Canada
Department of Mines
Hon. CHARLES STEWART, Minister
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Victoria Memorial Museum
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Museum Bulletin No. 48

BIOLOGICAL SERIES, No. 13 NOV. 11, 1927

A STUDY OF BUTEO BOREALIS, THE RED-TAILED HAWK, AND ITS VARIETIES IN CANADA

BY

P. A. Taverner

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
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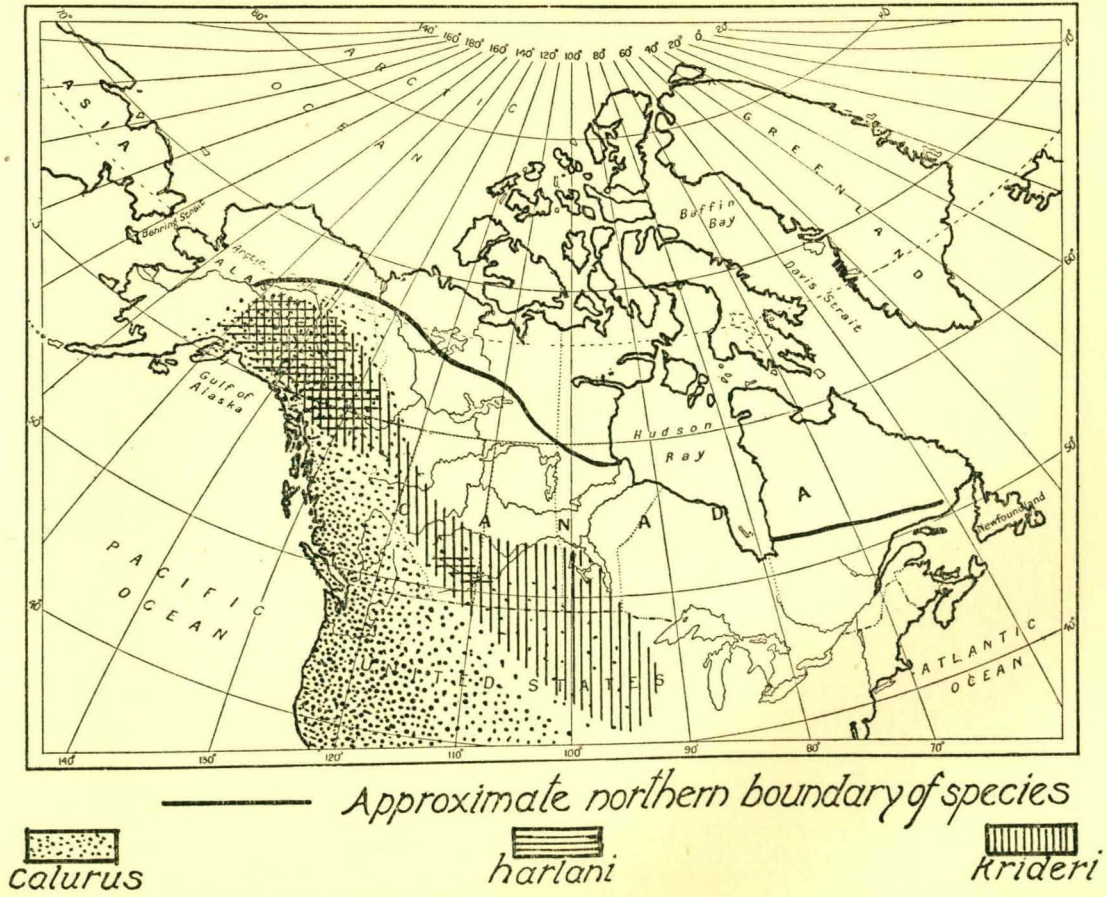

FIGURE 1. Generalized breeding distribution of forms of *Buteo borealis* in Canada.

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Page 5, line 8, "Plate II" should be Plate III.
Page 7, line 13, "Plate III" should be Plate II.

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BIOLOGICAL SERIES No. 13

A STUDY OF BUTEO BOREALIS (GMELIN), THE RED-TAILED HAWK, AND ITS VARIETIES IN CANADA

INTRODUCTION

The exceeding variability of the Red-tailed Hawk has been a source of confusion and misunderstanding to systematic ornithologists. There are few common or generally distributed North American species of birds of which so little is known, or which have received so little critical attention. This has largely been due to lack of material, especially of breeding or summer birds, in collections. Most of the specimens available for examination are migrant or winter birds, that offer no clear explanation of the relationship between the bewildering variety of characters they exhibit. Separation of individual from racial characters by the study of migrant material is practically impossible.

Lately, however, considerable material has become available, and it seems that the time has come when a critical study of the species is advisable. This material consists of a large number of specimens composed mainly of breeding birds, in many cases in original, complete families, collected across the Dominion by the staff of the National Museum of Canada. Through the courtesy of the Museum of Zoology, University of Michigan, and Mr. Walter Koelz, of the same university, a magnificent series was borrowed of migrant and winter specimens taken in North Dakota and Arkansas. Besides these the important collections of Dr. L. B. Bishop and the Museum of Vertebrate Zoology, University of California, have been freely studied. Specimens have also been borrowed from, or examined in, the collections of the American Museum of Natural History, the Provincial Museum of British Columbia, the Philadelphia Academy of Natural Sciences, the Museum of Zoology, University of Oklahoma, Dr. Jonathan Dwight, Major Allan Brooks, Mr. J. H. Fleming, and Mr. J. A. Munro. The writer has also had illuminating correspondence with Mr. H. V. Williams of Grafton, North Dakota, Dr. C. H. Richmond, of the United States National Museum, and Mr. C. G. Harrold, of Winnipeg, Manitoba. To all the above thanks are extended, not only for the courtesies received but in particular for their assistance in bringing together for direct comparison so fine a series, consisting of 157 skins, with the rarer forms in particular abundance, and for detailed notes on half as many more pertinent specimens. Of special value has been the series of breeding birds and their offspring, which has been a key to unlock many difficulties and without which no clear picture of the involved relationships could have been obtained.

BUTEO BOREALIS, RED-TAILED HAWK

The Red-tailed Hawk inhabits North America from the tree limit in the north to northern Mexico. It migrates from the northern regions in winter, but seems to breed throughout its range. In the east it is monochromatic; in the west it is dichromatic, one phase of which is completely melanotic; and through the middle of the continent occur two types of variants, known as Krider's and Harlan's Hawks, which seem largely of sporadic occurrence and without well-marked distribution.

There is no appreciable difference in plumage in the sexes of the species,[1] but in most individuals there is one decided change with age. Juveniles are usually distinct in coloration from adults, but correlation of the juvenile with its proper adult plumage has been largely a matter of intuition, guesswork, or judgment rather than demonstration, and false ideas on the subject are current. A study of the material bearing on the subject shows that there is only one abrupt change of plumage pattern in the life history of the individual after leaving the nest. The juvenile plumage is assumed in the nest and is retained until the next midsummer moult, when the adult plumage is assumed at approximately fifteen months of age. After this there is no appreciable progression of plumages or colour changes year after year, except that due to fading of pigment or wear of feather structure. In a large number of moulting birds we find them in every case either going directly from juvenile into a highly developed adult plumage or changing from an adult plumage to another practically identical with it. There is no indication of the generally assumed continued progression from a less to a more mature type after the adult plumage has been once assumed. This greatly simplifies matters as it leaves two usually distinct sets of plumage to correlate within each race, instead of a multitude of slight progressions. On the other hand, the fact that many age plumages have been assumed to occur indicates the extreme variability of the individuals for which segregation into racial groups has been attempted.

Although in most normal plumages birds of the year are easily distinguished from adults, there are certain phases (melanotic phases, for instance) in which determinations of age by plumage becomes difficult, if not impossible. In general, the tail feathers of juveniles are narrower and more pointed than freshly grown feathers of the adult. However, numerous undoubted adults have the ends of their tail feathers reduced by wear or otherwise to quite juvenile outlines and in some cases it takes nice judgment to decide from this criterion whether particular birds are juvenile or adult. This is particularly true of some forms of *krideri* and introduces an element of doubt when transition material is not available as a check.

There does not seem to be any evidence that the Red-tailed Hawk ever breeds in the juvenile plumage. It probably does not nest until the spring after the adult plumage is obtained, when the bird is about two years old. Nesting birds, therefore, can normally be assumed to be finally adult in plumage.

[1] Dr. L. B. Bishop informs the writer that "Male *krideri* is always paler than the female, and all very fine birds (typical) I have seen were males." This may well be so, but the form is so variable that the writer has not been able to verify the statement beyond question by his own experience.

The species is somewhat variable in size and proportions, but the writer can find no constant difference in measurement to correlate with the various races.

The species is at present considered in the A.O.U. Check-list, and by most present-day authors, to be composed of the following subspecies:

Buteo borealis borealis (Gmelin), Eastern Red-tail
Buteo borealis calurus (Cassin), Western Red-tail
Buteo borealis krideri Hoopes, Krider's Hawk
Buteo borealis harlani (Audubon), Harlan's Hawk
Buteo borealis alascensis Grinnell, Alaska Red-tail

BUTEO BOREALIS BOREALIS, EASTERN RED-TAIL

Single-phased. Adult—upper parts rich, dark brown; lower surface white to cream, with more or less dark, streaked flanks, broken abdominal band, and in some cases dark throat; tail brick red, usually with black, subterminal band (Plate II, figure 5).

The principal characteristic of this, the type form of the species, in comparison with the other races, is its constancy, there being only a single phase over most of its range and comparatively little individual variation. Some birds are more creamy than others or even slightly rufous below, and some are without the subterminal black tail band (Plate I, figure 1), but there is not the great variation of colour that is so notable in the western forms. Contrary to commonly accepted opinion, highest plumaged adults in many cases show perceptible purplish reflections on the back.

The adult always has a red, unbarred tail (Plate I, figures 1, 2). Juveniles always have dark brownish or blackish tails with black bars (Plate I, figure 3); occasionally with a faint admixture of reddish. The back is brownish black (blacker than in adult) with more or less concealed white feather edges, bases, and spots. Below is largely white with little suggestion of cream, but with a broken abdominal band of blackish brown and flank patches of similar colour.

BUTEO BOREALIS CALURUS, WESTERN RED-TAIL

Double-phased, with all intergrades between the two extremes. Dark phase—practically blackish brown, sometimes with reddish or chestnut suffusion on breast. Tail of adult brick red, usually with 10 to 12 sharp black bands. Juvenile form is not certainly known, but is assumed to be as most juveniles of the other forms, blackish with black bars (Plate I, figure 8). Light phase—like *B. b. borealis*, but with decided tendencies towards rufous and brown below, considerable barring on flanks, abdomen, and flags. Tail red, black barred. Juvenile like juvenile of *borealis*, but more heavily coloured below.

The Western Red-tail shows a most remarkable range of colour. It was originally described from an almost solidly black bird with red, black-barred tail (Plate III, figure 1). This melanotic type intergrades perfectly with typical *borealis*. *Calurus* has three distinctive characters in the adult, any one or more of which may be absent: general blackness or melanism, chestnut or reddish areas on breast and elsewhere, and black bars across a red tail. Any one of these characters when present in pronounced degree is sufficient to designate *calurus* with reasonable certainty.

Melanism is not linked with age, as is shown by a brood of half-feathered nestlings in our collections Nos. 10455-57, from near Red Deer, Alberta, July 4, 1917, which is going directly from the natal-down into an unmistakable melanotic plumage.

Juvenile *calurus* in the light phase are not always strikingly different from juvenile *borealis*. The most distinctive character of this plumage is a considerable mixture of red in the greyish-brown background of the tail (Plate I, figure 7). This red, however, seems largely evanescent, for although it is very common in birds just leaving the nest it is rarer in fully grown, self-supporting birds, and probably fades quickly, as does the cream and ochreish washes of the white parts of the very young.

Many associations of *calurus*, however, include birds of strong *borealis* appearance. The last *calurus* character to persist is the crossbarring on flags and tail. These bars are occasionally faint or incomplete in *calurus*, but are still rarer in pure *borealis* strains. It is likely that birds occur in the heart of the range of their respective subspecies, that cannot be identified by anything except the probabilities of geography.

BUTEO BOREALIS KRIDERI, KRIDER'S HAWK

Single phased (*See* footnote, previous). Like *borealis*, but with large and in many cases striking extension of white below, above, and on head and tail. It is largely black and white, with little or no cream or rufous in any plumage except when just leaving the nest.

This subspecies is something of a puzzle. It was first described from a juvenile bird (Plate II, figure 1). As it seems even more confusingly variable than *calurus* and few specimens of known parentage or in changing plumage have been studied, the progression of plumage with age has been assumed rather than demonstrated. Most of the other forms of the species are essentially alike during juvenility, but juvenile *krideri* seem as variable as the adults and it is yet uncertain just what are the adult forms of many young types of *krideri*. The distinctive character of *krideri* in any age is the large amount of white. In extreme cases the head, face, neck, and all below may be pure immaculate white. There may be much white on the scapular tips and the wing coverts, and the tail may be white with or without dark bars either broken or entire (Plate I, figures 9-15; Plate II, figures 1, 2, 3, 6). There is every combination of these characters with those of *borealis*, *calurus*, or *harlani* (Plate II, figure 3; Plate III, figure 6).

The white tail seems to be the most persistent *krideri* character and many specimens appear to be straight *borealis* or *calurus* with strongly marked *krideri* tails (Plate II, figure 3). On the other hand occasional specimens occur in which the body is strongly *krideri*, whereas the tails are straight *harlani* (Plate III, figure 6). It thus seems that the white *krideri* tail is dominant relative to *borealis* and *calurus*, but recessive to *harlani*. As in other races of *B. borealis* many juvenile *krideri*, identified by their parents, carry little or no distinctive subspecific characters of their own.

BUTEO BOREALIS HARLANI, HARLAN'S HAWK

This hawk is nearly as puzzling as Krider's and from the same cause. It, too, was originally described from a juvenile (Plate III, figure 8) and the application of the name to the adult has been assumed, but not heretofore demonstrated. *Harlani* occurs in two phases, a completely melanotic one and a white-breasted form very similar to the normal *borealis* juvenile. The adult is characterized by a tail freckled, marbled, or mottled with shades of black, white, grey, or red in various proportions (Plate I, figures 16-22; Plate II, figures 3, 6)—in fact no two seem ever to be exactly alike, but the peculiar design of pattern and the tendency to form longitudinal aggregations of specklings are characteristic.

Juveniles of *harlani* have the same dark, black-barred tail (Plate I, figure 22; Plate III, figures 4, 8) that is normal to *borealis* and *calurus* (Plate I, figures 3, 7, 8) and which occurs more or less frequently in *krideri* (Plate I, figures 12, 14, 15). Such birds may be impossible to recognize as *harlani* by any test now known.

This irregularly mottled or marbled tail seems to be the only constant criterion of adult *harlani*. At all ages *harlani* tend to be a purer black (less brown) than the melanos of *calurus*, but this is not constant and several specimens have been examined in which the black is distinctly brown. The writer has never seen one with decided reddish areas on breast or elsewhere except the tail (Plate I, figure 21); but suggestions of red breast occur in some specimens (*vide*, Koelz specimen, Pea Ridge, Arkansas, Feb. 8, 1925), and in view of the extraordinary variability of the species he would hesitate to say that it never occurs in stronger degree.

Many young birds as they leave the nest have considerable ochre or rusty ochre feather edges on breast, underparts, flags, and elsewhere to a lesser degree. Most of this appears to be lost by fading and wear soon after leaving the nest and by the time the birds are able to fend for themselves it is very largely reduced to pure white. As in other forms of the species, this white usually spreads from the breast, where it may show as a few semi-concealed streaks and it may extend until it merges the melanotic into the light phase (Plate III, figures 3, 6). The white of the back is also more or less variable. There is a general tendency toward light or white crossbarring on back and wing coverts that may be either concealed or exposed. In many of the darker birds these show only as slight, indefinite grey spots like pale thumb-marks over the upper surface of the body. Others are distinctly if unevenly white spotted, in extreme cases even approaching the general appearance of *krideri* (Plate III, figure 6).

BUTEO BOREALIS ALASCENSIS, ALASKA RED-TAIL

Of general *calurus* character (light phase), but of small size and with richer and darker colours.

The writer has examined the cotypes of this form in the Museum of Vertebrate Zoology, but saw no new character nor any new association of characters in them. Two adults seem like ordinary small-sized *calurus* with red tails, one narrowly but decidedly barred, the other practically unbarred. One juvenile is of normal light phase, the other is partly melanotic. These birds have the darks blacker and richer than specimens from more arid regions; but this is true of many of the northwestern mem-

bers of the species, is not confined to them, and may occur throughout the more northern ranges, where a moister air and milder sun are less conducive to desiccation and fading. As for size, equally small birds can be obtained almost anywhere in the range of *Buteo borealis*. The points of distinction, therefore, seem too fine and inconstant to be dignified with subspecific recognition.

GENERAL DISCUSSION

All these forms, *borealis*, *calurus*, *krideri*, and *harlani*, so distinct from each other when typical, intergrade with each other in occasional specimens. Could well-defined, distinct distributions be ascribed to them, each would have to be acknowledged as good subspecies. Tracing the distribution of these forms, however, is particularly difficult. Very few of the published records of the several forms can be accepted without confirmation of specimens, as the general and often the technical public has had hazy or inaccurate ideas as to their distinctive characters. Such specimens as are in collections are mostly migrant or winter birds and useless for defining nesting ranges.

Oologists have collected eggs of the species assiduously and should be in a good position to define the breeding range, but they who have been in a most favourable position to advance distributional ornithology have too often wasted their opportunities and have followed where they should have led. Instead of correcting current error they have largely been content to rubber-stamp the pronouncements of existing authorities and have in many cases perpetuated error instead of correcting it. Owing to the dearth of breeding material in collections and the above-mentioned uncertainty in published records, it has been necessary to rely largely upon the specimens in the National Museum of Canada in deciding racial characters and distributions. These specimens almost alone consist of any large proportion of breeding or moulting birds or of juveniles of demonstrable parentage. This series, although fairly complete for Canada, unfortunately does not represent more southern localities and an element of doubt exists, therefore, in statements referring to south of the International Boundary.

The Red-tailed Hawk of eastern Canada, as far west at least as the Manitoba boundary, is typical *B. b. borealis*, though rarely, on migration dates in southern Ontario, specimens are found with *krideri* or *calurus* tendencies more or less pronounced. These may well be disregarded as erratic or stragglers.

Throughout the southern parts of the provinces of Manitoba, Saskatchewan, and Alberta the predominant bird seems to be *borealis*, usually with a slight tendency towards *calurus*, with numerous intrusives of *krideri* and occasional *harlani* specimens. The *calurine* tendency generally shows itself in the partial (sometimes complete) barring of the tail and flags, but melanotic or erythrismic birds or those with any marked tendency towards it are decidedly scarce in summer. They occur during migration and may possibly nest in the wooded country to the north. Dark birds have been reported there, but with other melanotic hawks (as *swainsoni* or even *Archibuteo*) as probabilities the evidence is not conclusive. That melanotic birds do occur in at least parts of the prairie region is evidenced

by three specimens in our collections (the nestlings mentioned before from near Red Deer, Alberta), which are assuming a practically complete dark plumage. It is notable that four supposedly breeding birds collected near Belvedere, 60 miles northwest of Edmonton, on the edge of the northern spruce forest, are almost pure *borealis* and that no marked *calurus* characters have been noted in the summer birds of that neighbourhood, even by Mr. A. D. Henderson, who has had long experience with the raptores of that locality.

Along the southern edge of these prairie provinces many specimens of distinct *krideri* type occur with the predominating *borealis*. There are nesting *krideri* with the young belonging to them, from Oak Lake, Manitoba (Plate II, figures 6, 7), and from various points along Red Deer river below Red Deer, Alberta (Plate I, figure 15; Plate III, figures 3, 4). A juvenile in the collection of Mr. Hoyes Lloyd, taken from a family group with the parents still in attendance in Riding mountains, Manitoba, is also strongly *krideri*. *Harlani* is common during a short period in spring and autumn, through Manitoba, where it has been noted in numbers and collected by Hamilton M. Laing and C. G. Harrold. Autumn flights are also reported by H. V. Williams (1926) at Grafton, North Dakota. At Belvedere, Alberta, H. M. Laing and C. G. Harrold noted considerable numbers passing over during September, 1926. We have juvenile specimens, that may be this form, taken at similar dates at and between these various stations.

In British Columbia well-marked *calurus* predominates. The normal bird there runs consistently darker than breeding prairie specimens, with heavy abdominal bands and much rusty red in the light parts (Plate II, figure 8, is typical). The tail is usually decidedly banded in the adult, and melanotic specimens are comparatively common. Mixed with these are occasional birds of stronger *borealis* type, but the writer has never seen any from there whose identity was very doubtful. These heavily marked birds extend northward an unknown distance into the Yukon.

Near the northern boundary of British Columbia a strange and complicated condition exists. In the neighbourhood of the Alaska, Yukon, and British Columbia boundary intersection *calurus*, *krideri*, and *harlani* are inextricably intermixed, breeding together and throwing both pure and mixed strains. At Atlin lake, Brooks and Swarth took eight *harlani*, of which one juvenile is accompanied by a parent. The other parent was seen and its general characters noted, but it was not taken. These birds vary between complete melanism and a condition rather whiter in body than Plate III, figure 3 (Swarth, 1926).

Of the Red-tails of this region, Allan Brooks (1927) writes: "The ordinary type of Red-tail (pale-coloured *calurus*) was seen by me in the heart of the breeding range of '*harlani*' at least seven times. In fact I suspect that a pair of typical red-tailed birds were breeding only a few miles from our quarters at Atlin."

No. 2664, Wilson creek, Atlin, June 19, 1914, an adult *calurus*, is in the Provincial Museum, Victoria, B.C. This bird is described in detail by Mr. Swarth (loc. cit.). It is fully melanotic, but with light-barred tail (Plate I, figure 23). In the L. B. Bishop collection there is also a *calurus* (4349, Lower Laberge, Yukon river, July 17, 1899) almost duplicating Plate III, figure 2.

The most enlightening series of birds from this neighbourhood, however, is that taken by Hamilton M. Laing, Chitina glacier, Mount Logan area, Alaska, near the southern point of the Alaska-Yukon boundary. It consists of a complete family, both parents and three nearly fledged young. Three other specimens, an adult and two juveniles, are normal melanotic birds, the adult completely so with tail similar to Plate I, figure 20. One of the juveniles shows a faint suggestion of white breast patch, and the other has the same character well marked. The male of the family is in full melanotic phase, but is a well marked *calurus* with red, black-barred tail (Plate III, figure 2). The female is about half-way between melanotic and light phases, with tail characteristically *harlani* (Plate III, figure 3). It is notable that the amount of white on the head of this partial melano is sufficient to suggest *krideri*. The three young show an interesting range of coloration. They are all melanotic. The darkest one is very black indeed, with tail so dark that the banding is almost obliterated (Plate III, figure 4). The lightest is freely feather-edged, especially on breast, with rufous-ochre (Plate III, figure 5). Its tail is shown in Plate I, figure 22. These juveniles differ in no significant degree from any other specimens of supposedly pure *harlani* and present no suggestion of hybrid origin.

To complicate matters birds of distinct *krideri* type appear in the same region. The above-mentioned female (Plate III, figure 3), shows decided leanings that way. We have a specimen, 6573, Teslin lake, Yukon territory (on the British Columbia boundary), Sept. 3, 1912, a juvenile, in body practically identical with that shown in Plate II, figure 2. Its tail is shown in Plate I, figure 12. This may be a migrant like the "apparently *krideri*" near Gladys lake, Sept. 7, reported by Swarth (1926, page 110), but at this far extension of the specific range the distinction between migrant and resident birds loses much of its value, especially as the same author (1922, page 212) describes what seems like a good *krideri* breeding at Flood glacier, well to the south, and Bailey (1916) records a winter juvenile *krideri* taken at Eagle, Alaska, well to the north. It is thus quite evident that these three forms, *harlani*, *calurus*, and *krideri* occur together, not at some central point where distinct distributions might be expected to meet but near the periphery of specific distribution, where isolation and specialization should be greatest and in the heart of what we should expect to be the range of pure *harlani*. If the latter is not racially pure here it seems hopeless to look for racial purity in it anywhere.

Although this far northwestern area and the Red Deer River region of Alberta[1] have so far produced the only substantiated breeding records of *Buteo borealis harlani*, it has been taken in migration over a considerable area. As before remarked, Laing has noted strong migrations of melanotic Red-tails, many of which were satisfactorily identified as *harlani*, in September at Belvedere, Alberta. Harrold has seen similar flights and taken specimens spring and autumn at Whitewater lake, Manitoba, and H. V Williams (1926) reports late September and October movements of *harlani* and melanotic *calurus*. The writer has seen a number of winter *harlani* in the Bishop collection from Hamilton, Kansas, and others in the Koelz

[1] Dr. L. B. Bishop informs the writer " . . . . I collected a fine old male *krideri* in worn breeding plumage, but with a fresh *harlani* tail, near Rolla, Rolette county, North Dakota, July 24, 1901, some 20 miles south of the International Boundary . . . . " This adds a considerable extension to the possible breeding range of birds with *harlani* characters.

collection from Pea Ridge, Arkansas. Swarth distinctly states that they do not migrate down through California, with which, after a careful examination of the Red-tail series in the Museum of Vertebrate Zoology, the writer agrees. It, therefore, seems safe to say that Harlan's Hawk breeds in northern British Columbia, southern Yukon territory, and adjacent parts of north Alaska, perhaps irregularly south to southeastern Alberta or even Dakota, migrates across the Canadian prairies to the Mississippi valley, and winters in the area between Arkansas and Missouri rivers. It is probably a small race numerically, with a narrow migrational route, and of local residential distribution.

CONCLUSIONS

A summary of the foregoing distribution indicates that the Red-tailed Hawk of eastern Canada is pure *borealis*, a bird of practically constant character. The prairie provinces are inhabited by birds that are predominantly *borealis*, but with *calurus* features, more or less common intrusion of *krideri*, and at least a sporadic influence of *harlani* towards the west. Southern British Columbia is inhabited by practically pure *calurus*, and the far northwest, at least centring about the British Columbia-Yukon-Alaska boundary intersection, contains birds that are predominantly *harlani*, but with strong intermixtures of *calurus* and *krideri*.

Borealis has an extreme eastern distribution and *calurus* an extreme western one and they are the only forms that occur anywhere practically free from other strains. *Krideri* occurs along the western boundary of the *borealis* range and *harlani* at the northern extent of *calurus* territory, neither having any centre of distribution where they occur in purity. The conclusion seems obvious, that whereas *borealis* and *calurus* are good subspecies in the modern acceptation of the term, *krideri* and *harlani* are only colour phases, the former of *borealis*, the latter of *calurus*.

The suggestion of geographic distribution exhibited by both *krideri* and *harlani*, especially the latter, does not necessarily deny the conclusion in regard to polychromatism. Nowhere do they appear in pure strain and we find similar local single-phased communities in acknowledged dichromatic species, of which the Screech Owl and Grey Squirrel are outstanding examples. The geographic separation of dark and light-phased Swainson's Hawk is also a case in point. The black phase of this species is far more common to the north of the prairies than near the International Boundary and Major Brooks tells the writer that the black Swainson is characteristically a bird of the higher elevations in British Columbia, as the light one is of the valleys. The writer views *harlani*, in similar but more strongly marked case, as a local chromatic form of *calurus*, whereas *krideri* represents a dichromatism limited to the western representative of *borealis*, but transmitted to *calurus* at the northern extension of the latter's range.

There remains a nomenclatural difficulty regarding *Buteo harlani* Audubon (*Buteo borealis harlani* of the Check-list). *Harlani* is based on Plate LXXXVI, of Birds of America (folio) 1830, with which the description, vol. I, page 40 (octavo), agrees perfectly. Incidentally the writer has also examined the original drawing for this plate in the Natural History Society of New York to interpret the intention of the author and correct the slight

variations exhibited by different copies of the hand-coloured plates. The specimen there described and figured is undoubtedly a juvenile Red-tailed Hawk in melanotic plumage, but whether it would develop at its next moult into a freckled-tailed bird such as we have here called *harlani* or a bird with a barred, red tail like *calurus* there is absolutely no means of telling. The geographical probability of the locality is *calurus* as much as *harlani* and there is no evidence against the former in either plate or description. Audubon was certainly mistaken in believing that these birds had bred at Francisville, Louisiana, as he states.

The original specimens seem to have disappeared and are not available for examination. Even if they were, it is a question whether they could be certainly identified in this plumage. Audubon says that he deposited the female of the pair illustrated in the British Museum, and in the "Catalogue of Birds" of that institution, vol. I, page 191, a specimen is attributed to him and described as his type. Comparison of this description with that of Audubon and the plate, however, makes it evident that different birds and plumages are dealt with in the two cases. Audubon's birds have dark, barred tails, the British Museum one has a freckled tail. If Audubon ever saw this extraordinary, freckled-tailed adult, it is remarkable that he should have left no record of it. There has certainly been some mistake or accident in the history of this British Museum specimen and, with Audubon's lack of reference to the adult of this form, more proof than is evident is necessary to connect him with it.

It thus appears that Audubon, in 1830, named a juvenile black-phased Red-tail "*harlani*." In 1855, Cassin named another black-phased Red-tail "*Calurus*," and there is no evidence except later usage to show that they were not one and the same race; they probably were. The bird as drawn by Audubon is distinctly brown rather than black and the Western Red-tail seems the more likely occurrence in Louisiana where the specimen was collected. Therefore, *harlani* has either to be abandoned as a *nomen nudem* or else retained and given priority over *calurus* as the name of the Western Red-tail. The first case would cause little or no nomenclatural confusion, but does not seem to be justified, especially if, as here advocated, the two black-phased Red-tails be united in a single subspecies. Unfortunately, it seems necessary to sink *calurus* into synonomy and to apply the name *harlani* to the bird that has carried it so long. That this will confuse an enormous amount of literature is regrettable, but unavoidable if we follow the facts of the case as here presented and the established rules of nomenclature.

The species should then appear in the Check-list as follows:

Buteo borealis (Gmelin) Red-tailed Hawk, as defined in 1910 Check-list

Buteo borealis borealis (Gmelin) Eastern Red-tail, including *B. b. borealis* and *B. b. krideri* of Check-list

Buteo borealis harlani (Audubon) Western Red-tail, including *B. b. harlani* and *B. b. calurus*

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Records and remarks on Krider's, Harlan's, and Western Red-tails.

Plate I

Central Tail Feathers

Showing common variations in the principal subspecies of *Buteo borealis*

Buteo borealis borealis

Figure 1. 5652 ♂ad. Detroit, Michigan, January 20, 1908.
A rather richly coloured bird, tail without subterminal band.

Figure 2. 14725 ♂ad. London, Ontario, January 9, 1892.
Not quite as warmly coloured a bird as preceding, but with suggestions of purplish reflections in blacks of back. Tail with usual subterminal band.

Figure 3. 17323 ♀jv. Near Bathurst, New Brunswick, August 25, 1921.
The common juvenile type. There is very little variation in the juveniles of this race.

Buteo borealis calurus

Figure 4. Hoyes Lloyd collection. ♂? Armstrong, British Columbia, 1892.
Completely melanotic, but with strongly red underparts and flags. Like Plate II, figure 8, but throat brown and the red below extending to undertail coverts.

Figure 5. 54845 Univ. of Mich. ♀ad. Grafton, North Dakota, October 14, 1923.
Melanotic, like type of *calurus* (Plate III, figure 1), but with broad, decided red breast-band. The right outertail feather departs widely from the rest. It looks as if the pattern and colour of figure 23 were superimposed on figure 17 with the subterminal band broken into *harlani* mottling.

Figure 6. Walter Koelz collection. ♀ad. Bentonville, Arkansas, Dec. 20, 1924.
Melanotic. Body close to type of *calurus*, but slightly redder on breast.

Figure 7. 10518 sex? nestling. Near Drumheller, Alberta, July 13, 1917.
Light phase. Body like that of pure *borealis*, except for more heavily marked flags. This amount of red in the tail at this age is unusual in *borealis* and even in *calurus* seems rather evanescent, usually fading within a few weeks after leaving the nest to a dull greyish brown.

Figure 8. 3267 ♂jv. Skagit river, British Columbia, August 3, 1905.
Light phase, but body rather heavily banded with dark across abdomen and throat.

Buteo borealis krideri

Figure 9. 37635 (L. B. Bishop collection). ♂ad. Hamilton, Kansas, Dec. 2, 1924.
Body like a juvenile *borealis*, but with a noticeable admixture of white on crown, nape, lower back, and wing coverts.

Figure 10. 10503 (Acad. Nat. Sci., Phila.) ad?. Mississippi.
Lower breast and abdomen almost clear white, flanks slightly and faintly barred.

Figure 11. 26382 (Acad. Nat. Sci., Phila.) sex?, ad?. Winnebago county, Iowa, August 30, 1879.
Back almost half white, crown more than half white, and only a few dark shaft streaks and incipient bars on flanks.

Figure 12. 6573 ♀jv. Teslin lake, Yukon territory, September 3, 1912.
In body almost exactly like Plate II, figure 2.

Figure 13. 47154 (Univ. of Mich.). Clay county, Iowa, September 25, 1914.
Flanks and abdomen with dark streaks and drops almost as in normal *borealis*, but head and neck three-quarters white, and much white on back.

Figure 14. 16727 ♂nestling, three-quarters grown. Oak lake, Manitoba, July 8, 1921.
Body figured Plate II, figure 7. A *borealis*-looking bird identified as *krideri* by accompanying parent, also figured on same plate. Note red in tail.

Figure 15. 10485 sex? nestling, three-quarters grown. Near Nevis, Alberta, July 9, 1917.
Body figured Plate II, figure 4, almost identical with preceding and identified as *krideri* by accompanying parent, also figured. This parent is almost normal *borealis*, but with strongly marked *krideri* tail. Note lack of red in tail.

Buteo borealis harlani

Figure 16. 20521 (Jonathan Dwight collection) sex? ad. Portage la Prairie, Manitoba, April 14, 1899.
Melanotic. Body nearly entirely black, but breast and throat about one-third white. Very little white on crown, nape, or face and none on scapular edges. Back lightly flecked with white.

Figure 17. 55569 (Univ. of Mich.). ♂ad. Grafton, North Dakota, November 17, 1925.
Melanotic. Black deep, with little brownish. Throat and lower breast with considerable white. Undertail coverts and flags barred with ochreous rust.

Figure 18. 20628 ♀ad. Grafton, North Dakota, May 1, 1916.
Similar to preceding, but black browner, and less white on throat and breast.

Figure 19. Walter Koelz collection. ♂ad. Pea Ridge, Arkansas, December 3, 1925.
Almost solidly dark, rich brown. A few white feathers on lower breast and a broken chin-spot.

Figure 20. 19826 ♀ad. Whitewater lake, Manitoba, April 2, 1925.
An almost complete melano. A small, broken, white patch on breast and a few semi-concealed white streaks on throat.

Figure 21. 20629 ♀ad. Grafton, North Dakota, October 28, 1924.
Light phase. Much white below and considerable on crown, nape, and back. More white than Plate III, figure 3, body much like ordinary juvenile *borealis*.

Figure 22. 20394 ♂nestling. Chitina River glacier, Alaska, near mount Logan, July 19, 1925.
In full black phase, but with much ochreish feather streaks and edges on breast, flags, and elsewhere. Figured with parents, Plate III, figure 5.

Figure 23. 2664 (Provincial Museum, Victoria, British Columbia), ♀ad. Wilson creek, Atlin, British Columbia, June 9, 1914.
All deep, rich brown rather than black. Pale thumb-marks on wings. Slight, semi-concealed white streaks on nape. A few light flecks on breast and abdomen, those on breast tending towards ochre. An interesting bird, fully adult, as incoming tail feathers show the same pattern as the old ones. It has been identified by various good authorities as *calurus*, *harlani*, and even *B. swainsoni*. There is another almost exactly similar bird in the Koelz collection ♂, Bentonville, Arkansas, December 13, 1914, with the black extreme even for *harlani*, comparable to Plate III, figure 4, in this particular. The outer tail feathers of this Arkansas bird show strong *harlani* mottling. Note also final remarks under figure 5 of this plate.

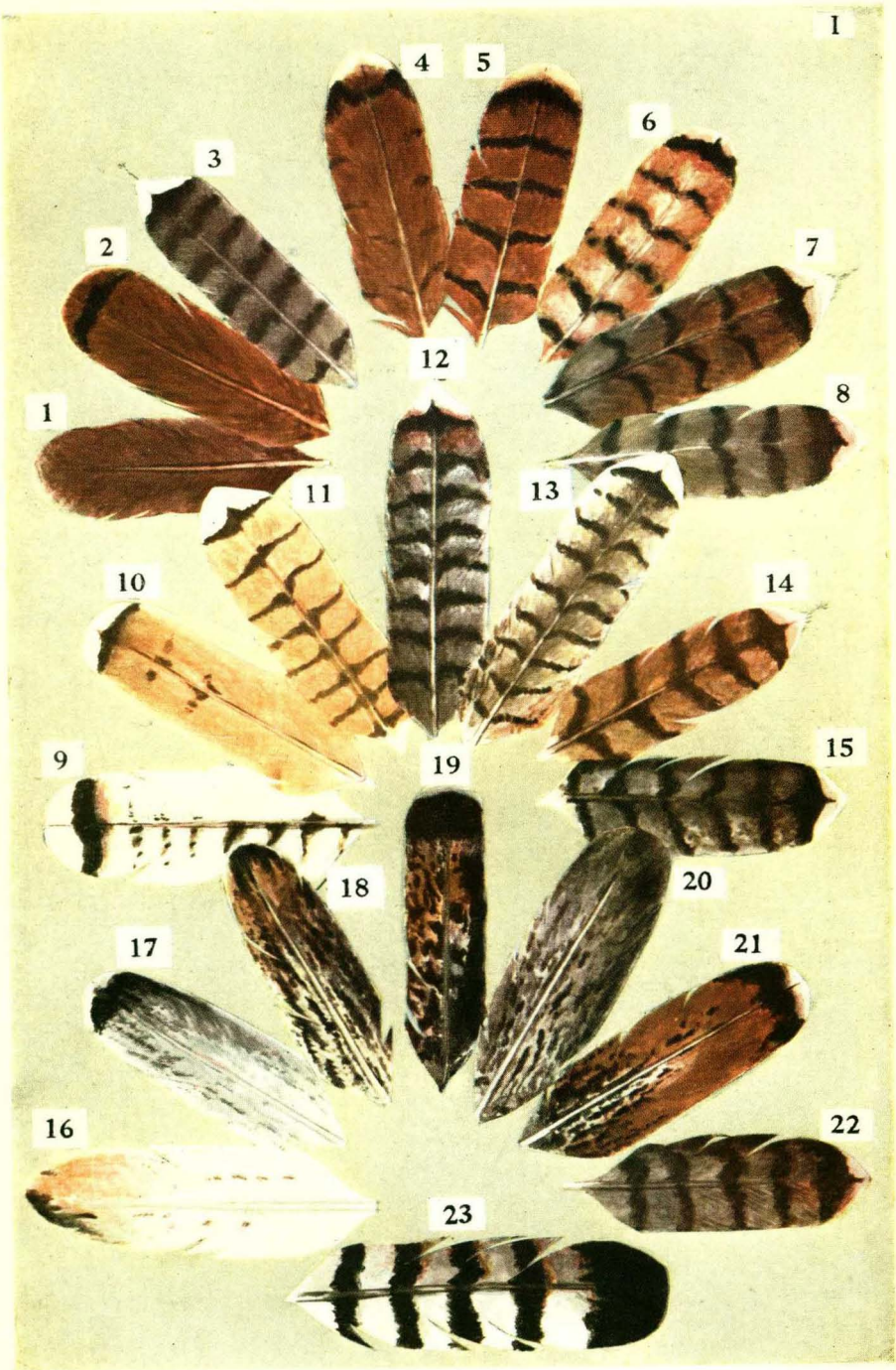
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PLATE II

BUTEO BOREALIS KRIDERI

and

BUTEO BOREALIS CALURUS

Diagrammatic representations showing characteristic body and tail colorations

Figure 1. 1493 (Acad. Nat. Sci., Phila.) ♂ jv. Winnebago county, Iowa, September, 1872.
Type of *Buteo krideri* Hoopes. Though this bird is exceptionally white it is obviously juvenile.

Figure 2. 20614 ♂ jv. Innisfree, Alberta, September 26, 1925.
A well-marked *krideri* of same general type as above. It is obviously juvenile, still having down adherent to the tip of the tail. Note the decided tendency toward *harlani* pattern near base of tail.

Figure 3. 10484 ♀ ad. Near Nevis, Alberta, July 9, 1917.
Body that of normal *borealis*, hardly distinguishable from figure 5, but with characteristic white tail of *krideri*. Parent of next specimen.

Figure 4. 10485 ♂ jv. nestling. Near Nevis, Alberta, July 9, 1917.
Offspring of preceding. Note large amount of creamy white on head.

Figure 5. 10454 ♀ ad. Near Red Deer, Alberta, July 4, 1917.
A normal *borealis*, in body indistinguishable from figure 3, but with tail entirely different. The offspring of this specimen (No. 10453) only differs from figure 4 in having a little red in tail—about half-way between tail of figure 4 and that of figure 7.

Figure 6. 16728 ♀ ad. Oak lake, Manitoba, July 8, 1921.
A rather light-coloured *borealis* with very white breast, and faint flank patches, but well-marked *krideri* tail. Note newly grown pin feather, suggesting the amount of fading to be expected in a season's wear. Parent of following specimen.

Figure 7. 16727 ♂ jv. nestling. Oak lake, Manitoba, July 8, 1921.
Offspring of preceding, showing strong *krideri* body characters.

Figure 8. 14112 ♂ ad. Tow hill, Graham island, Queen Charlotte islands, British Columbia, August 7, 1919.
A dark, reddish *calurus*, typical of a type common in British Columbia, especially towards the coast, but which does not seem to be found on the prairies in breeding season.

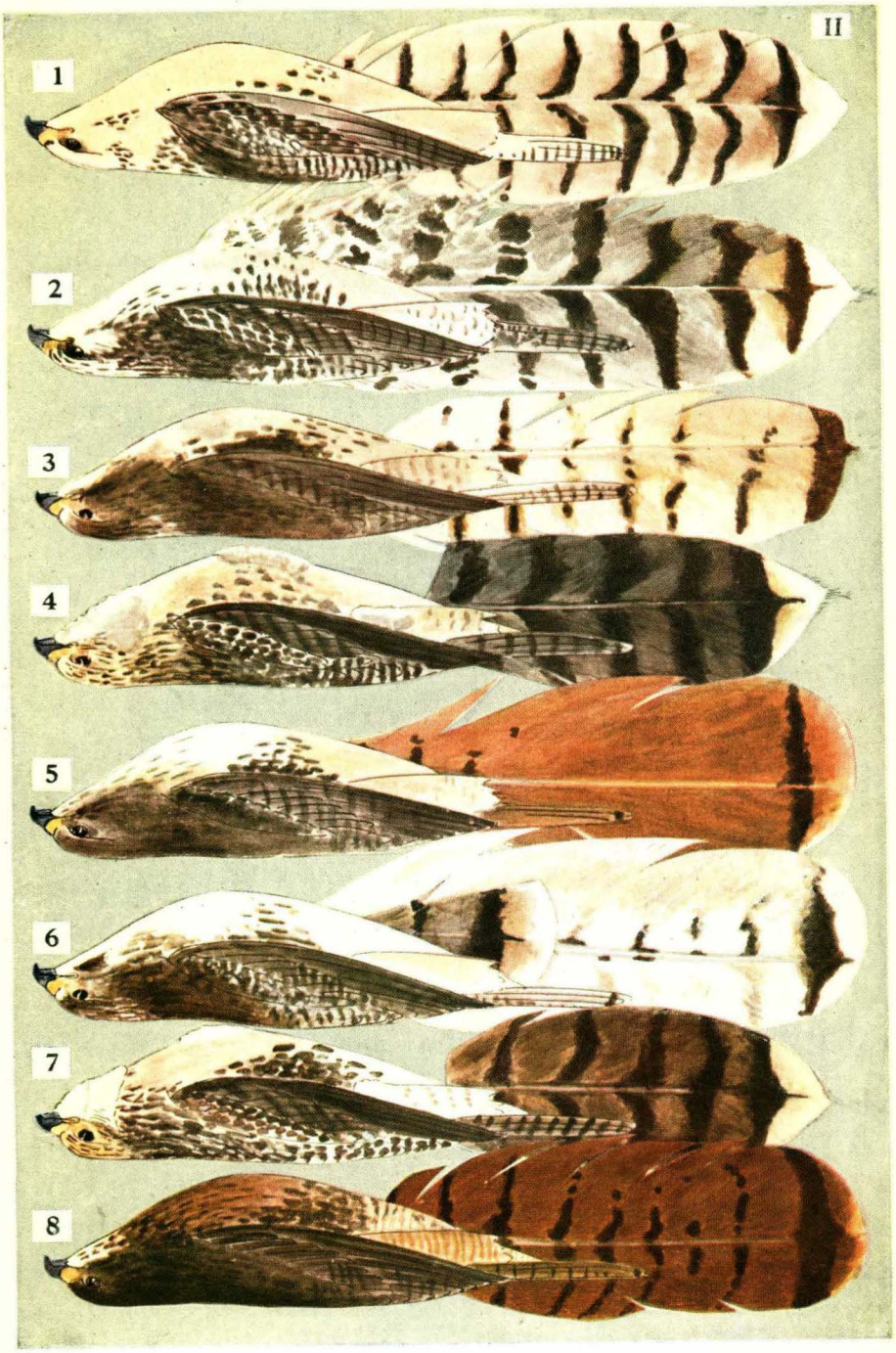
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Plate III

Buteo borealis calurus
and
Buteo borealis harlani

Diagrammatic representation showing characteristic body and tail colorations

Figure 1. Sex? ad. From Plate XIV, U.S.P.R.R. Exp. and Surveys, vol. X.
Approximate type of *Buteo calurus* Cassin. One of the two specimens of this supposed new species known at the time to the describer. It agrees closely with the original description and may be the type. It was taken either near Fort Webster, New Mexico, date not given, or at Petaluma, California, April 25, 1856.

Figure 2. 20395 ♂ad. Chitina River glacier, Alaska, Mount Logan area, July 20, 1925.
The mate of the next and parent of the two succeeding specimens. This is an almost typical black-phased *calurus*.

Figure 3. 20382 ♀ad. Chitina River glacier, Alaska, Mount Logan area, July 14, 1925.
The mate of the preceding and parent of the two succeeding specimens. A typical *harlani* in light phase. The amount of white on head suggests an approach towards *krideri*.

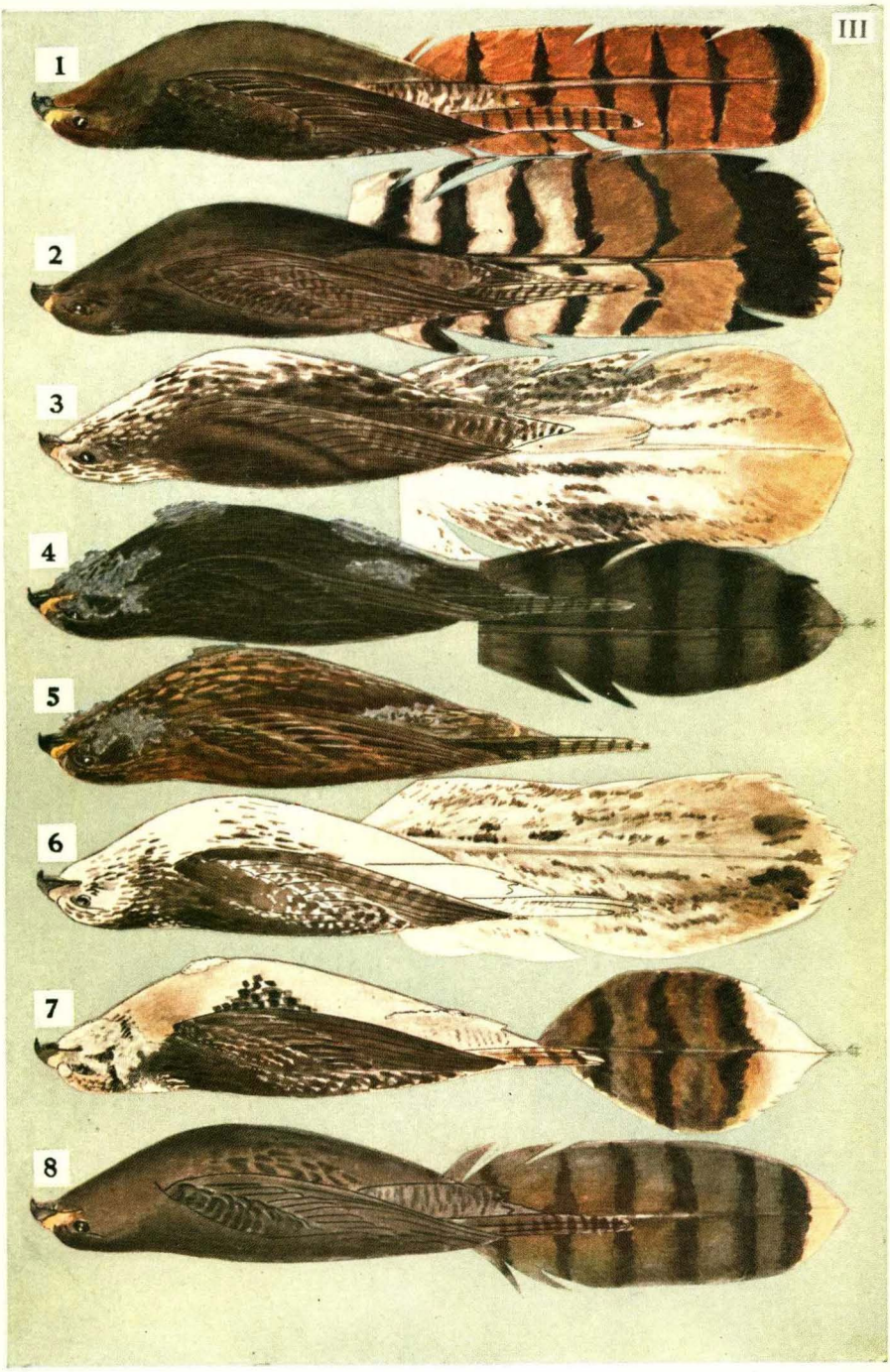
Figure 4. 20393 ♀jv. nestling. Chitina River glacier, Alaska, Mount Logan area, July 19, 1925.
Offspring of two preceding and nest sister to the following specimen. The blackest and most completely melanotic of the brood of three. Note that the brown is almost black.

Figure 5. 20394 ♂jv. nestling. Chitina River glacier, Alaska, Mount Logan area, July 19, 1925.
Offspring of figures 2 and 3 and nest brother to preceding specimen. The lightest and brokenly melanotic of brood of three. The tail is essentially like that of preceding, but with a suggestion of red bordering the subterminal band. Note that the black is distinctly brownish.

Figure 6. 19690 ♀ad. Red Deer river, near Nevis, Alberta, June 29, 1925.
Parent of next specimen. The body of this bird is strongly *krideri*, the tail is typical *harlani*. This is the most southern substantiated breeding record for *harlani* influence.

Figure 7. 19691 sex? jv. nestling. Red Deer river, near Nevis, Alberta, June 29, 1925.
Offspring of preceding. Rather light in general colour, but not certainly distinguishable from many *borealis* of same age.

Figure 8. ♂ or ♀ jv. Near St. Francisville, Louisiana, autumn, 1829. The type of *Buteo harlani* Audubon. Drawn from Plate LXXXIV, "Birds of America," and corrected from notes made from the original drawing in the New York Historical Society collections in New York. Note that the bird is not certainly identifiable as between juvenile *harlani* and *calurus* in black phase.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