *benti* based on the University of Kansas collection and particularly on a series taken by himself in the winter of 1950-51.

In the same period I collected about 50 specimens in northern Idaho. The University of Idaho collection (65 specimens) differs from that at Kansas in that, although I attempted particularly to secure red males, all plumages are represented, including juveniles molting into the immature plumage. Also the series is made up of breeding crossbills as well as "vagrants." For this reason I feel that a more accurate account of the plumage sequence of this species, or at least the subspecies of Idaho, can be drawn from this collection. For comparative study I have borrowed 17 specimens of *sitkensis* and 11 of *bendirei* from the State Museum of the University of Washington through the courtesy of Mrs. M. Flahaut.

On the basis of his series, Tordoff suggests that some juveniles molt directly into the bright red plumage of the full adult (as suggested by Griscom?, p. 111). He bases the immaturity of these specimens on the incomplete ossification of the skull. He suggests there are three plumages in the male: a juvenal, a mixed yellow to red immature plumage, and an adult red plumage. The immature red plumage is differentiated from that of the fully adult bird by the retention of juvenal tail and wing feathers.

From my series of crossbills it is clear that there are four typical plumages in the male (with rare variants): a striped, juvenal plumage, a mottled orange and yellow plumage (the first immature) which later is replaced by an adult-like red plumage (the second immature), and lastly an adult plumage characterized by reddish or brownish margined tail and wing feathers, wherever noticeable margins occur.

The juvenal plumage is shown by four specimens in our collection, two of which have the bill short and only weakly crossed. This plumage is much like that of juveniles in the genus *Carpodacus*. The skulls of this group range from thin with one lamella to spongy but not of adult thickness. The duration of this plumage is unknown but it probably begins to be molted within a month of leaving the nest. This plumage is represented by specimens taken in June, September and December and indicates the erratic seasonal breeding of this species.

From this plumage there is a gradual transition (postjuvenal molt) into the first immature stage, beginning with a few feathers on the chest and sides of belly and then spreading to the throat, forehead, sides of head, and rump. The molt tends to progress from the head to the rump and from the dorsal side to the belly, the last indications of the juvenal plumage being feathers along the midline of the belly and the tail coverts. The wing is essentially unaffected although a few of the marginal lesser coverts may be shed. Seven male specimens taken in January, April, July, August, and October show transitional plumages from the dark-striped juvenile to the mottled orange-yellow of the first immature. Although some of these specimens have red feathers, all are mottled and fairly consistent in their general tone.

The second immature plumage is red as in the adult but differs in that the greater tail coverts and greater and lesser coverts of the wing have been molted. The primaries, secondaries and rectrices of the juvenile are usually retained as indicated by the greenish or yellow margining of these feathers as contrasted with the reddish or brownish margins of the adult feathers; the tail feathers appear to be more reliable in this regard than the primaries. Juvenal tail feathers can be differentiated from adult feathers usually by being narrower and more pointed. In some of the specimens a few of the primaries and some or all of the tail feathers have been replaced, but this would appear to be due both to accidental losses and exceptional molting: the margins are intermediate in color. It is important that none of the red immatures have juvenal feathers in their dress. All have completely molted the body feathers at least once. For this reason it seems that these individuals have actually molted the body feathers twice, to replace the yellow or orange feathers with the adult red feathers, without replacing the large wing and tail feathers. There are eight specimens in this series taken in April, June, July, August and September. The specimens taken in August and September are molting into the adult plumage, for the inner primaries have been replaced.

There are fourteen fully adult males in my series identified by reddish- or brownish-margined primaries and tail feathers or by obviously completely molted wings and tail if the margins are greenish like the juvenal feathers. The body color is solid, with one exception, although the throat may be yellow and scattered feathers on the top and sides of the head may be yellow. In a few cases some olive-green feathers appear on the neck and shoulders. The yellow and olive feathers that may occur in this plumage appear as the result of feathers replaced in early spring (the prenuptial molt of Tordoff). In one this "prenuptial" molt appears to have been nearly complete, possibly coinciding with the annual molt. The specimen, taken in breeding condition in March, has almost completely molted the wing feathers (a few secondaries and the outer primary remain) and has completely replaced the tail feathers, although one or two of the feathers are short. The tail feathers have greenish margins like those of the juvenile. The body is mottled like that of a second immature. This specimen apparently represents a second immature molting to the adult in the course of becoming reproductively active. Feathers replaced at this time are more immature in coloration than those produced in the annual molt. It is a common idea that fully adult specimens may commonly be mottled in coloration like the immature, but this is definitely not the case; rather, such a pattern represents an uncommon aberration. Tordoff has questioned whether the color of these prenuptial feathers is due to an abnormality of nutrition or to mediation by the endocrine system. I believe it is a matter of endocrine state.

Griscom points out that the shade of red of the adult varies within a race from brick-red to scarlet and that some races, notably *minor* (= *sitkensis*), have a high percentage of xanthochroistic males. There are three adult specimens (1 *sitkensis*, 2 *bendirei*) in my series of an orange (saffron-coppery) color which have both the wing and tail feathers completely replaced and appear to be examples of the xanthochroistic plumage type. The margining of the tail feathers in these specimens is intermediate between that of the juvenile and adult. This plumage is probably genetically determined.

The time involved in the transition of the male from the juvenile to the adult is not known. If we assume that Tordoff's observations on the skull are correct, then the process would take less than six months, for in other passerines the skull reaches adult thickness within a month or two of completion of the postjuvenal molt. It would seem that the transition from the juvenile to the second immature is a more or less continual process, which accounts for the incomplete ossification of the skull at the end of this molting period. Within a month or so after the completion of the second immature plumage the skull reaches the adult thickness, as would be expected.

Apparently the molting of crossbills is as erratic as their behavior and probably it is not until the second year that a complete molt occurs. We have several specimens that indicate a typical complete molt in progress and these were taken in March, July, August, and September. Like other passerines, molting crossbills are quieter and shier than ordinarily and hence are more easily overlooked. Almost all of the juveniles and the first immatures were molting contour feathers when taken, but few of the adults are so involved, except for the replacement of accidentally lost plumes or when they are in the "prenuptial" period. I have yet to see a crossbill molting heavily like other passerines.

The plumage sequence of the Red Crossbill is paralleled to a certain extent by that of the Pine Grosbeak or the Cassin Finch. In these species there is a first winter immature plumage, resembling that of the female. In the case of the Pine Grosbeak the second fall and winter plumage is red as in the adult. In a few instances the tail and wing feathers are not molted. Some specimens appear to molt juvenal tail feathers in late winter or early spring, but these new feathers retain the gray margins of the juvenile in contrast to the red margins of the adult. The first adult plumage of the Pine Grosbeak may show variations suggestive of the second immature and adult plumages of the Red Crossbill.

The plumages of the female Red Crossbill are much simpler. The juvenile molts into a typical female plumage soon after leaving the nest, but the wing and tail feathers are retained as in the male. A second molt is needed to replace the wing and tail feathers. The female plumage is not particularly variable, showing differences in the amount of yellow or orange margining on the breast and forehead, whiteness of the throat and abdomen, and gray or olive in the back. Griscom indicated the more constant coloration of the female of different races but did not utilize this characteristic in his descriptions. The immature or adult female can never be confused with the immature plumages of the male.

That both sexes may breed in the immature plumage is indicated by the condition of the gonads. The development of the testis at different times of the year is of interest. The change in size is relatively slight as compared with other passerines. The resting gonad of the adult is larger than that of the juvenile: about one millimeter in length. That of the breeding male, whether immature or adult, is about six and one-half millimeters long, and is round-ovoid in shape in both cases. Although this represents a large volume increase it is not comparable to that of some of the sparrows, in which species of similar size will have a gonad ten or eleven millimeters in length and of the same shape.

The problem of subspecies cannot be solved as yet. The work of Griscom will need to be repeated and the limits of variation in size and coloration of the different plumages of each race carefully described before we can hope to cope with this highly variable species. Tordoff has indicated that Griscom's identifications have not been sound because age differences have been interpreted as subspecific differences. Tordoff has indicated that in his sample the adults average larger than the immatures. In my series the largest bird is an immature and the mean measurements for these age groups are the same. This series from Idaho raises some questions regarding subspecies not suggested by Tordoff.

I have collected crossbills on twenty-four different occasions, at all times of the year, and from groups ranging in size from a single family to flocks of 20 to 50 individuals. Unfortunately, selective collecting of red males was done, so that truly representative series were taken only on about half of these occasions. Although the sampling was spotty and inconclusive, still I have never taken more than one size of crossbill from a flock. Griscom reports three subspecies in the same flock in the east and mixed flocks as a common thing.

In northern Idaho individual crossbills range in size from a wing length of 80 mm. to one of 96 mm. There is a similar, wide range in variation when other linear measurements or weight are considered. These specimens can be identified as belonging to three subspecies: *sitkensis*, *bendirei* and *benti*. Although all three sizes have been present in the same area and at the same time on the University of Idaho Campus, they have always been encountered in different flocks. For example on April 13, 1951, there were two flocks of crossbills in the University arboretum. One flock contained *sitkensis*, or at least very small dark individuals, and the other flock was made up of the largest type found here. It seems possible that the homogeneity of flocks is due to behavioristic differences between flocks. From their composition—adults, immatures and even juveniles—these flocks appear to represent families that have nested in the same general area. There is probably some exchange between flocks of like behavior and a tendency for individuals to leave flocks of unlike habit and food choice.

Observations on crossbills in Idaho indicate that they occur in flocks, or at least groups in a more or less restricted area, whether the birds are breeding or "vagrant." The species has a positive social attitude at all times. In one case birds appeared to be breeding when they were still associated with a flock. As soon as the young leave the nest the birds of the area draw together and begin to move about. It is well known that isolated single pairs are sometimes encountered, but generally several pairs nest in a circumscribed area.

In the light of the foregoing ideas, the specimens in my series can be separated into three groups which overlap in size and obviously intergrade to a certain extent. The smallest crossbills appear to be *sitkensis* and are probably only vagrants in the area. The other two groups are usually identified as *bendirei* although some individuals of the larger type have been identified as *benti*.

If the specimens that appeared to be about to breed, or that were breeding, or had just finished breeding are arranged according to locality and habitat, they can be divided into the same two groups as before, excluding the small *sitkensis* group which is not known to breed. In the areas predominantly grown to yellow pine there is a light red, large type, some members of which resemble *benti*. Fifteen of the eighteen specimens taken have a wing length of over 90 mm. (mean 92.1). The males tend to be lighter red with more white in the vent region than the smaller *bendirei* type, which is found in the Douglas fir, white pine and lodgepole pine regions at higher elevations. This smaller type is represented by only five, known resident, specimens, the wing length of which is usually less than 90 mm. (mean 88.2). The males of this smaller type are darker, approaching brick red, and the vent patch is smaller and darker. The females of these two groups are indistinguishable except by size.

The extreme in size of the possibly resident individuals is represented by three red males collected in a lodgepole pine area near McCall, west-central Idaho. These individuals are very dark, like *sitkensis*, and range in size between *sitkensis* and *bendirei*. These specimens were taken from a flock of about 30 individuals.

The collection contains no females of *sitkensis* from Idaho, but there are three females with wings 82.5 to 85.4 mm. in length which fall within the size range of that subspecies. They are lighter below and grayer above as compared with the darker, browner and more orangish colored females of *sitkensis*. These small females are similar to the typical females of *bendirei* in coloration and were taken with flocks of, or in company with males of, the smaller type.

The large yellow pine type extends down into southwestern Idaho where individuals of "*benti*" have been reported. These individuals probably represent only extremes of this group, as is indicated by the like identification of similar individuals in northern

Idaho. This same type also occurs in the yellow pine areas of the east slope of the Cascades in Washington, with indications of the smaller, "intergrade" *bendirei* type in higher areas, and *sitkensis* on the coast. The small *bendirei* type appears to be a regular vagrant in the coastal areas.

In summary, four plumages are described for male crossbills belonging to the subspecies *bendirei* and *sitkensis*; the female has only the juvenal and an adult plumage although the wing and tail are not molted until the second year. Females serve readily to separate *sitkensis* from *bendirei* and should be utilized more in the taxonomy of this species. In northern Idaho the race *bendirei* appears to be made up of two ecologically separate but intergrading groups. One group approaches *sitkensis* in habitat selection and appearance and the other approaches *benti* in like manner. Members of this latter group have actually been identified as *benti*; it likewise is possible that some of the former group may be indistinguishable from *sitkensis*.

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