

## HYBRIDIZATION AND INTROGRESSION IN FLICKERS

By Lester L. Short

It is well known that the eastern "Yellow-shafted" Flicker and western "Red-shafted" Flicker groups of the North American Flicker (Colaptes auratus) hybridize massively in the Great Plains and the Northwest (Short, Bull. Amer. Mus. Nat. Hist., 129: 307-428, 1965). The results of their interbreeding is a hybrid zone, variable in width, and occupied entirely by phenotypically diverse hybrids. A further result of this hybrid zone is gene flow, or introgression, from west to east, and vice versa, through the hybrid zone and into the surrounding populations. Evidence of the occurrence of introgression is found in the incidence of characteristics of western flickers ("Red-shafted" Flickers) in eastern birds, and vice versa. Although the incidence of such traits varies from character to character, it is clinal, that is, a gradient occurs such that birds nearest the hybrid zone show the most indications of introgression, those farther away show fewer indications, and those farthest away show the fewest such indications. This cline or gradient thus "points" to the hybrid zone as a primary factor influencing it.

The implications of the flicker hybrid zone and extensive introgression for bird banders are several. The major point is that traits of western Red-shafted Flickers are present in breeding flickers throughout the East (the reverse is true in the West), even along the East Coast. Second, flickers showing such traits are more numerous, and the traits more strongly expressed the farther west one goes (toward the hybrid zone). Finally, it is incorrect to designate these off-colored, introgressant flickers as "hybrids." Such a designation infers that the birds originated in the breeding population of the hybrid zone, implying that they are "out-of-range" wanderers. It is obviously incorrect to suggest by such a designation that a flicker actually hatched in New York State and a part of the flicker population of that state, came from the western hybrid zone. I would report such birds as "introgressant" flickers, but would describe them in detail. A "label" is a convenience, and as we have seen from this discussion, if incorrect it can be very misleading. There is no substitute for careful examination and detailed description of these flicker hybrids--and of all odd birds (readers might be interested in my comments on bird lists and listing in the Linnaean News-Letter, 23 (nos. 8 and 9): 1-2, 1970, and in California Birds, in press.).

How then can "hybrid" flickers be distinguished from "introgressant" flickers? Not every individual can be distinguished. That is, since both

result directly or indirectly (and that is their essential difference) from the same phenomenon, they grade into each other. Strongly introgressant birds resemble hybrids. Such strongly introgressant birds are to be expected more commonly near the hybrid zone, but they occur in lesser numbers far to the east as well. The bander handling migrant flickers in the East can expect to see various introgressant flickers; hybrid flickers may occur, but uncommonly (although they are to be expected more often than are vagrant Red-shafted Flickers from west of the hybrid zone, simply because the hybrid zone is closer and hybrids hence have a shorter distance to "wander" than do Red-shafted Flickers). The bander in the Great Plains and just to the east of there (e.g., in Missouri, Iowa) can expect to handle hybrid flickers and introgressant flickers.

Briefly, hybrid flickers usually show indications of their hybridity in several features, and these indications although variable (from character to character, and bird to bird), are apt to be strongly expressed; introgressant flickers are apt to show lesser indications of introgression in several characters or weak to strong indications in one character. Every flicker exhibiting variation in a pertinent character (see below) should be examined with respect to all such characters. (The reader is referred to various field guides for comparison of the eastern and western flickers, and to my 1965 paper (cited above) for details concerning these characters, as well as an extensive discussion of hybridization and introgression). A flicker showing "hybrid" indications in one character alone should be considered an introgressant, and not a hybrid. On the other hand, a bird showing strong indications of "hybridity" in several characters may be considered a hybrid. I prefer to err in favor of introgressant flickers, knowing from studies of specimens how common these are, rather than to err in designating introgressants as "hybrids"--when in doubt, then, I would call the bird an introgressant.

I am reminded of a striking example of introgression affecting one character. One June some years ago an adult female Flicker in breeding condition was picked up dead in Ithaca, New York. This bird was typical of eastern ("Yellow-shafted") flicker in every respect but one--it had totally "red" shafts (i.e., the under-wing and under-tail surfaces were salmon pink without a trace of yellow or orange). This bird was probably an introgressant flicker (until we know about the genetics of the situation, we cannot disallow other causes in a given instance), but it certainly was not a hybrid!

A brief discussion is in order of the characters, and especially of their value in determining a flicker's status with regard to hybridization and introgression.

Red or orange in the "shafts" is an indication of introgression or hybridization in eastern flickers. As far as we know (see Short, 1965), dietary effects on the carotenoid pigments responsible for red, yellow and orange "shaft" color in flickers can cause "yellowing" or "orangeing" of red shaft color, but not reddening of the feathers. Further studies are needed, but for now I prefer to assign introgression or hybridization as a causal factor for orange or red in the shafts of eastern flickers when the occurrence is symmetrical, i.e., when the same feathers on opposite sides of the flicker's body show orange or red. Orange or red individual feathers which are asymmetrical in occurrence are unexplainable at the moment--however, they ultimately may be related to the effects of interbreeding. Weak to strong expression of orange or red in a few feathers symmetrically, or a weak orange cast throughout are lesser indications of introgression or hybridization than are very orange shafts throughout the under-wing and under-tail surfaces. Nearly one-third of eastern flickers show moderate or strong indications of orange or red shaft color. These may not all be due to introgression and they may vary locally to a considerable degree, although a clinal increase toward the hybrid zone indicates some influence of introgression. Red feathers in the black moustache or malar patch of male eastern flickers usually are suggestive of introgression. Greater numbers of red feathers are a stronger expression of introgression (or hybridization). When only a few feather show red they are detectable only upon careful scrutiny, particularly along the edges of the moustache. About 10 percent of East Coastal male flickers show a significant (more than traces in one feather!) amount of moustachial red coloring.

A red nuchal or nape patch of the eastern flicker is lacking in the western flicker. Further, its genetic control and the operation of natural selection are such that intermediate conditions of the patch (e.g., thin red nuchal, nuchal split in two in center or reduced to two lateral, small patches) occur almost entirely in hybrids, that is within populations in the hybrid zone. Flickers originating east of the hybrid zone so rarely show this intermediacy that birds which do so are inevitably hybrids (one should look for other indications of hybridity). In the fall one must be careful not to interpret birds molting the nuchal feathers as off-colored individuals--the nuchal patch may appear superficially "intermediate."

Definite brown feathering in the crown is an indication of introgression or hybridization in eastern flickers. However, fall eastern flickers have brownish edging on the crown feathers. This edging is gradually lost and the typical gray crown thus results from wear. Banders should examine museum specimens of fall "Red-shafted" Flickers and "Yellow-shafted" Flickers in order to appreciate their resemblances and differences in crown color at that season. Perhaps only the fully intermediate condition is recognizable in fall hybrids or introgressants. About 10 to 15 percent of East Coastal breeding birds show definite traces of brown coloration in crown feathers, mainly as a result of introgression. (Nearly one-third of the birds from just east of the hybrid zone show such traces. One might say that East Coastal birds show no introgression, and ascribe only the effects west of there to introgression, but the doubling of the incidence of brown traces in crown color toward the zone of hybridization indicates considerable introgression affecting even East Coastal populations; hence brown color in crowns of East Coastal birds seems largely ascribable to introgression.)

Throat and ear covert color may be discussed together because the colors involved are similar--however, their genetic control differs somewhat because hybrid indications in the two characters are not strongly correlated. These characters are the most difficult to assess because of several complexities. Gray coloring in the tan feathering of the throat, indicative of introgression, is easily confused by the "frosted" gray-white edging of the throat feathers of fresh plumaged (fall) birds. If allowance is made for this "frosting" effect, the gray mixed with tan in the feathers of hybrids can be appreciated easily. However, there is relatively introgression in this feature in far eastern populations, so that mixed color in the throat region is a good indicator of hybridization and introgression. Only 2 to 4 percent of eastern birds show such indications, although this incidence rises sharply to 27 percent or so within 350 miles of the hybrid zone. Ear covert color is very difficult to treat because many eastern birds normally have gray in the rear edges of the coverts (due to introgression?). Thus, only when gray appears in the central portion of the ear covert area should it be ascribed to introgression or hybridization. I do not recommend the use of this character in estimating the hybrid or introgressant nature of an individual, except that when other characters show such indications it is useful to note the ear covert color as well.

Note that the above discussion refers to adult birds. Birds in juvenal plumage must be evaluated separately, for their characters differ and indications of introgression are more difficult to analyze.

This presentation should indicate the problems, and the care which must be taken in treating "hybrids" or odd-plumaged birds of any sort. I cannot overemphasize the need for detailed written (or tape-recorded) descriptions of such birds--nor can I overemphasize the need for the collecting and depositing in museums of specimens of extraordinarily "odd" birds. I realize that collecting does not appeal to many people--indeed as such it has no appeal to me. However, specimens are scientific documents, available for careful study to many specialists over generations (and means of their appraisal are subject to change). As such, they "feed back" information from which we can infer evolutionary dynamics and relationships, determine some causes (as in feather color analysis, biochemically), and upon which ultimately are based discussions such as that above. Judicious--and of course legal--collecting of "odd" individuals of commoner avian species for these reasons is to be encouraged. As examples of the kinds of information banders have supplied, and studies they have stimulated through appropriate collecting of specimens I cite: 1) the apparent hybrid Blackpoll x Northern Waterthrush, and evaluation of the relationships of warbler relationships and variation by Short and Robbins (*Auk*, 84: 534-543, 1967); and 2) a number of Slate-colored Junco x White-throated Sparrow hybrids, several collected through banding operations, resulting in reappraisal of the relationships of the "genera" Zonotrichia and Junco, and of these species in particular (see Short and Simon, *Condor*, 67: 438-442, 1965; and Short, *Auk*, 86: 84-105, 1969).

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