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VARIATIONS IN COLOR OF THE SHOULDERS OF THE MALE GOLDFINCH

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DURING the six-year period, 1940 to 1946, I banded 1,249 Eastern Goldfinches, *Spinus tristis tristis*, in Ardmore, Montgomery County, Pennsylvania. Forty-two birds (3.36%) returned to Ardmore in the following years. Some returned one year after banding and again a second and third year, while others were not recaptured until two or three years after banding.

When the birds were banded, their wings were measured. The closed-wing measurement, or the chord, was taken of a series of 1,027

birds. The wings were measured in millimeters with dividers, with the length determined from the anterior part of the bend of the wing to the tip of the longest primary, without flattening the curve of the feather. A series of 696 male wings measured 65.5 to 77 mm. (average, 72.1). A series of 331 female wings measured 65 to 73.5 mm. (average 69.5).

Reference to Table I will show that of the 1,249 Goldfinches banded, 1,080 (86%) were captured during the months of March and April, and since at this time of the year the young birds had already passed through their first winter, the sex ratio was checked for any possible indication of a difference in the mortality rate between young males and young females.

TABLE I
NUMBER OF GOLDFINCHES BANDED

<i>Year</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>Yearly total</i>
1940	11	9	4	13	8	45
1941	—	48	242	179	—	469
1942	16	57	172	125	—	370
1943	—	—	—	117	4	121
1944	10	2	2	11	—	25
1945	—	—	16	—	—	16
1946	—	4	115	84	—	203
	—	—	—	—	—	—
<i>Total each month</i>	37	120	551	529	12	1,249

Sex determination, with live Goldfinches in the hand, is almost entirely a matter of color of plumage. There is, of course, no difficulty in recognizing the male from the female during the summer months, and it is also not difficult, with the bird in the hand, to identify the young male from the adult male in the winter and early spring months.

As each Goldfinch was banded, sex was determined by the color of the wings and tail, and by the color of the lesser wing-coverts. During late winter and early spring months, the males may also be recognized by black spots or patches on the crown or forehead. Adult female wings and tail are usually brownish or dusky, and the lesser wing-coverts are usually tinged with greenish. The young female, in first winter plumage, usually has the wings and tail brownish, with the white markings tinged with tawny and the lesser wing-coverts brownish. The adult male has wings and tail deep black, with at least some yellow in the lesser wing-coverts, while young males have the wings and tail dull black with the lesser coverts dark-colored. The males may also be distinguished from the females during the

latter part of the winter and the early spring months, as already stated above, by some black feathers or tips of feathers on the crown or forehead; in some individuals I have observed these black spots as early as January. In examining Goldfinch specimens in the collection of the Academy of Natural Sciences of Philadelphia, I found a number of both adult and young male skins with these black spots on the crown, collected, according to the labels on the skins, in the months of November, December, and January. Whether these black feathers on the crown or forehead were old feathers that remained from the previous summer plumage and were not renewed at the postnuptial molt in the fall of the year, or whether they were new feathers indicating the beginning of the spring prenuptial molt, I do not know. However, during the latter part of March and April, the partial prenuptial molt advances rapidly and instead of small black spots on the crown and forehead of the male, sizable black patches appear, and from banded birds that repeated in the traps, I noted that these black patches very soon develop into the full black cap of the male.

A total of 1,080 Goldfinches banded in March and April were determined as to sex. Of this number, 804 (74%) were males and 276 (26%) were females; differential, 2.9 males to 1 female.

Of the males, 303 (38%) were adults and 501 (62%) were young. Of the females, 214 (77%) were adults and 62 (23%) were young.

It is difficult to account for the small number of young females. Young females may not enter banding traps as readily as the young males, or the young females may migrate north in the spring along a different route from that of the adult females, or there may possibly be a higher mortality rate of the young females during their first winter than of the young males during the same period.

While I was banding the Goldfinches, my attention was attracted to the great variation of the colors of the lesser wing-coverts (shoulders) of the young males, and also some variations of the color of the shoulders of the adult males. Notes were made of these variations in 501 young males and 303 adult males, all banded during the spring months of March and April. Notes were also made of the color of the lesser wing-coverts of 27 male Goldfinches that were banded and that returned to Ardmore in the years following banding. As each male was recaptured upon his return, notes were again made of the color of his lesser wing-coverts and these notes were compared with those made when he was originally banded.

The color of the lesser wing-coverts of the young male is usually

referred to as 'brownish.' Forbush (1929; note by C. L. Whittle) states: "Living male first winter plumage has yellowish-brown lesser wing coverts with a marked greenish cast. Such birds in the second winter plumage in life, have the lesser wing coverts bright lemon yellow."

Roberts (1936), referring to the brown shoulder patches of the young male, writes: "A prenuptial molt produces a bright yellow body and a black cap and the first year breeding male is like the adult except the brown shoulder patches, which are not changed to yellow until the postnuptial molt, when old and young are alike."

Dwight (1900), referring to the first winter plumage of the male, writes: "Dull black, brownish or yellowish edged lesser wing coverts (the 'shoulders') distinguish young birds from adults, which have them bright yellow."

In the series of 501 living young males banded at Ardmore, I noted 14 variations of color of the lesser wing-coverts, as listed in Table 2. The reason living young male Goldfinches show greater variation in color in these feathers than is usually found in museum specimens may possibly be due somewhat to fading of the museum specimens. Age of the specimens may account for a certain amount of loss of color which would result in a decreased amount of variation. In recently examining a series of adult male Goldfinch skins, I was rather surprised to find so very few adult males with deep black wings and tails, most of which were blackish-brown, no doubt the result of fading. It is well known, of course, that certain particular colors fade much more rapidly than do others, and some of these, such as the browns, the greens and the yellows, are to be found in the lesser wing-coverts of the male Goldfinches.

Dwight (1902), referring to the variation and fading in the Goldfinch, writes: "The seasonal variation in plumage is considerable, there being no less than six plumages easily recognizable in the male, and although most of the feathers are renewed by moult twice in the year, they are subject to a large amount of fading and actual loss of substance. Seasonal variation is due to moult and subsequent fading of plumage. Probably no colors are more susceptible to fading than the browns and the buffs and therefore the Goldfinch, particularly in the winter dress, varies between wide extremes on the Atlantic Coast, but fades less on the Pacific. Specimens show that *tristis* (Eastern Goldfinch) and *salicamans* (Western Goldfinch) are equally brown after the postnuptial moult, the drier, brighter climate in the east fading *tristis* quite rapidly in the subsequent months, while *salicamans* remains dark."

Another factor that may account for some of the variation in the colors of the lesser wing-coverts of the living young males is a possible molt of these feathers during the prenuptial molt in the spring. Dwight (1902) indicates that some young males renew their lesser wing-coverts at this molt. Writing of the first nuptial male, he states: "The wings and tail are left over from the juvenal stage, while a few tail coverts, abdominal and crural feathers, together with the lesser coverts (sometimes, however, renewed at this moult), remain of the first winter dress." Although Dwight does not say there is some change of color when the lesser wing-coverts are renewed by the young male at the prenuptial molt, yet it is not improbable, since most of the feathers, except the wings and tail, change color at this molt.

About the middle of April, 1946, when I was banding many Goldfinches daily, it occurred to me that it might be worth while to pluck a few of the lesser wing-coverts of the males to see if any of them were new, which might perhaps indicate a prenuptial molt of these coverts. The feathers of 15 birds were secured, 11 young males and four adult males. These feathers, now in my collection, were later examined under a 50-power microscope. The lesser wing-coverts of eight out of the 11 young males contained several new feathers, and three of these eight birds had several bright yellow feathers that could be seen without the aid of a glass.

Under the microscope, new feathers were easily distinguished from old ones, since they showed very slight or no abrasion at the tips of the barbs and no loss of barbules, while the old feathers showed considerable wear and a loss of the tips of the barbs and barbules. In some of the new feathers examined, small particles of the sheath that had crumbled away were still in evidence, lying on other parts of the feather. Since eight of the 11 young males had some new lesser wing-coverts, it may indicate a partial prenuptial molt of these coverts, but not a complete one. However, since only a few feathers were plucked from this area of each bird, the amount of material for study was limited, and, therefore, no definite conclusion could be reached without further investigation.

The feathers plucked from the three remaining young males were all old. Those taken from the four adult males were also old feathers, showing much abrasion of the tips of the barbs and loss of some of the barbules. Also, there appeared to be a certain amount of disintegration of the bright yellow pigment in the barbs, so that the terminal portion of the barbs was very pale yellow, almost approaching white.

It is stated in the literature that the lesser wing-coverts of the adult male Goldfinch are bright lemon or canary yellow. The young male is said to assume these bright yellow shoulders at the postnuptial molt in the fall. By reference to Table 2, it will be noted that the variations of color of the lesser wing-coverts of living adult males were found to include bright canary yellow, dull greenish yellow, and, in a large percentage of the adult males, partly bright canary yellow and partly other colors such as yellowish olive or dull yellowish green. In the 303 living adult males examined, 119 shoulders

TABLE 2
COLOR OF LESSER WING-COVERTS
501 LIVING YOUNG MALES

<i>Number of birds</i>	<i>%</i>	<i>Color</i>
91	18.0	Dull yellowish olive
73	14.5	Dull yellowish green
71	14.1	Light yellowish olive-green
43	8.5	Dusky olive-green
37	7.3	Yellowish olive and black
26	5.1	Yellowish green and black
25	4.9	Olive green and black
25	4.9	Brownish and olive-green
24	4.7	Dull greenish yellow and black
25	4.9	Deep olive and black
21	4.1	Brownish olive and black
16	3.1	Dark olive
15	2.9	Brownish and dull yellow
9	1.7	Dark greenish olive
303 LIVING ADULT MALES		
119	39.2	Bright canary yellow
94	31.0	Partly bright yellow and partly other colors
90	29.7	Dull greenish yellow

(39.2%) were bright canary yellow, 94 (31%) were partly bright yellow and partly other colors, and 90 (29.7%) were dull greenish yellow.

Roberts (1936) knew that all adult males did not have complete bright yellow shoulders, since he made the following statement regarding the adult male fall and winter plumage: "The male has blacker wings and tail than the female and more conspicuous white markings, which in the female are buffy. The yellow shoulder patches are retained, in part, at least."

Dwight (1902) also found that the lesser coverts of all the adult males were not bright canary yellow. He states: "In some specimens the lesser wing coverts are greenish tinged, being dusky basally, and there is much white in the median coverts. Such birds usually show

a white spot on the primaries, while the yellow shouldered do not, but whether they represent the second winter plumage and the others the third winter plumage, I cannot say. Osteological characters show that none of these birds are first winter."

It is evident from the above statements that there is a certain amount of variation in the colors of the lesser wing-coverts of adult males as well as of young males. There are also some other factors that should be considered, which may account for the variations. Stone (1896), writing of the assumption of adult plumage, states: "It is, however, quite likely that certain individuals, whether from excessive vitality, or some other cause, assume adult dress at an earlier period in their lives than others, and certain other individuals never attain the highest development of plumage coloration exhibited by the species."

My investigation appears to confirm this, at least in part.

Table 3 lists banded birds that returned and gives the colors of the lesser wing-coverts at the date of banding and when the birds returned. It will be noted that some of the banded males that returned one or more years after banding did not assume the highest plumage in their lesser wing-coverts even though they had reached their second or third year.

A young male, 41-74527, at least four months old when banded (Jan. 14, 1942), returned 15 months later (Apr. 15, 1943) when at least 19 months old, and still had not acquired the bright canary yellow shoulders of the adult male. Two other young males, 140-47962 and 140-48001, both banded in March, 1941, returned about two years later, one in March and the other in April, 1943, when at least two and a half years old, and they also had not yet assumed the bright canary yellow shoulders of the adult male.

Again referring to Table 3, it will be noted that the two adult males, 40-95345 and 42-36903, with lesser wing-coverts dull greenish yellow at the time of banding, one in April, 1940, and the other in April, 1943, when at least 20 months old, returned one year after banding when they were 32 months old, with these coverts only partly bright canary yellow and not in the height of color of the adult male. Two other adult males, 40-95187 and 40-95346, one banded in February, 1940, and the other April, 1940, when at least 18 to 20 months old, returned about two years later, when approximately three and one-half years old, and still did not have the complete, bright canary yellow shoulders of the adult male; they were only partly bright canary yellow and partly dull-colored.

TABLE 3
27 BANDED MALE GOLDFINCH RETURNS

YOUNG MALES					
<i>Band no.</i>	<i>Date banded</i>	<i>Lesser wing-coverts Color at banding</i>	<i>Date returned</i>	<i>Lesser wing-coverts Color at return</i>	
41-39384	3/30/41	Olive green and black	3/11/42	Bright canary yellow	
40-95216	3/20/40	Light yellowish olive green	12/19/43	Bright canary yellow	
140-47975	3/12/41	Dull yellowish olive	3/22/42	Bright canary yellow	
41-39335	3/27/41	Yellowish green and black	3/22/42	Bright canary yellow	
140-47962	3/12/41	Dull yellowish green	4/3/42	Bright canary yellow	
140-48001	3/14/41	Olive green and black	3/9/43	Inner rows of feathers brownish, outer rows dull yellow	
			4/7/43	Inner rows of feathers yellow olive, outer rows bright canary yellow	
41-74754	3/14/42	Dull greenish yellow and black	1/9/44	Dull greenish yellow	
41-74527	1/14/42	Yellowish olive and black	4/8/43	Bright canary yellow	
			4/15/43	Inner rows light yellowish-olive green, outer row dull greenish yellow.	
41-74579	2/15/42	Brownish olive and black	12/19/43	Dull greenish yellow	
ADULT MALES					
40-95029	1/25/40	Dull greenish yellow	3/1/42	Bright greenish yellow	
40-95239	3/10/40	Dull greenish yellow	2/10/41	Bright canary yellow	
40-95345	4/28/40	Dull greenish yellow	4/12/41	Inner rows light yellow olive, outer rows bright canary yellow	
40-95346	4/28/40	Dull greenish yellow	2/22/42	Inner rows dull greenish yellow, outer rows bright canary yellow	
40-95492	2/12/41	Bright canary yellow	3/11/42	Bright canary yellow	
40-86570	1/10/40	Dull greenish yellow	3/15/42	Bright canary yellow	
			4/10/43	Bright canary yellow	
40-95390	5/5/40	Dull greenish yellow	3/28/42	Bright canary yellow	
40-95354	4/28/40	Dull greenish yellow	3/28/42	Bright canary yellow	
41-56540	4/19/40	Bright canary yellow	4/3/42	Bright canary yellow	
			4/14/43	Bright canary yellow	
40-86569	1/10/40	Dull greenish yellow	4/16/44	Bright canary yellow	
41-56547	4/26/41	Inner rows dark olive, outer rows bright yellow	4/14/42	Bright canary yellow	
			4/18/42	Bright canary yellow	
40-95187	2/22/40	Dull greenish yellow	4/17/44	Bright canary yellow	
			4/18/42	Inner rows light yellowish olive, outer rows bright canary yellow	
140-48004	3/14/41	Dull greenish yellow	4/19/42	Bright canary yellow	
141-24444	4/17/42	Bright canary yellow	4/7/43	Bright canary yellow	
			1/15/44	Bright canary yellow	
41-56505	4/13/41	Inner row dull greenish yellow outer rows brownish streaked black	4/8/43	Bright canary yellow	
141-24437	4/17/42	Bright canary yellow	4/14/43	Bright canary yellow, also median coverts	
41-74633	3/1/42	Bright canary yellow	4/14/43	Bright canary yellow, also median coverts	
42-36903	4/7/43	Dull greenish yellow	4/6/44	Inner row dull greenish yellow outer rows bright canary yellow	

These facts may account, to some extent, for the greater amount of color variation in the lesser wing-coverts of the living birds than is usually found in museum specimens.

Colors listed in Tables 2 and 3 are, with few exceptions, in accordance with Ridgway's 'Color Standards and Color Nomenclature' (1912).

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BIBLIOGRAPHY OF HAWAIIAN BIRDS SINCE 1890

BY HARVEY I. FISHER

THE war has wrought many changes in the islands of the Pacific Ocean, not the least of which will be its effect on the bird life. Perhaps more naturalists, both professional and amateur, have visited the islands of the Central and Western Pacific in the last four years than in all previous years. Most of these men were in military service, but at the same time they were making observations and collections. Although some of the notes and specimens will probably never be reported, the work done by these individuals may constitute a significant segment of the ornithological research in the Pacific.

Many islands hitherto unknown ornithologically have been visited. Additions to the fauna of other islands have been made. We may expect much clarification of range and taxonomy and the natural history of the various species.

One of the most serious defects of many of the expected publications may well be the absence of any considerable collectanea of literature or specimens. In most cases it has been impossible for any one person to gather specimens from more than a few localities, and in many museums the Pacific is none too well represented by avian specimens suitable for comparative work. Moreover, publications on the Pacific dating from the early exploring expeditions to the present time are scattered in various journals all over the world and will not be available to all who wish to publish their findings.