

AC, and therefore the resultant air current velocity would be much greater than in the case of the straight downward wing beat. Since with the forward downward wing beat the air would slip under the front edge of the wing with greater velocity it would also come off the back edge with greater velocity. So the downward horizontal and velocity components would be proportionately increased, and hence the lift upward and thrust forward would be increased.

This explains why the forward downward wing stroke is so much more effective than the straight downward wing stroke, and hence is the wing motion usually employed in flapping flight.

GREENWOOD FARM, KANSAS, ILLINOIS.

HARLAN'S HAWK*

BY NORMAN A. WOOD

Harlan's Hawk (*Buteo borealis harlani* (Audubon)) has interested me for many years past, but more so since I received my first specimen, taken May 1, 1916, in northeastern North Dakota by H. V. Williams, who has since that time sent me fifty more from the Red River Valley. From a small area in northwestern Arkansas I have added eighty more, and seven others from different states, or 137 in all. The last mentioned eighty-seven of these birds are all from the winter home of the species, and thirty birds have reached me in the flesh. These I have weighed and measured, and have made photographs of a few, showing the "peculiar" and "characteristic" markings of this fine bird.

Several years ago I noticed the plate of Harlan's Hawk by Audubon, and compared the figures with his description in the Ornithological Biography, 1831, pp. 442 and 443. He described an adult male (Birds of America, Pl. 86, Fig. 1) as having the tail "rather narrowly barred with brownish black." None of our adult birds have barred tails, so I agree with Taverner¹ that this bird was an immature one, probably a redtail. Audubon does not describe the adult female (Fig. 2 on same plate) but says that it resembles the male and measures twenty-two inches, which is about the same as twenty-two females measured by me in the flesh. I have examined Plate 86 carefully and find neither male nor female in adult plumage. I believe both are melanistic redtails. Both have the tails barred and both are entirely without white spots. Certainly neither one is the type as described by Sharpe. (In the British Catalogue of Birds, Vol. 1, 1874, p. 191).

*Read at the Detroit meeting, 1931, of the American Ornithologists' Union.

¹Bulletin 48, Victoria Memorial Museum, p. 10. Ottawa, 1927.



FIG. 18. An adult male melanistic Red-tailed Hawk from northwestern Arkansas. January 14, 1929.



FIG. 19. An adult male melanistic Red-tailed Hawk from northwestern Arkansas. January 14, 1929. This is the under surface of the specimen shown above (Fig. 18).

No sex is given, but by the measurements and description it is a female Harlan's Hawk (not Fig. 2, as painted by Audubon, however). This type specimen described by Sharpe is very like several in our collection. Mr. J. H. Fleming has written me that he has examined this type in the British Museum, and that it is no doubt a (so-called) Harlan's Hawk.

We must therefore accept Taverner's theory of a mistake or accident in the history of the British specimen, but I, for one, can not accept his theory that *harlani* and *calurus* are the same. He regards *harlani* as a melanistic redtail. Now, in our Museum collection we have twenty birds in this phase of plumage ranging from pure brownish black to a mixture of reddish black, but all have no white in the plumage except at base of feathers on head and nape (Fig. 18 and 19), while *harlani* has white spots both above and below, often from bill to feet (Fig. 20). In melanistic redtails, the adult birds have the red (more or less) barred tail, while adult Harlan's Hawks have the tail streaked and spotted (Fig. 21), never red barred. Immature Harlan's Hawks with barred tails have usually the same black and white spotted plumage (Fig. 22), in strong contrast to the brownish black of immature redtails. Ridgway (Ornithology of Illinois, 1889, pp. 469-471) gives the best description of Harlan's Hawk I have found, both light and dark phases. Of the tails of immature birds he says, "The black bars are wider and decidedly zigzag and oblique."² An immature female taken January 25, 1931, in northwestern Arkansas, has two new outside rectrices on one side and three on the other, while the balance are barred with the wavy or U-shaped black bars characteristic of immature Harlan's Hawks (Fig. 23). There are others also in the collection that show this change of tail coloration from immature to adult. In handling these birds in the flesh I noticed a great difference in the markings of the under side of the wings. Harlan's Hawks are more extensively mottled and streaked than redtails. This is also true of the axillaries, which in *harlani* are blackish, while in redtails they are brown (Fig. 24). Figure 25 is a Western Red-tailed Hawk. Figure 26 is a typical adult male of *harlani* taken in northwestern Arkansas on February 26, 1929.

²Ridgway says, "Plumage of flanks, tibia, and crissum remarkably lengthened and lax, the latter reaching within two inches of the tip of tail, and the tibial plumes reaching to the base of the toes."

I find these characters very constant in most of our specimens.



FIG. 20. An adult male Harlan's Hawk taken in southwestern Missouri, January 22, 1929. Ventral aspect.

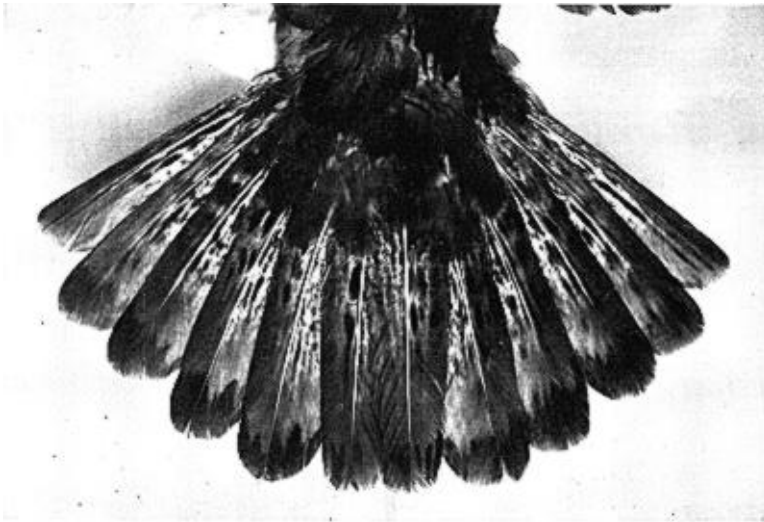


FIG. 21. Upper surface of the tail of an adult male Harlan's Hawk, taken in northwestern Arkansas, January 1, 1929.

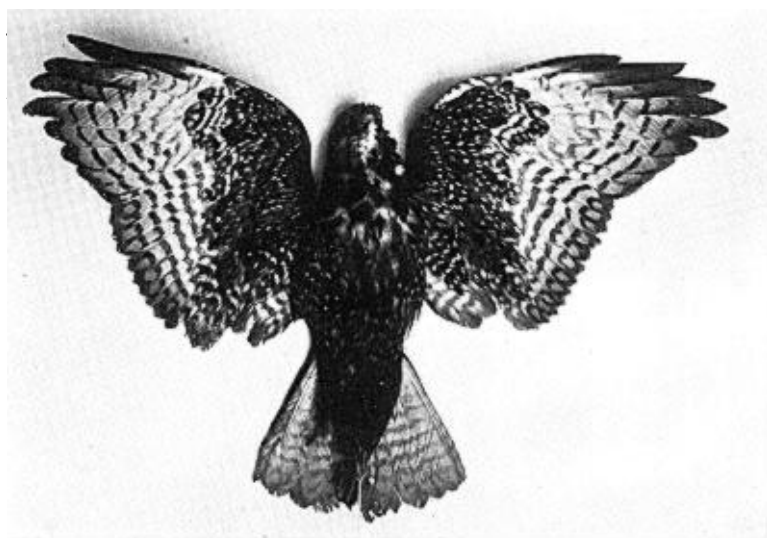


FIG. 22. Immature female Harlan's Hawk taken in Benton County, Arkansas, January 18, 1929. Ventral aspect.

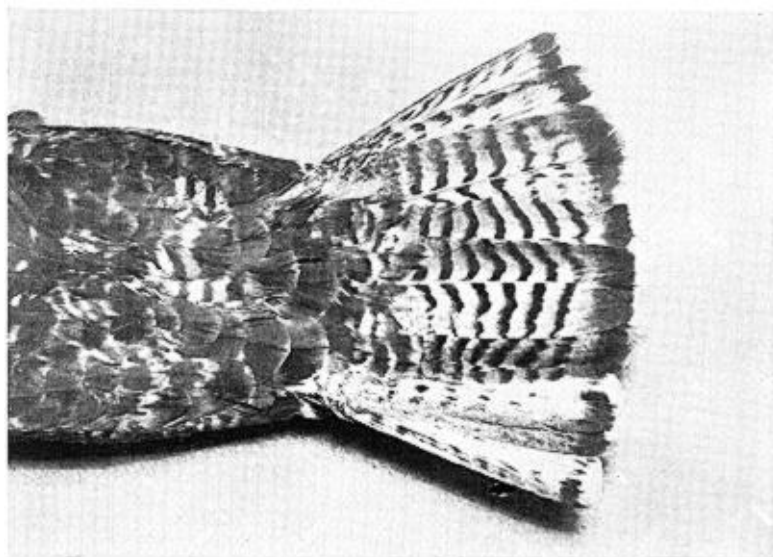


FIG. 23. Upper surface of the tail of an immature female Harlan's Hawk taken at Pea Ridge, Arkansas, January 25, 1931.

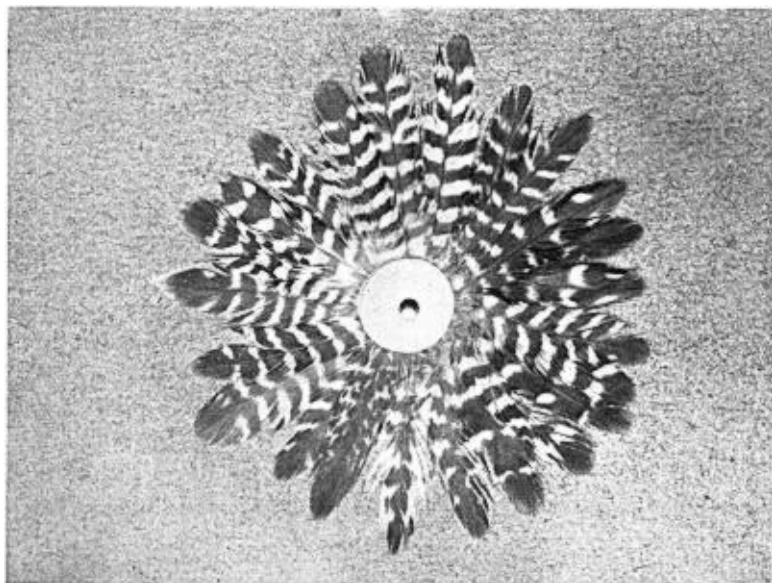


FIG. 24. Axillaries of Harlan's Hawk.

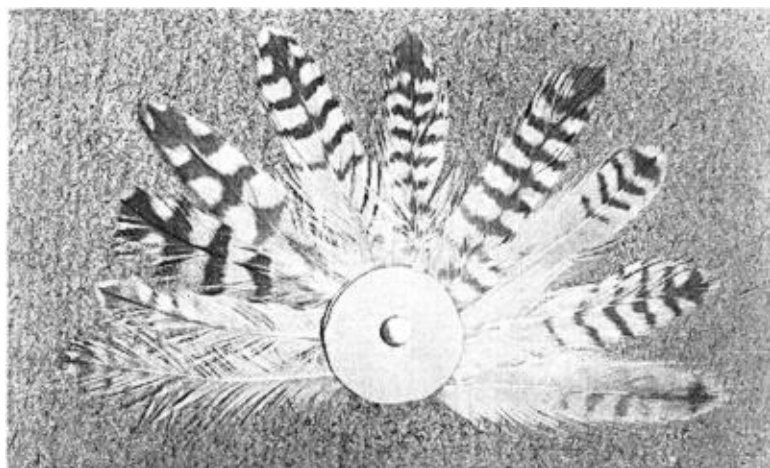


FIG. 25. Axillaries of the Western Red-tailed Hawk.

TABLE I. COMPARATIVE WEIGHTS AND MEASUREMENTS

	<i>Harlani</i>		<i>Borealis</i>		Differ- ence
	No.spec.	Lbs.	No.spec.	Lbs.	
Average weight of female hawks	10	3.25	7	2.75	8 oz.
Average weight of male hawks	17	2.25	11	2.00	4 oz.
		Inches		Inches	
Average length female hawks	10	22.50	7	22.00	.5 in.
Average length male hawks	14	20.75	5	20.50	.25 in.
Average length female wings	36	16.25	61	15.75	.5 in.
Average length male wings	28	15.50	29	14.75	.75 in.
Average length female tails	37	9.75	61	9.00	.75 in.
Average length male tails	48	9.25	29	9.00	.25 in.
Average length female tarsus	30	3.38	49	3.42	.04 in.
Average length male tarsus	60	3.37	57	3.45	.08 in.

The measurements of length are all from birds in the flesh, all from birds taken in winter quarters, and all from birds in good condition—some of them being fat. Harlan's Hawk is somewhat larger and heavier than the redtail.

Harlan's Hawk has a light phase; at least, we have seven in our collection that have much the same pattern of coloration as some red-tails, but the markings are black and the tails of all adults (6) are mottled and streaked, in fact typical *harlani* in that respect. Ridgway (Birds of Illinois, 1889, p. 469) describes this phase, and Taverner (*Op. cit.*, Pl. III, Fig. 6) shows a typical photograph of this phase. Figure 8 of his same plate is drawn from Audubon's plate of the "Black Warrior or Harlan's", as described. As I have mentioned before, this bird is a pure immature melanistic redtail. Prof. G. Eifrig (WILSON BULLETIN, Vol. XL, No. 4, 1928, pp. 216-218) has an article "On the Status of Harlan's Hawk". He gives several reasons for the belief that Harlan's Hawk is a distinct subspecies. However, his reasons were based on a very small number of specimens, and some of them will not hold. He says, first, there is much more white in the plumage of Harlan's Hawk than in the redtail. Yes, this is one of its chief characters. Second, he says there is no brown on breast and belly in *harlani*; this does not hold for all specimens. Third, he says there is an utter lack of barring on the tibial feathers in *harlani*. In fact in nearly all of Harlan's Hawks the tibia is spotted or barred, often with reddish brown. Fourth, he says the tail of *harlani* is decidedly different from that of *calurus*. This I believe is the chief distinguishing character. In adult of Harlan's Hawk the tail is spotted and streaked, but never red-banded. However, there is quite a variation in the color of the tail, more even than in the body color.

Its winter range includes a territory embracing all of Arkansas, southern Missouri, Oklahoma, and northern Texas, according to Mr.

D. R. Gipple, one of our collectors, who says, "I trap these birds on the ground, using opossum and rabbit for bait, and I see an average of from five to seven a day from the last of October to the middle of April. They seem to feed mostly on rabbits and quail and more or less on the smaller birds of all kinds." Mr. Clyde Day, our other collector, says, "These hawks seem to make their winter quarters in a strip about 100 miles north and south and 300 miles east and west. I see on an average ten a day, half of them Harlan's." Both men say



FIG. 26. Adult male Harlan's Hawk taken in northwestern Arkansas, February 26, 1929. Ventral aspect.

they have never seen a Harlan's Hawk nesting in that region, but many redtails nest there. Mr. H. V. Williams, of Grafton, northeastern North Dakota, who has collected in that region for many years, says he has never seen Harlan's Hawk except during their migration north in April and May (dates April 3 to May 6), and the migration south in September, October, and November (dates, September 28 to November 20). He says, "They are a decidedly larger and heavier bird (very noticeable in the flesh) and the general markings are different." Mr. Williams has collected fifty or more of these birds and is in a position to know them well. He says the flight usually starts with a few stragglers, and gradually increases to its height (about 200 birds

for a day or so), then gradually decreases. He says, "I see usually from 700 to 1000 every spring and fall. They fly with the redtails and circle the same way, usually very high, but after the first few days a number of them stop to feed, but are very shy and wild." We have a specimen from Cherry County, northern Nebraska, November 12, 1925; and a specimen from Hamilton, in southeastern Kansas, November 22, 1924.

Swarth³ says, "Breeds in extreme northern British Columbia, east of the coast ranges, north into the valley of the Yukon, and eastward for an undetermined distance, migrates southward east of the Rocky Mountains, through the Mississippi Valley, to a winter home in the Gulf states." In fact its normal winter range is well to the north of the gulf region. There are few records east of the Mississippi River. On April 12, 1893, Mr. Albert Lano collected a female near Madison, Minnesota, near the Red River (*Auk*, XIII, p. 342). Robert Ridgway records "a fine adult male of this rare species. It was taken by Mr. Chas. K. Worthen near Warsaw, Hancock County, in March, 1879," (*Ornithology of Illinois*, Part I, p. 472). F. Woodruff records "one shot near Calumet Lake, Chicago, October 1, 1895," (*Birds of the Chicago Area*, 1907, p. 95). In "Birds of Indiana", A. M. Butler, in the Report of the State Geologist for 1897, p. 784, says, "accidental visitor. Mr. R. B. Williams, Lebanon, Indiana, has a fine specimen of this hawk, shot in September, 1887, in Boone County, Indiana. This is the first record of the black hawk from Indiana. The well-known Indian chief, Black Hawk, was probably named after this bird." Taverner quotes Dr. L. B. Bishop, who says, "I collected a fine old male *krideri*? in worn breeding plumage, but with a fresh *harlani* tail, near Rolla, North Dakota, July 24, 1901." This might possibly have been a breeding bird, as this is only twenty miles south of the U. S. boundary line. Swarth, 1926, p. 108, says, "I cannot find, though, that there are definite published accounts of the breeding of *harlani* in any region whatever." He overlooked the account of Charles R. Keyes in *The Warbler*, Vol. III, 1907, pp. 41-45, who described the breeding of Harlan's Hawk in Iowa County, Iowa, near Amana. A pair of the birds nested in the same woods for five years in succession, and the first set of eggs was taken April 21, 1898; then Set No. 2 on April 24, 1899; Set No. 3, April 9, 1900; Set No. 4, March 29, 1901; and Set No. 5 on April 10, 1902, from the same tree and nest as Set No. 1. Photographs of three of the sets accompany this paper. Three of

³Report on a collection of birds and mammals from the Atlin region, northern British Columbia. Univ. Calif. Publ. Zool., Vol. 30, No. 4, 1926, pp. 51-162.

these sets were in the John Lewis Childs collection. He says the nests were placed from thirty to thirty-two feet above ground, and "it will be seen from the above that the nidification of Harlan's Hawk differs quite naturally from the typical instances of the Red-tailed Hawk, the nest being placed at so low an elevation and without the commanding view . . . the latter species prefers. The eggs, too, are readily distinguishable from a typical series of Red-tails." Later one of these hawks was shot at the nest and was identified by Mr. Brown as "Harlan's Hawk in the melanistic phase of plumage." This is the most southern locality from which this species has been recorded as breeding, and while it was possibly Harlan's, it may have been only a melanistic redtail.

Swarth (1926, p. 110) says, "The most I can claim for the facts here adduced is that they are corroborative of the idea of *Buteo b. harlani* being a geographic race rather than a color phase," while my work on these birds tends to show that color is one of the constant and chief differences between it and the redtails.

My study of this species was finished in the winter of 1931, and this paper was written at this time. The result of my study convinced me that "*harlani*" was entitled to a specific place in the check-list and when "The Check List of the Birds of the World" came out I was glad to see that Peters had arrived at the same conclusion and had given the species its proper name and place.

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