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PLUMAGE COLORATION AND AGE OF EVENING GROSBEAKS

By G. HAPGOOD PARKS

During the six winters that Evening Grosbeaks (*Hesperiphona vespertina vespertina* Cooper) have come to our banding station at Hartford, Connecticut, we have trapped and banded 2,867 of them. These banded birds have supplied us with 2,417 repeat records and 36 of them have returned to us again during some season subsequent to its banding. Ninety-one foreign recoveries have also been trapped. In short, we have actually held in our hand on not less than 5,411 distinct occasions, one of these fascinatingly temperamental, gloriously plumaged birds.

Some of our experiences have already been described in *Bird-Banding*, in the *Bulletin* of the Maine Audubon Society, and in *Audubon Magazine*. Each season has brought its new adventure. First, there was the thrilling experience of becoming acquainted, of learning how best to attract and trap these birds, and how to handle them without inviting more than that necessary minimum of pain which the ample mandibles of excitable individuals can inflict. Another winter afforded us the opportunity of studying vocal characteristics, food preferences, and individual temperaments. Still another season revealed to us the miracle of the pigmentation change in their mandibles which accompanies the approach of spring. Then we felt the challenge of learning how to distinguish with certainty the immature individuals from the adults.

Available literature produced almost no helpful information. During the 1945-46 invasion we had tried unsuccessfully to uncover some evidence in justification of Dr. A. A. Allen's statement that the young males "retain their juvenile wings and tails until the following fall." This statement indicated to us that males of the year should still have wings and tails similar to those of the females when they reached our traps. Our inexperience prevented us from interpreting the statement meaningfully, however, and, as a result, we became confused by observations which seemed repeatedly to be in conflict with each other. We learned, at least, that individual plumages varied widely, but, with so many other fascinating things to observe, our divided attention discovered neither rhyme nor reason in this variation.

Our relative inexperience with this species had, at first, led us, for lack of a distinguishing feature, to classify as "adult" any bird capable of making the long flight to Hartford from the breeding range. We admitted that this decision lacked seriously of scientific logic and truth, so we resolved to make a systematic plumage study of these birds in an attempt to discover any characteristics which might reveal, with some degree of consistency, the age of the individual.

We had already examined all available literature and had failed to find more than the Allen statement which has already been quoted in part. More completely, he wrote: "Young Evening Grosbeaks, when they leave their nests, all resemble their mother, but before winter the males have acquired their yellow body feathers, though they retain their juvenile wings and tails until the following fall." We decided to renew our search for instances which might justify this statement and, if possible, to amplify it to include marks for distinguishing the ages of females as well.

THE STUDY OF MALE PLUMAGES

We chose to focus our attention upon three male plumage characters which were capable of being studied with reasonable consistency. They were the presence of: (1) black areas on the white tertial feathers of the wings, (2) yellow fringes on these same tertial feathers, and (3) white areas on the black tail feathers. Throughout our study we found no reason to modify this original choice, although infrequent additional features were noted as, for example, some distinct variation in the color of the under tail-coverts, the presence of white or yellow or black tips (which looked like tiny "leopard spots") on some of the upper and under tail-coverts, and, very late in the study, the presence of white areas on the black wing primaries.

During this season's flight of Evening Grosbeaks, which lasted at our station from February 4 to May 22 (1950), we examined a total of 381 males. Of this number, 362 were apparently being trapped for the first time, for they wore no bands, 16 were recoveries from other stations, and the other three were returns.

Our three returns and the two recoveries which had been banded prior to the present season gave us, of course, most valuable observations upon which to base judgment regarding the plumage characteristics of male Evening Grosbeaks which were unquestionably adult. So let us summarize these observations first of all.

TABLE I
BANDED ADULT MALE EVENING GROSBEEKS RECOVERED AT HARTFORD, CONNECTICUT

Band No.	Banded by	Date	At	Recovered	Minimum Age (yrs.)
41-219192	W. P. Wharton	Feb. 24, 1942	Groton, Mass.	Apr. 19, 1950	8½
44-201582	(author)	Dec. 15, 1945	Hartford, Conn.	Mar. 4, 1950	4½
44-214693	(author)	Dec. 30, 1945	Hartford, Conn.	Mar. 18, 1950	4½
40-232556	(author)	Jan. 7, 1947	Hartford, Conn.	May 3, 1950	3½
48-228836	G. D. Chamberlain	Apr. 20, 1949	Presque Isle, Me.	Feb. 4, 1950	1½

A study of the three plumage characters as revealed by these five adult males gave the following data:

TABLE II
PLUMAGE CHARACTERISTICS OF FIVE ADULT MALE EVENING GROSBEEKS

Band No.	41-219192	44-201582	44-214693	40-232556	48-228836
Minimum age (yrs.)	8½	4½	4½	3½	1½
a. Black on white tertials	tiny bit	very faint	none	faint	none
b. Yellow fringes on tertials	trace	faint	medium	trace	(no record)
c. White on tail feathers	none	none	none	none	none

The number of records reported above is admittedly too few to be at all conclusive, but it is of interest to note the perfect uniformity of character (c) and the distinct similarity of characters (a) and (b) among these five males. Inconclusive though it may be, such consistency within even so small a group may certainly be accepted as indicative of a trend.

Of the 394 males which, during this season, were released wearing our bands for the first time, 32 were banded at a Hartford substation by E. A. Carrier. (Although Mr. Carrier reported his data on the plumages of the birds he banded, it has been considered inadvisable to include them in this study since we found it impossible to institute a control which would assure entirely consistent observations at the two disconnected stations.) The tails of six other males which we examined were so badly soiled that it was impossible to determine accurately whether any whiteness existed near the tips of the feathers. Another male was trapped with all of his tail feathers missing. So we were left with 355 males upon which to base any conclusions which our observations might indicate.

The following table shows the distribution of the three color characteristics as determined by an examination of the plumages of these 355 male Evening Grosbeaks.

TABLE III
COLOR CHARACTERISTICS OF 355 MALE EVENING GROSBEEK PLUMAGES

	(a) None	(b) Faint	(c) Medium	(d) Conspicuous
A. Black on white tertials	115	81	121	38
B. Yellow fringe on white tertials	58	137	149	11
C. White on black tail feathers	170	109	53	23

It takes little more than a cursory examination of the above table to reveal the fact that no significant correlation exists among the three characters studied. To discover whether combinations of these characters might provide the answer to our problem of ascertaining the age of the bird through its plumage coloration, we took each of the subdivisions ((a), (b), (c), and (d)) of Group A from Table III and subdivided it further according to the relative presence of characters B and C. For example, males having no black on their tertials were divided into groups according to whether the tertials showed no yellow fringes while the tail feathers showed no white, faint white, medium, or conspicuous white areas. Likewise, those having no black on their tertials, but revealing faint yellow, medium yellow, or conspicuous yellow fringes on the tertials were similarly subdivided according to the absence or prevalence of white on the tail feathers, and so forth. In this manner we were able to classify our three characteristics into a possible 64 different combinations of degree.

When our recorded data had been so distributed it was learned that only 44 of these possible character combination patterns were represented, as follows:

TABLE IV
COLOR CHARACTER COMBINATIONS OF 355 MALE PLUMAGES

	D. No black on tertials	E. Faint black on tertials	F. Medium black on tertials	G. Conspicuous black on tertials
e. No yellow, no white	31	8	5	.....
f. No yellow, faint white	4	3	1	1
g. No yellow, medium white	1	.....	1	.....
h. No yellow, conspicuous white	.....	.....	3	.....
i. Faint yellow, no white	44	16	7	.....
j. Faint yellow, faint white	6	15	21	2
k. Faint yellow, medium white	2	3	12	4
l. Faint yellow, conspicuous white	2	.....	.....	3
m. Medium yellow, no white	18	16	16	6
n. Medium yellow, faint white	3	15	27	8
o. Medium yellow, medium white	.....	2	20	6
p. Medium yellow, conspicuous white	.....	2	5	5
q. Conspicuous yellow, no white	3	.....	.....	.....
r. Conspicuous yellow, faint white	1	.....	1	1
s. Conspicuous yellow, medium white	.....	.....	2	.....
t. Conspicuous yellow, conspicuous white	.....	1	.....	2
	115	81	121	38

It is apparent from Table IV that there is, in general, a definite decrease in the distinctness of the white areas on the black tail feathers as any black area on the white tertials also decreases. Of the 196 males (D plus E) having not more than faint black on their tertials, only 60 (30.6%) revealed any white at all on the tail feathers, and only 13 (6.6%) of these showed the white sufficiently for it to be recorded as more than faint. On the other hand, of the 159 males (F plus G) whose white tertials showed medium or conspicuous black areas, 125 (78.6%) had at least faint white on the black tail feathers, and in 63 (39.6%) of

these cases the white areas were definite enough to be recorded as medium or conspicuous.

The intensity of the yellow color fringing the tertials showed some tendency to parallel the intensity of the white on the tail feathers. This trend, however, revealed so many irregularities as to render the character unreliable for our intended purpose.

Looking back to Table I for just a moment let us recall that each of those definitely adult birds possessed not more than faint black on the white tertials and no white at all on the black tail feathers. If we may accept this as a normal plumage condition for adult male members of this species, our Table IV seems to reveal to us some 133 males which are distinctly adult (De, Di, Dm, Ee, Ei, and Em), and 31 others which are also apparently, but not certainly, adult (Dq, Fe, Fi, and Fm). Similarly, if we are willing to accept the presence of black on the tertials and white on the tail feathers as indicative of immaturity, we find 63 males which seem to be distinctly immature (Fg, Fh, Fk, Fo, Fp, Fs, Gk, Gl, Go, Gp, and Gt). Those 61 individuals included in groups Ff, Fj, Fn, Fr, Gj, Gn, and Gr, can also, with reasonable accuracy, be classified as immature.

So we have classified, it seems, some 288 of our 355 males, but we find ourselves uncertain about groups Df, Dg, Dj, Dk, Dl, Dn, Dr, Ef, Ej, Ek, En, Eo, Ep, Et, Gf, and Gm, a total of 67 individuals whose plumage fails to reveal their maturity in terms of the three characters we chose to study.

We need other substantiating characteristics, perhaps, such as the two which came to our attention too late to be incorporated into this investigation. One of these involves the color of the under tail-coverts. Although not enough data were gathered to be conclusive, we believe that the faint, almost lemon-colored or whitish-yellow under tail-coverts accompany the black-on-tertials-white-on-tail-feathers combinations, whereas the deeper, richer "golds" accompany those plumage combinations which we have considered to be typical of adult birds. The other embraces those areas of white which are to be discovered on the black primaries of some of the males by spreading apart the overlapped wing feathers. Just how far these two characters may help to reduce the size of our uncertain group must await some future opportunity for a continuation of this study.

THE STUDY OF FEMALE PLUMAGES

At the beginning of our female plumage investigation we lost precious time and many valuable data by concentrating on but a single characteristic, namely, the amount of yellow on the white wing bars. It was not until we had released 313 females that we trapped Return female No. 45-200057. While handling her our attention was attracted by the color of her under tail-coverts. They were white with just enough buffy to give them a distinctly silvery appearance. Since this bird had been banded on March 13, 1946, she must now be at least 4½ years old. Were these "silvery" under tail-coverts a mark of female adulthood?

So we began, tardily, to pay heed to the color of female under tail-coverts as well as to the amount of yellow on the wing bars. Then, after having released an additional 219 females, we awoke to the poten-

tialities of a third characteristic. This time we noticed that there was a varying degree of color contrast between the under tail-coverts and the patch of buffy-brown feathers which extended down both sides of the body, sheltering the fleshy parts of the legs, and continuing, frequently, completely underneath the bird's belly. As earlier bandees repeated we added observations on the latter characteristics to their previous records.

Lighting proved to be a factor of major importance particularly in this study of female plumages. The color of the under tail-coverts of the females showed a wide variation when examined under different lighting conditions. For this reason we attempted to examine all of the birds by the light from a north door. Even this lighting, which changed with the time of day and with weather conditions, provided a variable over which we had no control, but which we tried to meet as consistently as possible. We realize, too, that the terms we have chosen to use in describing relative degree are intangible and that there is no perfectly consistent way of determining or interpreting them. We have been unsuccessful in our attempts to devise a better terminology, however, and we hope that our reader may be able to see with reasonable clarity what we saw.

During this study we examined the plumages of 898 female Evening Grosbeaks. Of this number 848 were new bandees, 45 were recoveries from other stations, and five were returns. (Forty-four females which were banded at Mr. Carrier's substation have been omitted here as were his males, and for the same reason.)

Our five returns and ten of the recoveries provided us with plumages which were unquestionably adult. The two tables which now follow summarize this group of adult females and their plumages.

TABLE V

BANDED ADULT FEMALE EVENING GROSBEEKS TRAPPED AT HARTFORD, CONNECTICUT

Band No.	Banded by	Date	At	Recover- ed at Hart- ford 1950	Mini- mum Age (yrs.)
39-206885	B. M. Shaub	Mar. 18, 1949	Northampton, Mass.	Mar.	1 1½
46-218996	(author)	Mar. 5, 1949	Hartford, Conn.	Feb.	5 1½
47-216991	Mrs. H. A. Drew	Mar. 1, 1949	Barre, Vt.	Mar.	5 1½
48-218505	(author)	Mar. 6, 1949	Hartford, Conn.	Feb.	20 1½
48-218574	(")	Apr. 16, 1949	" "	Mar.	16 1½
48-218579	(")	Apr. 17, 1949	" "	May	3 1½
48-226771	Mrs. H. A. Drew	Apr. 16, 1949	Barre, Vt.	Feb.	8 1½
48-228344	B. M. Shaub	Mar. 31, 1949	Northampton, Mass.	Mar.	14 1½
48-228355	" " "	Apr. 4, 1949	" "	Mar.	22 1½
138-112617	A. O. Gross	Mar. 3, 1947	Brunswick, Me.	Feb.	21 3½
46-130580	B. M. Shaub	Mar. 26, 1947	Northampton, Mass.	Feb.	20 3½
46-203380	E. M. Grout	Jan. 11, 1947	Walpole, Mass.	Feb.	7 3½
47-100025	E. A. Mason	May 8, 1947	Easthampton, Mass.	Mar.	24 3½
45-200057	(author)	Mar. 13, 1946	Hartford, Conn.	Feb.	23 4½
42-226484	M. J. Magee	Oct. 28, 1945	S. Ste. Marie, Mich.	May	2 4½

A study of the plumages of these fifteen adult females supplied the following facts: (* In the tables which follow, "contrast" refers to the

degree of color contrast between the under tail-coverts and the side-belly stripe.)

TABLE VI

PLUMAGE CHARACTERISTICS OF FIFTEEN ADULT FEMALE EVENING GROSBEAKS

Band No.	Minimum Age (yrs.)	Yellow on white wing bars	Color of under tail-coverts	Degree of contrast*
39-206885	1½	medium	buffy light gray	(no record)
46-218996	1½	faint	buffy medium gray	(no record)
47-216991	1½	faint	bright buffy	medium
48-218505	1½	faint	(no record)	(no record)
48-218574	1½	faint	buffy medium gray	conspicuous
48-218579	1½	faint	buffy light gray	conspicuous
48-226771	1½	faint	(no record)	(no record)
48-228344	1½	none	buffy light gray	faint
48-228355	1½	none	silvery	faint
138-112617	3½	none	buffy dusky	faint
46-130580	3½	faint	(no record)	(no record)
46-203380	3½	medium	(no record)	(no record)
47-100025	3½	conspicuous	buffy light gray	medium
45-200057	4½	faint	silvery	(no record)
42-226484	4½	medium	buffy light gray	medium

Table VI reveals no very consistent correlation between the ages of these adult females and the plumage characteristics which we have studied. At least part of this apparent inconsistency may very well have been caused by our admitted inability to estimate and record with perfect uniformity the relative values of those characteristics. And, besides, it should be remembered that we are certain only of the *minimum* ages of these birds. This latter fact should prevent us from attaching too much significance to any consistency, or inconsistency, which may seem to exist among the observations pertaining to the first nine birds (the "1½-year-olds") in this table. It is evident, however, in spite of the spread among our four "3½-year-olds," that the adult female Evening Grosbeaks here summarized show a distinct trend toward relatively little yellow on the white wing bars and relatively light-colored under tail-coverts.

Let us now summarize the observations which we made while handling 848 previously unbanded females. The apparent irregularity revealed by the totals in the following table has already been explained as due to the fact that not all of the birds were examined for all three of the characteristics.

TABLE VII

PLUMAGE CHARACTERISTICS OF FEMALE EVENING GROSBEAKS

	(a)	(b)	(c)	(d)
	None	Faint	Medium	Conspicuous
A. Yellow on white wing bars	107	429	180	132
B. Buffy gray on under tail-coverts	105	233	220	63
C. Contrast*	23	108	232	24

Following a procedure similar to that used in the male study let us now distribute the character combinations that were discovered in the 387 female plumages which we examined for all three characteristics.

TABLE VIII

COLOR CHARACTER COMBINATIONS OF 387 FEMALE PLUMAGES

Under tail-coverts	Amount of yellow on white wing bars			
	H.	I.	J.	K.
	None	Faint	Medium	Conspicuous
e. No gray, no contrast*	.....	1	1	.....
f. No gray, faint contrast	4	1	2	.....
g. No gray, medium contrast	4	35	1	.....
h. No gray, conspicuous contrast	2	10	1	.....
i. Faint gray, no contrast	.....	1	.....	2
j. Faint gray, faint contrast	5	12	9	4
k. Faint gray, medium contrast	20	66	22	7
l. Faint gray, conspicuous contrast	1	5	2	.....
m. Medium gray, no contrast	1	1	5	4
n. Medium gray, faint contrast	3	22	13	12
o. Medium gray, medium contrast	3	37	13	12
p. Medium gray, conspicuous contrast	.....	.....	1	1
q. Conspicuous gray, no contrast	2	1	4	.....
r. Conspicuous gray, faint contrast	2	9	6	4
s. Conspicuous gray, medium contrast	2	6	.....	4
t. Conspicuous gray, conspicuous contrast	.....	.....	.....	1
	49	207	80	51

This table suggests a rather definite increase in the grayness of the under tail-coverts as the conspicuousness of the yellow on the white wing bars also increases. There is, too, an apparent, though not so consistent, parallel trend toward less color contrast between the side-belly stripe and the under tail-coverts.

The following table shows the spread in plumage characteristics among 234 additional females not included in Table VIII. In these cases only the amount of yellow on the white wing bars and the color of the under tail-coverts were observed. It will be noted that the same general relationship between these two characters exists here as was found in Table VIII.

TABLE IX

COLOR CHARACTER COMBINATIONS OF 234 ADDITIONAL FEMALE PLUMAGES

Under tail-coverts	Amount of yellow on white wing bars			
	L.	M.	N.	O.
	None	Faint	Medium	Conspicuous
a. No gray	11	20	8	4
b. Faint gray	13	46	12	6
c. Medium gray	3	43	27	19
d. Conspicuous gray	1	8	7	6
	28	117	54	35

It will be remembered that early in our study only the amount of yellow on the white wing bars was recorded. Our final table which summarizes our observations of this one character on 227 female plumages not included in Tables VIII and IX is added merely to make the story complete.

TABLE X

AMOUNT OF YELLOW ON WING BARS OF 227 ADDITIONAL FEMALE EVENING GROSBEEKS				
Amount of yellow	None	Faint	Medium	Conspicuous
No. of individuals	30	105	46	46

Although we find it more difficult here than in the case of the males to point out significant plumage-age correlations, we have become convinced that the mature females possess the lighter colored under tail-coverts and that their white wing bars are less conspicuously edged with yellow. The degree of contrast between the under tail-coverts and the side-belly stripe has not proved to be significant.

As a result of our study this writer concludes, as follows, regarding the species *Hesperiphona vespertina vespertina*:

1. Young males tend to retain a considerable, though variable, area of black on the characteristically white tertial feathers.

2. These same young males tend to retain more or less conspicuous white areas near the tips of their black tail feathers, and, in some cases, hidden areas of the black wing primaries may also be more or less conspicuously white.

3. Subsequent molts evidently result in an adult male plumage having little or no black on the tertials and no white at all on the tail feathers or on the wing primaries. We were unable to determine, however, just how consistent is this change or at what age it is complete.

4. Regarding the females, a distinct trend was more difficult to discover. The most definite mark of female maturity appears to be the white, silvery, or buffy very light gray under tail-coverts. This condition was accompanied, most frequently, by not more than faint yellow on the white wing bars.

5. The younger females were characterized more frequently by a combination of medium or conspicuous yellow on the wing bars and more gray or dusky on the under tail-coverts, but, as in the males, it was impossible to determine the exact age signified by any particular degree of coloration.

5. So many individuals of both sexes elude this system of age classification as to make it rather inconclusive. It is hoped, however, that an acceptable start has been made which may be modified and improved as a greater amount of comparative data is obtained from future possible recoveries or returns of these birds.

We wish to acknowledge most sincerely the valued assistance and the inspiration which came during the season from those banders and interested observers with whom we correspond. Especial thanks are due Hazel C. Parks for her unflagging cooperation throughout the banding of these birds and the recording of the many observations, and, too, for her final constructive criticism of this paper.

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GENERAL NOTES

Proposed Regional Colors for Evening Grosbeaks.—The United States Fish and Wildlife Service suggests the discontinuance of the use of celluloid bands, because of reported injuries to birds and the uncontrollable and highly variable colors of the material. The Service has asked the Massachusetts Audubon Society to co-operate in making available to banders a new type of colored aluminum band. These are in stock at Audubon House, 155 Newbury Street, Boston 16. The sizes available correspond to the regular band sizes of 1, 1A, 2, 3, and 6. The cost is \$1.50 for a string of one hundred bands, except that size 6 costs \$2.00 per hundred. The colors available are red, gold, blue, and green, and eventually others will be added.

It is therefore proposed that color bands for Evening Grosbeaks (*Hesperiphona vespertina*) be used on a regional basis as follows:

- GREEN:** Quebec, New Brunswick, Nova Scotia, Maine, Vermont, New Hampshire and Northern New York (Area north of the line delineated by Route 29 from its eastern terminus to Middleville; thence Route 28 to Trenton (Barneveld P.O.); thence from Trenton along a line running westerly to Taberg on Route 69; thence along Routes 69 and 13 to Lake Ontario. Cities on the line belong in the region using gold).
- GOLD:** Massachusetts and Central New York (South of the area defined under "GREEN," and north of the northern boundary of Pennsylvania and a line extending from the northern boundary of Pennsylvania to the southern boundary of Massachusetts).
- BLUE:** Rhode Island, Connecticut and Long Island.
- RED:** Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, Indiana, Ohio and New York south of the area defined under "GOLD."
- BLACK:** Ontario, Michigan (except upper peninsula).
- SILVER:** Wisconsin, Minnesota, Iowa, Illinois and the upper peninsula of Michigan.

It is suggested that the new 1A band would be best for Evening Grosbeaks. The colored aluminum bands are of the same temper as the 1A bands which just recently were made available. In 1949-50 quite a few reports were received of Number 2 bands being partially opened. The new 1A band is just as strong as the Number 2 band and seems ideal for the Evening Grosbeak.

To satisfy the desire for local or regional studies, we submit for your consideration the following techniques. It should be emphasized that no system of marking birds is of value unless there is central control to avoid duplication. This is important if our efforts are to mean anything at all. We at Arcadia Sanctuary, Northampton, Massachusetts, offer our services as a clearing house for the registration of bands and color combinations. Here are some of the possibilities:

1. Colored lacquers for marking bills. (These markings are good for at least one month.)
2. Brands, made like rubber stamps, to mark the white wing patches of males. One letter, one number, or a simple design in a square or circle, the total to be about the size of a quarter. (See Bull. Mass. Aud. Soc., Vol. XXXIV, No. 6, Oct. 1950, pp. 244-247.)
3. Dyed chicken feathers to be attached, upcurled, to the base of tail primaries. This is the technique used by Richard Lee Weaver and mentioned in his paper "The Purple Finch Invasion of Northeastern United States and the Maritime Provinces," *Bird-Banding*, 11: 3, for July, 1940.

We have two new baits to offer. They are dried currants and hemp seed. Sun-