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VARIATION IN WEST INDIAN FLICKERS (AVES, *COLAPTES*)

LESTER L. SHORT, JR.[1]

SYNOPSIS: An analysis of the characters of three West Indian flickers (*Colaptes auratus chrysocaulosus* of Cuba, *C. a. gundlachi* of Grand Cayman and *C. fernandinae* of Cuba) is presented. Variation in about 30 characters is discussed, and results indicate that the two races of *C. auratus* comprise a distinctive subspecies group, the populations of which have undergone considerable divergence in long isolation from their conspecific relatives in continental North America. The *chrysocaulosus* subspecies group is derived from ancestral North American *C. auratus*, and exhibits certain traits thought to be primitive in this species. The race *gundlachi* is well-differentiated and originated from pre-*chrysocaulosus* stock from Cuba.

Fernandina's flicker (*C. fernandinae*) is sympatric with *C. a. chrysocaulosus* on Cuba, and is highly distinctive. However, it does not differ sufficiently from other species of *Colaptes* to warrant status as a monotypic genus as currently recognized (genus *Nesoceleus* Sclater and Salvin). This species is apparently derived from very early North American flicker stock, for the history of flicker-like woodpeckers dates back to the early Pliocene in North America, while no evidence indicates that flickers have ever occupied West Indian islands other than Cuba and Grand Cayman.

Incipient geographic variation in *C. a. chrysocaulosus* makes it desirable to name a neotype of this form. Also a lectotype is designated from syntypical material of *C. a. gundlachi*.

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INTRODUCTION

A number of distinctive, ground-feeding woodpeckers, the flickers, occur in North America from the tundra south to northern Nicaragua. These distinctive flicker populations are all allopatric except in Cuba where two resident species occur. One of these Cuban species is the monotypic, endemic *Colaptes* (*Nesoceleus*) *fernandinae*. The other is presently considered (A.O.U. Check-list, 1957; Bond, 1960) a representative of the eastern, continental North American *Colaptes auratus*. It is perhaps best considered (Short, 1965) a well-differentiated representative of a single, widespread species *Colaptes auratus*, comprised of five allopatric differentiates called subspecies groups that interbreed wherever they are in contact. These groups are: 1) the *chrysocaulosus* group of Cuba and Grand Cayman; 2) the *auratus* group of the eastern United States and eastern and northern Canada; 3) the *cafer* group of the Mexican highlands, the western United States and western Canada; 4) the *chrysoides* group of the desert regions of southwestern United States and northwestern Mexico; and, 5) the *mexicanoides* group of the Central American highlands.

Detailed information on variation in population systems at the borderline stage of speciation is essential to our knowledge of evolution. The flicker groups mentioned above are at this borderline stage;

although the five groups are generally considered to comprise three species, students have recognized as many as five and as few as one species among them. The *chrysocaulosus* group, the variation of which is discussed in the present report, is a well-differentiated geographical isolate. Information on variation within it is important for several reasons. Geographical isolates, cut off from gene flow from related populations (Mayr, 1963: 366), are thus truly incipient species. Widespread hybridization on the continent among three of the groups of *C. auratus* (Short, 1965) makes essential a consideration of variation patterns in populations effectively separated from introgressive effects. Also, the unique sympatry of the *chrysocaulosus* group with another flicker increases the desirability of considering the variation within the sympatric forms.

This paper deals with patterns of variation in *Colaptes auratus chrysocaulosus, C. a. gundlachi* and *C. (Nesoceleus) fernandinae*. For comparative purposes Florida populations of *C. a. auratus* are also considered.

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I am indebted to the Chapman Memorial Fund Committee for providing an opportunity to continue my flicker studies, including the present one, as a Chapman Fellow of the American Museum of Natural History in 1962-63. Dean Amadon, Wesley E. Lanyon and the staff of the museum have been most helpful. James Bond, John Bull, Eugene Eisenmann, William B. Robertson, Jr., Albert Schwartz and Charles Vaurie aided me in various ways. Charles G. Sibley provided assistance and encouragement during early phases of my flicker investigations. I am grateful to the Karl P. Schmidt Committee of the Chicago Natural History Museum for a grant enabling me to visit that institution.

I wish to thank the following individuals and institutions for loaning me specimens necessary for this investigation, and for assistance rendered in visiting certain of their collections: American Museum of Natural History (Dean Amadon), Chicago Natural History Museum (Emmet R. Blake and A. L. Rand), Cornell University (Charles G. Sibley), Florida State Museum at the University of Florida (Oliver L. Austin, Jr.), Museum of Comparative Zoology of Harvard University (Raymond A. Paynter, Jr.), Zoology Collection of the University of Miami (Oscar T. Owre), University of Michigan Museum of Zoology (Robert W. Storer), Schwartz-Klinikowski Collection (Albert Schwartz), U. S. National Museum (Herbert G. Deignan), and Peabody Museum of Yale University (Philip S. Humphrey).

Material and Methods

This investigation is based primarily on examination of 289 specimens of adult flickers from various museums. To facilitate comparison with breeding North American flickers, emphasis is placed on birds collected from February through July. Fall and winter specimens were also examined to provide additional data for those characters not especially subject to seasonal variation. A breakdown of the total number of adults considered (variation in juvenile flickers is dealt with elsewhere) is as follows: *C. a. chrysocaulosus* - 73, *C. a. gundlachi* - 44, *C. a. auratus* (southern Florida) - 109, and *C.* (*Nesoceleus*) *fernandinae* - 63.

Standard taxonomic procedures were used in the investigation. Measurements taken included wing length (chord), tail length, bill length (from front of nostril), and tarsal length. Data, both quantitative and qualitative, were gathered on approximately 30 characters. Information gained from examination of some 5,000 specimens of all other forms of flickers and their relatives, including birds of both sexes and various ages for each form, provided a broad basis for consideration of the West Indian flickers. Color comparisons were carried out under natural light wherever possible.

The following abbreviations are used in referring to specimens: AMNH = American Museum of Natural History in New York, CNHM = Chicago Natural History Museum, MCZ = Museum of Comparative Zoölogy in Cambridge, Massachusetts, and USNM = United States National Museum in Washington, D. C.

Type specimens of *C. a. chrysocaulosus* and *C. a. gundlachi*

Gundlach described the Cuban form of North American flicker (*C. a. chrysocaulosus*) in 1858. As his detailed description contains no mention of a malar stripe, he probably made it from a female specimen. Gundlach did not designate a type specimen. He sent several specimens of the bird and the paper describing the form for publication to George Lawrence at the American Museum of Natural History. Lawrence (1858) commented on Gundlach's form and compared *chrysocaulosus* with *Colaptes auratus* (= *auratus* subspecies group) in a paper published with Gundlach's (1858) original description. Because considerable variation exists in the Cuban *chrysocaulosus* population, it seems advisable to designate a type specimen of this form. Attempts to ascertain whether Gundlach specimens of *chrysocaulosus* exist in Cuba were unsuccessful; none has been discovered there in the century since Gundlach described it. A Gund-

lach specimen (female) without other data in the British Museum (examined for me by I. C. J. Galbraith) came there from the Salvin and Godman collection. No information is available on its history, or when Salvin and Godman acquired it.

The American Museum of Natural History acquired with the Lawrence collection a male and a female *chrysocaulosus* (nos. 44215 and 44214) taken by Gundlach, but nothing shows when they were collected or when Lawrence received them. Probably these are the specimens Gundlach sent Lawrence with his manuscript describing *chrysocaulosus*. The female is comparable in measurements to those Gundlach gave for the bird he described, insofar as Gundlach's manner of measuring can be determined. Furthermore, this female shows rump markings that have been noted only in eastern Cuban birds. Its rump is whiter than most *chrysocaulosus*, and its markings are more spot-like and less barred than those of central and western Cuban birds.

As no existing material can be traced definitely to Gundlach at the time he described this form, I consider Gundlach's syntypical material lost, and therefore designate as a neotype the female specimen numbered 44214 in the American Museum of Natural History collection. Characters differentiating *chrysocaulosus* from other flickers are presented later in this paper. Data from the neotype's labels are: sex—female, *Colaptes chrysocaulosus,* Cuba, J. G. [= J. Gundlach], AMNH 44214, 5.44-412-1.38. I also restrict the type locality to Guantanamo, Oriente Province, Cuba, for several reasons. As noted above, the specimen has a rump pattern found only in eastern Cuban birds. In the paper describing *chrysocaulosus* Gundlach also described *Culicivora* (= *Polioptila*) *lembeyei* and *Teretistris fornsi,* which occur only in eastern Cuba. Cory (1919: 411) states "It is probable that the type [of *chrysocaulosus*] came from somewhere in eastern Cuba. Dr. Gundlach informed me that he had secured many species of birds in eastern Cuba (especially in the vicinity of Santiago de Cuba and Guantanamo) . . . . "

In describing the Grand Cayman flicker, *C. a. gundlachi,* in 1886, Cory designated no type. He based his description on specimens W. B. Richardson collected in the summer of 1886, and which were taken to the Chicago Natural History Museum in the 1890's. Cory (1919) listed 21 specimens of *gundlachi* in the CNHM collection, of which 15 specimens still remain there. These include 1 male and 4 females Richardson took in August, 1886, and which were among those Cory had on hand in describing "*Colaptes gundlachi.*" From these syntypes I designate as a lectotype the single male, CNHM no. 39443.

Data for this specimen, supplied by Emmet R. Blake, are: collected by W. B. Richardson on Grand Cayman Island, August 17, 1886; original no. 6815; eye red, bill black, feet dirty gray.

Habits and Present Status of the Flickers

The Grand Cayman flicker (*C. a. gundlachi*) occurs throughout Grand Cayman Island in hammock woods, about pastures and wherever trees, other than mangroves, are found (A. Schwartz, *in litt.*). According to Schwartz this bird is abundant, especially in the western part of the island, and appears to be in no danger of extinction. Its habits are largely unknown. Molting follows the breeding period; available specimens in molt were taken from July through September.

The Cuban yellow-shafted flicker (*C. a. chrysocaulosus*) is not uncommon in woodlands and open country throughout Cuba (Bond, 1960). It is particularly abundant about the Zapata Swamp (A. Schwartz, *in litt.*). Although found in open country and savannas as well as woodlands, this flicker is more arboreal than continental yellow-shafted flickers (Barbour, 1923; Bond, 1947). This is also suggested by the heavier structure and scutellation of the feet of *chrysocaulosus* when compared with continental *auratus*, to which Lawrence (1858) first called attention. The distribution of *chrysocaulosus* includes all of Cuba (specimens available from all provinces), but not the Isle of Pines (Todd, 1916). Interactions between *Colaptes auratus* and *C. fernandinae* have not been reported.

Colaptes (*Nesoceleus*) *fernandinae*, Fernandina's flicker, originally described from near Havana by Vigors (1827), is rare in much of Cuba (Barbour, 1923; Bond, 1947); specimens are available from throughout Cuba, except Havana Province and the Isle of Pines. A Schwartz (*in litt.*) reports this flicker to be far less common than *chrysocaulosus*. Bond (1947, 1960, *in litt.*) contrasts the habits of the two flickers, and states that *fernandinae* is more terrestrial than *chrysocaulosus* or even continental *auratus*. Barbour (1923: 94) considers Fernandina's flicker similar in habits to *auratus*. Habitats *fernandinae* favors include dry, open areas such as savannas and pastures where only scattered trees, usually palms, occur (Bond, 1947, 1950). Information concerning the abundance, life history, and behavior of this distinctive species is lacking and certainly to be desired.

ANALYSIS OF CHARACTERS

Colaptes auratus chrysocaulosus Gundlach 1858

GENERAL DIAGNOSIS: Resembles flickers of the *auratus* subspecies group of northern and eastern continental North America in its yellowish under-wing and tail color, face pattern, the presence of a red nuchal patch, amount of back barring, yellowish cast below, and the reduced black area at the tip of the tail. Differs from the *auratus* group in the following features:

a) tail more barred
b) breast spots more bar-like
c) breast patch deeper, less crescentic in shape
d) underparts with a deeper yellow cast
e) throat and ear coverts deeper vinaceous in color
f) upperparts more greenish or bronze (occasionally reddish)
g) rump patch lacking; rump heavily barred and/or spotted
h) color of under-wing and under-tail surfaces usually golden yellow rather than lemon yellow
i) wings shorter and more rounded
j) tail proportionally longer
k) legs stronger, more heavily scuted

WING LENGTH: The wings of *chrysocaulosus* average significantly shorter (table 1) than resident flickers of the *auratus* subspecies group from southern Florida (hereafter "Florida flickers" and "Florida *auratus*" refer to breeding flickers of southern peninsular Florida). The measurements overlap a great deal; those of *chrysocaulosus* males completely overlap those of Florida males. The wings of females average 2% shorter than those of males. Birds from Oriente Province tend to have longer wings than flickers from central and western Cuba. Both male and female samples from Oriente show a mean wing length 2 mm greater than samples from central and western Cuba (sample sizes—6 to 12 individuals), but the difference is not statistically significant.

TAIL LENGTH: The tails of Cuban flickers average 6 to 7 mm longer than those of Florida *auratus* (table 1). Females have tails 3% shorter than males. Tails of eastern Cuban flickers average 1 to 4 mm longer than in birds from western Cuba, but the difference is not significant. Tail/wing ratios reflect the relatively longer tails of Cuban *chrysocaulosus* over Florida *auratus*. Fifty *chrysocaulosus* individuals (both sexes) show ratios ranging from .70 to .82, with a mean of .754.

TABLE 1. ANALYSIS OF MEASUREMENTS OF THE THREE FORMS OF WEST INDIAN FLICKERS *

Form	N	X ± 2 SE	SD	R	CV
		Males			
WING LENGTH					
auratus	33	144.24 ± 0.90	2.60	138-150	1.80%
chrysocaulosus	24	141.95 ± 1.14	2.77	138-149	1.95%
gundlachi	15	126.40 ± 1.40	2.73	123-131	2.16%
fernandinae	19	147.63 ± 2.22	4.83	138-157	3.27%
TAIL LENGTH					
auratus	33	100.06 ± 1.46	4.21	92-109	4.21%
chrysocaulosus	25	107.04 ± 1.20	2.98	102-115	2.79%
gundlachi	13	90.69 ± 1.38	2.50	85-95	2.75%
fernandinae	22	117.95 ± 2.08	4.86	110-128	4.12%
BILL LENGTH					
auratus	36	27.26 ± 0.48	1.47	22.2-31.4	5.39%
chrysocaulosus	34	27.52 ± 1.26	1.16	25.1-30.2	4.22%
gundlachi	23	24.93 ± 0.30	0.74	23.8-26.2	2.96%
fernandinae	27	32.86 ± 0.50	1.32	30.5-35.2	4.02%
TARSAL LENGTH					
auratus	57	26.28 ± 0.26	0.97	23.6-27.9	3.69%
chrysocaulosus	34	25.95 ± 1.28	1.18	24.0-27.9	4.54%
gundlachi	24	23.67 ± 0.28	0.70	22.3-24.8	2.96%
fernandinae	29	29.51 ± 0.36	0.97	27.7-31.8	3.29%
10th PRIMARY					
auratus	20	34.25 ± 1.36	3.06	26-40	8.93%
chrysocaulosus	20	38.40 ± 1.00	2.26	35-44	5.89%
gundlachi	9	34.11 ± 1.18	1.76	31-36	5.16%
fernandinae	18	45.72 ± 2.32	4.92	37-55	10.76%
9th PRIMARY					
auratus	20	85.95 ± 1.58	3.53	78-95	4.11%
chrysocaulosus	22	88.91 ± 1.06	2.51	85-93	2.82%
gundlachi	9	79.33 ± 1.00	1.50	76-81	1.89%
fernandinae	17	92.76 ± 2.44	5.04	85-104	5.43%
		Females			
WING LENGTH					
auratus	32	143.56 ± 1.20	3.40	136-150	2.37%
chrysocaulosus	27	139.11 ± 1.22	3.15	132-145	2.26%
gundlachi	11	126.82 ± 1.30	2.17	122-129	1.71%
fernandinae	23	145.13 ± 1.44	3.44	139-152	2.37%

TABLE 1 (Continued)

Form	N	X ± 2 SE	SD	R	CV
TAIL LENGTH					
auratus	28	98.64 ± 1.48	3.92	93-107	3.97%
chrysocaulosus	26	104.62 ± 1.26	3.21	98-112	3.07%
gundlachi	9	89.22 ± 1.28	1.86	87-92	2.08%
fernandinae	24	117.75 ± 1.86	4.53	111-130	3.85%
BILL LENGTH					
auratus	32	26.58 ± 0.50	1.39	22.7-29.3	5.23%
chrysocaulosus	38	27.20 ± 1.10	1.08	25.7-30.4	3.97%
gundlachi	19	23.91 ± 0.40	0.89	22.0-25.9	3.72%
fernandinae	30	31.56 ± 0.36	1.00	30.0-33.6	3.17%
TARSAL LENGTH					
auratus	47	26.00 ± 0.30	1.04	24.0-28.6	4.00%
chrysocaulosus	38	25.73 ± 0.34	1.03	23.0-27.8	4.00%
gundlachi	20	23.15 ± 0.24	0.56	22.2-24.5	2.42%
fernandinae	33	28.74 ± 0.36	1.20	27.0-30.8	4.18%
10th PRIMARY					
auratus	17	33.47 ± 1.36	2.79	27-37	8.34%
chrysocaulosus	21	36.57 ± 1.12	2.56	32-42	7.00%
gundlachi	5	32.40 —	—	31-34	—
fernandinae	13	44.62 ± 2.32	4.19	38-53	9.39%
9th PRIMARY					
auratus	16	83.88 ± 1.72	3.42	76-90	4.08%
chrysocaulosus	21	85.29 ± 1.40	3.21	79-92	3.76%
gundlachi	4	(79.5) —	—	78-81	—
fernandinae	12	91.25 ± 1.92	3.33	84-98	3.65%

* Specimens of *C. a. auratus* from southern peninsular Florida also included for comparison. Statistics include number of specimens (N), mean (X), two standard errors (2SE) about each mean, one standard deviation (SD), sample range (R) and coefficient of variability (CV). Measurements in millimeters.

These ratios compare with a mean tail/wing ratio of .695 for 41 Florida flickers (range .63 to .74). Examination of specimens shows *chrysocaulosus* to be a larger form than Florida *auratus*. In tail length the Cuban birds approximate flickers breeding in the northern United States. The absence of weight data for Cuba flickers and the possible adaptive modification of their bills and tarsometatarsi prevent determining whether wing or tail modification has been primarily responsible for its greater tail/wing ratio. I suspect that the evolution of shorter, more rounded wings in *chrysocaulosus*, rather than lengthen-

ing of its tail, has been the major factor. Evidently wing length is not a good index to body size in these flickers (see Hamilton, 1961). The tail of *chrysocaulosus* shows modifications apparently related to its more arboreal habits in comparison with continental *C. auratus*. The central rectrices of *chrysocaulosus* have more protracted tips than in Florida *auratus* which gives the feathers a more lanceolate effect. Also the shafts of the central rectrices are more rigid and less flexible than in *auratus*, and average slightly thicker (average 2.1-2.2 mm in diameter at the bases of the central rectrices, compared to 1.9-2.0 mm in Florida *auratus*).

BILL LENGTH: The bills in Florida and Cuban flickers are comparable in length. As *chrysocaulosus* is a larger bird, its bill is thus proportionally shorter. Females' bills average approximately 2% shorter than those of males. No differences in bill length among eastern, central, and western Cuban birds are apparent. The bill of the Cuban flicker appears slightly straighter and less massive than that of Florida *auratus*.

TARSAL LENGTH: Cuban *chrysocaulosus* has slightly shorter tarsi than Florida *auratus* (table 1). Again, because of the larger relative size of *chrysocaulosus*, its tarsi (= tarsometatarsi) are therefore proportionally shorter than in *auratus*. This is apparently related to the more arboreal habits of *chrysocaulosus*, as is the fact that this flicker generally has more thick-set tarsi with heavier, more pronounced scutes. Females average but 1½% shorter tarsi than do males. Eastern Cuban flickers tend to have shorter tarsi than do central and western Cuban birds. The tarsus length/bill length ratio of 50 adult *chrysocaulosus* averages .951, with a range of .84 to 1.05 (figures for southern Florida *auratus*—mean = .973, range = .84-1.16).

WING SHAPE AND LENGTH OF 10TH PRIMARY: Although *chrysocaulosus*' wings average 2-3 millimeters shorter than Florida *auratus*, all the primaries of *chrysocaulosus* are not shorter than their counterparts in the Florida birds. The shorter wings of *chrysocaulosus* are due to reduction in length of the longer primaries (primaries 5-8), for its outer primaries (9 and 10) are longer than the same remiges of southern Florida *auratus* (table 1). The 9th primary of *chrysocaulosus* is only 3% longer than in *auratus*, but the 10th primary of *chrysocaulosus* is 11% longer than in *auratus*. Hence the outermost primary is also proportionally longer in *chrysocaulosus*. This is also evident from the ratios of primary 10/primary 9 in the two forms; *chrysocaulosus* specimens show mean ratios of .432 (♂) and .429 (♀) compared with .398 (♂) and .399 (♀) in southern Florida *auratus*. In the *auratus* subspecies group primaries 4-8 are longer than in *chrysocaulosus*, and do not

approach each other closely in length as they do in the latter form. The 2nd and 3rd primaries are usually longer than primary 9 in *chrysocaulosus,* although the 2nd occasionally equals the 9th in length. While the 3rd primary is longer than the 9th in the *auratus* group, primary 2 is shorter than (occasionally equal to) primary 9. The extreme primaries (1,2,9,10) of *chrysocaulosus* are thus longer than in Florida *auratus,* in keeping with the larger size of *chrysocaulosus.* The central primaries (3-8) are reduced to a length less than in Florida *auratus,* accounting for the more rounded and hence shorter wings of *chrysocaulosus.*

BREAST SPOTTING: The spots on the breast and abdomen of *chrysocaulosus* are about as deep but somewhat wider than those of Florida *auratus,* which makes them appear more bar-like. The depth of the largest breast spots averaged 4.35 mm in 22 male *chrysocaulosus,* about the same as the mean of 4.39 mm for 21 *auratus* from southern Florida. The mean spot width of *chrysocaulosus* (table 2) is significantly greater in both male and female samples. The spots of *chrysocaulosus* males average 1.34 mm wider than deep, while spots of Florida *auratus* males average but 0.62 mm wider than deep; female spots average 1.75 mm and 0.30 mm broader than deep in the two forms, respectively. Furthermore, while 41 of 43 adult *chrysocaulosus* measured had spots broader than deep (spot depth equaled spot width in the other two), 13 of 35 Florida *auratus* (32%) showed spot depth equal to or greater than spot width. The greater tendency toward barring

TABLE 2. MEASUREMENTS OF COLOR CHARACTER FEATURES OF WEST INDIAN FLICKERS*

	Males				Females			
Form	N	X ± 2 SE	SD	R	N	X ± 2 SE	SD	R
BREAST SPOT WIDTH								
auratus	19	5.01±0.40	0.89	3.0-6.4	16	4.82±0.44	0.88	3.7-6.3
chrysocaulosus	22	5.69±0.28	0.64	4.7-6.5	21	5.91±0.28	0.64	5.0-7.7
gundlachi	10	5.71±0.50	0.78	4.6-7.3	6	6.40 —	—	6.1-7.1
*fernandinae***	21	2.33±0.10	0.25	2.0-2.9	22	2.14±0.16	0.38	1.5-3.0
BREAST PATCH DEPTH								
auratus	56	17.89±0.28	1.06	12-23	48	16.21±0.76	2.64	11-23
chrysocaulosus	31	22.93±0.98	2.71	18-28	34	21.29±0.94	2.74	15-27
gundlachi	23	17.96±1.38	3.32	11-23	18	16.67±1.20	2.54	14-21
fernandinae	—	— —	—	—	—	— —	—	—

TABLE 2 (Continued)

Form	Males N	Males X ± 2 SE	Males SD	Males R	Females N	Females X ± 2 SE	Females SD	Females R
BACK BAR DEPTH								
auratus	20	2.70±0.14	0.30	2.2-3.2	25	2.80±0.20	0.48	1.9-3.5
chrysocaulosus	35	2.84±0.12	0.33	2.2-3.5	38	3.02±0.12	0.37	2.3-3.9
gundlachi	25	2.77±0.14	0.38	2.0-3.5	21	2.96±0.14	0.34	2.3-3.6
fernandinae	30	4.40±0.22	0.59	3.1-5.6	34	4.40±0.16	0.48	3.6-5.6
RUMP COLOR SCORE								
auratus	55	0.82±0.16	0.58	0-2	46	0.87±0.22	0.75	0-3
chrysocaulosus	34	3.76±0.52	1.53	2-4	37	3.85±0.48	1.44	2-4
gundlachi	23	3.48±0.28	0.67	2-4	19	3.95±0.10	0.23	3-4
fernandinae		4.00				4.00		
TAIL BLACK—TOTAL EXTENT								
auratus	39	36.72±1.14	3.58	28-45	36	35.83±1.08	3.21	27-42
chrysocaulosus	28	38.29±1.04	2.76	35-44	29	36.86±1.20	3.24	32-44
gundlachi	16	32.31±0.68	1.35	31-35	11	30.55±1.46	2.42	27-35
fernandinae		none—tail barred				none—tail barred		
TAIL BLACK—OUTER RECTRIX								
auratus	14	9.00±1.22	2.29	4-13	14	10.71±1.22	2.27	6-14
chrysocaulosus	17	8.29±0.94	1.93	6-14	25	7.80±0.80	1.98	5-15
gundlachi	12	8.17±0.60	1.03	6-10	7	8.57±0.96	1.28	7-11
fernandinae								
NUMBER OF TAIL BARS—CENTRAL RECTRIX								
auratus	13	1.46±0.98	1.76	0-6	12	1.42±1.30	2.23	0-6
chrysocaulosus	15	4.73±0.36	0.70	4-6	18	4.17±0.40	0.86	2-5
gundlachi	9	3.10		2-4	5	3.60		2-5
fernandinae								
NUMBER OF TAIL BARS—EDGE OF OUTER RECTRIX								
auratus	13	4.23±0.56	1.01	2-5	11	5.09±0.74	1.22	0-7
chrysocaulosus	27	7.15±0.46	1.20	2-8	36	7.06±0.28	0.83	5-8
gundlachi	23	7.65±0.30	0.71	6-9	20	8.05±0.18	0.39	7-9
fernandinae	15			11-18	14			11-19

* See table 1. Numbers refer to measurements in millimeters, unless otherwise indicated and except for Tail Bar and Rump Score characters. **Depth of breast bars.

in *chrysocaulosus* is also evident in the markings of the lower abdomen. These vary in flickers from bars, to chordate (narrower reduced) bars, to spots. Flickers from southern Florida generally have chordate bars, though some show normal bars (13 of 41 examined for this feature) and a few exhibit spots (4 of 41). In contrast, nearly all (38 of 40) *chrysocaulosus* adults checked for this character were barred, with only two birds showing chordate bars. Females tend to have larger, more bar-like spots, and more abdominal barring than males. No geographic variation was evident in this character.

BREAST PATCH: The black breast patch characteristic of *Colaptes auratus* tends to take on a crescentic shape in the *auratus* and *cafer* subspecies groups, and to be more globular in the other groups. *Chrysocaulosus* exhibits a broad patch which is slightly, if at all, crescentic. As the patch is equally extensive laterally in both *auratus* and *chrysocaulosus*, the difference in depth best expresses its more crescentic shape in *auratus*; in *chrysocaulosus* it averages 5 mm deeper than in southern Florida *auratus* (both sexes; see table 2). This difference is statistically significant. No difference in the size of the patch is detectable among samples from various parts of Cuba. Females average 3% shallower breast patches than males.

MALAR PATCH: The malar area is almost equally extensive in the *chrysocaulosus* and *auratus* groups. Following the practice used in dealing with flicker hybridization (Short, 1965: 320-21), malar color was scored from 0 to 4. Briefly, an all black malar is scored 0, an all red one 4, and intermediate states from 1 to 3 (1—black with 1% to 25% red, 2—mixture of red and black, from 25-75% red, and 3—black present, but patch more than 75% red). Four of 35 Cuban *chrysocaulosus* show red malar traces (score—1, see table 3) Seven of 38 southern Florida *auratus* show such traces (including one female with *red* in its malar area). The black (or black and red) color of the malar area does not extend forward to the bill in most male flickers, but is interrupted by a small anterior area colored tan or tan and gray. This area averages 22% smaller in *chrysocaulosus* than in Florida *auratus* (sample sizes 19 and 20 respectively). The Cuban flickers thus have a slightly longer black malar patch than do flickers of the *auratus* group. Most *chrysocaulosus* males (11 of 19) show some gray traces in the otherwise tan area in front of the black malar, while most males of the *auratus* group (19 of 20 southern Florida males) show no gray. While the malar region in females of both subspecies groups is largely vinaceous tan, most individuals of both groups show slight to moderate amounts of gray.

BACK BARRING: The back bars of *chrysocaulosus* average deeper

than those of Florida *auratus* (table 2). Females show deeper bars than males, their bars averaging 6% deeper in the *auratus* and *chrysocaulosus* subspecies groups. Western Cuban *chrysocaulosus* average deeper bars than eastern Cuban birds, but the difference, which appears in samples of both sexes, is not significant. Mean back bar depth in the eastern Cuban sample is more nearly comparable to that in Florida birds, as males average bars 2.73 mm deep (N = 14) and those of females average 2.99 mm (N = 13; compare with values in table 2). The bar measured is the outer bar of a randomly selected feather in the interscapular region of the specimen's back. This outer bar was measured at its greatest depth, usually along the rhachis of the feather. A sufficiently large light brown area (bar) exists beyond the outer dark bar to allow measurements to be taken on all but extremely worn birds. In addition to measuring the outer dark bar, the total number of dark bars (complete and incomplete; the latter, usually the basal bar, was noted as ½, ½, or ⅔ complete) on the feather was noted. Males average 10% more barring than females, though the bars of the latter are usually deeper. Mean values for the two samples are as follows:

	Males	N	Females	N
chrysocaulosus	2.14	20	1.98	21
Florida *auratus*	1.85	17	1.54	12

Thus *chrysocaulosus* tends to have a greater number of complete bars per back feather, as well as deeper bars than Florida *auratus*.

BACK COLOR: The dorsal brown color in flickers shows considerable variation with wear and exposure to light. Flickers of both the *chrysocaulosus* and *auratus* groups have much darker backs in fall after the annual molt than in the breeding season. Southern Florida *auratus* in the fall have dark olive brown backs with a faint greenish cast, and a few birds show strongly greenish backs (3 of 74 adults). One individual (MCZ no. 229094) from Tarpon Springs has red, as well as green, on some of its back feathers. During the fall and winter the yellow-green gradually disappears; this is mainly due to fading, but is partly from wear of the feather tips, which tend to be more strongly olive. By June the back feathers are dull, even grayish brown. Individuals of *chrysocaulosus* in fresh fall plumage are not nearly so dark-backed as comparable Florida *auratus*, but show more yellow-green. Several specimens have backs so yellow-green they approach "*Chrysoptilus*" *melanochloros* in color. Of 72 adults, 7 are strongly yellow-green, and 4 birds show considerable red mixed with the yellow-green. Ripley and Watson (1956) noted this erythristic tendency

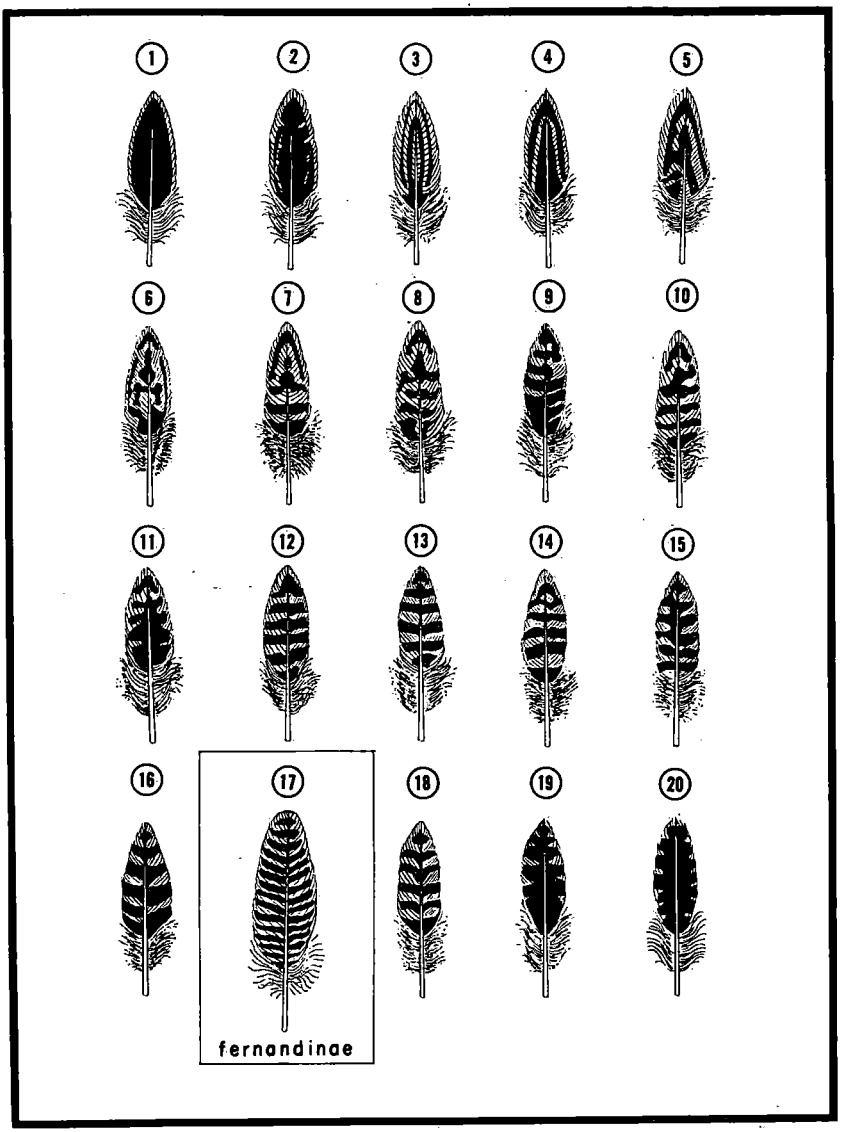
in *chrysocaulosus*. Much of the yellow-green cast is lost with wear, so that birds taken in early summer are paler and less yellow-green. Compared with early summer Florida *auratus*, the worn, early summer *chrysocaulosus* are generally browner and paler, and they retain a light yellow cast which distinguishes them from virtually all Florida birds. No sexual differences or geographic variation in back color were noted in *chrysocaulosus*.

RUMP: North American flickers (*C. auratus*) generally have a white rump patch. However, occasional individuals of the *auratus, cafer,* and *chrysoides* subspecies groups, and all birds of the *chrysocaulosus* and *mexicanoides* groups exhibit black markings of varying shapes on their rump feathers, as do some species of the subgenus *Chrysoptilus* (*C. melanochloros, C. punctigula*). The condition of the rump patch was assigned scores from 0 to 4, with 0 representing an unmarked rump condition and 4 the fully marked (spots and/or bars) condition, in which the rump shows as much or more dark coloring as it does white between the marks. A score of 1 represents a rump patch with 6 or fewer spots or bars. Individuals are scored 3 if they exhibit a well marked rump but with considerable white between spots. The intermediate condition (more than 6 markings present, but visible effect that of a definite patch with some markings) is assigned a score of 2. Mean rump scores for the southern Florida and Cuban samples are included in table 2. Of 106 southern Florida birds 15 scored 2 or 3, giving some overlap. Most *chrysocaulosus* (58 of 69 specimens) had completely barred and spotted rumps. All 11 specimens scoring 2 or 3 came from eastern Cuba, so more variation in rump markings is apparent in the easten population. A sexual difference in amount of marking seems to hold true for all populations of *C. auratus;* females consistently show higher scores in rump markings; fewer females of *chrysocaulosus* score 2 and 3 than males, and more *auratus* group females than males show spotting on the rump.

UPPER TAIL COVERT PATTERN: Chapman (1891) reported the great variability in markings of the upper tail coverts in the *auratus* group and depicted some of the patterns. Though not illustrating the entire variability I encountered, figure 1 shows the major patterns in the central (largest) upper tail coverts of West Indian and southern Florida flickers. The major patterns grade into one another, as shown by their sequence in the figure. The number of individuals (breeding only) showing each type of pattern is indicated in table 4. If an individual has a different pattern on each of the two central feathers, one-half a specimen is listed for each pattern. Also, where individuals show composite patterns with one part of a feather exhibiting one

Figure 1

VARIATION PATTERNS IN CENTRAL UPPER TAIL COVERTS OF WEST INDIAN AND SOUTHERN FLORIDA FLICKERS



Pattern types include all black (no. 1), V-striped (nos. 2-6), horseshoe-tipped (nos. 7-12) and barred (nos. 13-20).

pattern and another part still another pattern, one-half an individual is listed for each. The table shows that most flickers of the two forms have barred central upper tail coverts (patterns 13-18). Large horseshoe-tipped patterns (8-11) and very black patterns (19,20,1,2,4) are uncommon in Cuban *chrysocaulosus*, and in fact variants from the barred pattern comprise less than a quarter of the sample. Southern Florida flickers exhibit more patterns, and greater numbers (45% compared with 24% in *chrysocaulosus*) show black, horseshoe-tipped and V-striped patterns. The sexes do not differ in this feature, and no geographic variation was detected in Cuban birds. Chapman (1891) noted that juvenile *C. "auratus"* are more prone to show the simple barred pattern than adult flickers, and my investigations bear this out. However, I can find no definite evidence that changes from aging occur following the postjuvenal molt. Subadult males (first year birds) in small samples so far studied show no difference in frequency of various patterns from fully adult birds. The pattern progresses from the central tail coverts anteriorly to the smaller coverts, generally in a direction away from the barred condition. Finally, strong asymmetry in pattern is not uncommon in flicker upper tail coverts, as Chapman noted (1891), but only 1 Florida bird in 30 and 4 *chrysocaulosus* in 35 exhibit strong asymmetry between the two central upper tail coverts.

AMOUNT OF BLACK IN TAIL: All forms of *Colaptes auratus* have a black-tipped tail. Three measurements were taken of the extent of the black area: 1) the greatest extent of solid black from the tail tip toward the tail base (table 2); 2) the extent of black on the central rectrices from the tips toward their bases; and 3) the extent of black from the tip toward the base of the outer rectrix (rectrix 5), measured along the feather shaft (table 2). The data show that *chrysocaulosus* has less black in its tail than southern Florida *auratus*. The outer rectrices of *auratus* clearly have larger black tips than do those of *chrysocaulosus*. Furthermore, the black tip of the outer rectrix in the latter has a large border of yellow-white which restricts the dark area to an island. The black tips in *auratus'* outer rectrices are themselves tipped with a narrow white border, but the black area reaches the sides of the feather below this border. Hence, the black area on the outer rectrices of *auratus* is two to three times greater than that in the outer rectrices of *chrysocaulosus*. The measurement of greatest extent of black in the tail (measurement 1 above) seems to show that *chrysocaulosus* has a larger black area than *auratus*. However when the longer tail of *chrysocaulosus* is taken into account, the measurements become comparable and show the two forms to be nearly alike

only because *chrysocaulosus* has elongate central rectrices. The black lanceolate tips of these protrude, increasing the total extent of the black area, and making the amount of black appear comparable in *auratus* and *chrysocaulosus*. Means for the extent of black in the central rectrices are:

	Males	N	Females	N
Florida *auratus*	34.58 mm	12	31.90 mm	10
chrysocaulosus	38.17 mm	18	37.67 mm	18

The elongate tips of these feathers account for the seemingly greater amount of black in the central rectrices of *chrysocaulosus*. Comparison of rectrices 2-4 in the two forms clearly indicates a reduced amount of black in the tail of *chrysocaulosus*, although modification of the central rectrices tends to minimize the difference between the two forms. No geographic variation is apparent for this character in cuban *chrysocaulosus*. There is no sexual difference in the extent of black in the tail. After the annual molt the black tips of the rectrices begin to wear and the black area of the tail gradually diminishes.

TAIL BARRING: Both *C. a. chrysocaulosus* and *C. fernandinae* have more bars in their rectrices than does continental North American *C. auratus* (table 2). The number of bars visible on the central rectrices of *chrysocaulosus* averages 4-5 compared with 1-2 in Florida *auratus*. Likewise, the number of bars reaching the outer edge of the outer (5th) rectrix averages about 7 in *chrysocaulosus* and only 4-5 in Florida *auratus*. One or more bars are usually evident in all rectrices of *chrysocaulosus* but number 2. In *auratus* rectrices 2-4 usually lack bars, while bars are absent frequently on rectrix 1 and even occasionally on number 5. No sexual dimorphism was evident in extent of barring, and no geographical variation was detected in *chrysocaulosus*.

NUCHAL PATCH: Both the *auratus* and *chrysocaulosus* subspecies groups have red nuchal patches. The only reduction in extent of the patch noted in the forms being considered was in two southern Florida *auratus*. Reduced nuchal patches were assigned a score of 1, and the results are indicated in table 3. Very extensive nuchal patches occur in a few Cuban flickers showing erythrism in back color, and in a male (USNM 453896) having red extending from the nuchal patch toward the back and superciliary stripe, and onto the sides of its neck (this bird also has red feathers in the subocular region). Fifteen of the *chrysocaulosus* specimens examined show a slightly more extensive nuchal patch than Florida *auratus* specimens. Feathers in the nuchal area of Cuban *chrysocaulosus* show a strong tendency toward melan-

ism. Test (1940) noted two such melanic individuals. The generally darker red of *chrysocaulosus*' nuchal feathers seems largely attributable to an increase in melanins. Most Florida *auratus* specimens have orange-red nuchals, though some show darker red as in *chrysocaulosus*. No sexual or geographic variation was noted in this character.

TABLE 3. ANALYSIS OF COLOR CHARACTERS EMPLOYED IN HYBRID INDEX*

Form	N	X ± 2SE	SD	R	N	X ± 2SE	SD	R
	MALE NUCHAL SCORE				FEMALE NUCHAL SCORE			
auratus	55	0.00	—	0	51	0.04 ± 0.06	0.19	0–1
chrysocaulosus	33	0.00	—	0	38	0.00	—	0
gundlachi	20	0.00	—	0	15	0.00	—	0
fernandinae	30	3.83 ± 0.14	0.38	3–4	33	4.00	—	4
	MALE THROAT COLOR SCORE				FEMALE THROAT COLOR SCORE			
auratus	47	0.20 ± 0.12	0.40	0–1	47	0.09 ± 0.08	0.21	0–1
chrysocaulosus	33	0.00	—	0	37	0.00	—	0
gundlachi	20	0.00	—	0	16	0.00	—	0
fernandinae		see text				see text		
	MALE EAR COVERT SCORE				FEMALE EAR COVERT SCORE			
auratus	38	0.37 ± 0.14	0.46	0–1	32	0.42 ± 0.16	0.46	0–1
chrysocaulosus	31	0.48 ± 0.16	0.44	0–1	28	0.50 ± 0.18	0.47	0–1
gundlachi	23	0.28 ± 0.14	0.33	0–1	20	0.23 ± 0.16	0.38	0–1
fernandinae		see text				see text		
	SHAFT COLOR SCORE—♂ ♂ and ♀ ♀				MALE MALAR COLOR SCORE			
auratus	70	0.44 ± 0.12	0.51	0–1.5	38	0.20 ± 0.14	0.43	0–1.5
chrysocaulosus	76	1.15 ± 0.14	0.59	0–2	35	0.11 ± 0.10	0.32	0–1
gundlachi	44	0.26 ± 0.12	0.41	0–1	24	0.25 ± 0.18	0.44	0–1
fernandinae		see text			30	0.43 ± 0.18	0.50	0–1
	MALE CROWN COLOR SCORE				FEMALE CROWN COLOR SCORE			
auratus	35	0.26 ± 0.16	0.40	0–1	32	0.27 ± 0.16	0.42	0–1
chrysocaulosus	31	0.03 ± 0.06	0.18	0–0.5	36	0.03 ± 0.06	0.17	0–0.5
gundlachi	16	0.00	—	0	13	0.07 ± 0.08	0.14	0–0.5
fernandinae		see text				see text		

* See table 1 for statistical terms and samples used. See text for discussion of scores.

THROAT COLOR: Cuban *chrysocaulosus* individuals resemble southern Florida birds in their throat color, except that the tan is usually a richer vinaceous. Some individuals (25 of 70 adults) have the frosted appearance of certain *auratus* individuals whose throat feathers have a whitish-gray cast. No individual of *chrysocaulosus* approached the pale variants found among Florida *auratus* specimens. Neither did any *chrysocaulosus* exhibit definite gray coloring (scored 1 following hybrid index scores used by Short, 1965: 318) found in a few Florida *auratus* individuals (table 3). No sexual differences or geographical variation in this character were detected.

COLOR OF EAR COVERTS: The ear covert or auricular area, including its subocular extension to the mandible, is similarly colored in the *auratus* and *chrysocaulosus* groups. As in the case of throat color, *chrysocaulosus* exhibits a richer, deeper vinaceous tan ear covert color. I have already discussed (1965: 320) the appearance of gray at the posterior auricular edge in flickers of the *auratus* group and the effects on this character of hybridization between the *cafer* and *auratus* groups. Individuals of Florida *auratus* and of *chrysocaulosus* exhibiting gray color in feathers at the rear of the ear coverts were scored 1, and those lacking such gray were scored 0. Table 3 shows that the tendency for gray to appear in the posterior auricular feathers is as great, if not greater, in *chrysocaulosus* as it is in Florida *auratus*. The sexes show no difference in this feature, and no geographic variation is evident. As in the case of throat color, seasonal variation involves a slight paling from fall to the breeding season, presumably from exposure to light.

COLOR OF UNDER WINGS AND TAIL (= SHAFT COLOR): As shaft color varies the same way in both sexes, data from males and females can be treated together (Short, 1965: 321). Shaft color varies more in *chrysocaulosus* than in Florida *auratus*, and is usually a deeper golden instead of a lemon yellow. Shaft color was graded for table 3 from 0 to 2 as follows:

Score	*Condition*
0	— lemon yellow
0.5	— lemon yellow tending toward golden yellow
1	— yellow with deeper gold or orange tinge
1.5	— golden yellow, orangish traces in shafts
2	— definite orange-gold in shafts and barbs

More than half the Florida birds score 0, and but 3 of 70 birds score above 1. Only 16 of 76 *chrysocaulosus* specimens score below 1 (8 score 0), with most individuals (48) scoring 1 and 1.5. This difference

is highly significant. (For a discussion of changes in shaft color from wear and fading see Short, 1965: 321). No geographical variation in shaft color occurs among Cuban *chrysocaulosus* populations.

CROWN COLOR: Generally the gray crown color of *chrysocaulosus* is a shade lighter than in Florida *auratus*. Fresh-plumage fall *chrysocaulosus* differ less in crown color from worn spring and summer birds than do *auratus* specimens because *chrysocaulosus* tends to have less brown in the edges of the crown feathers following the annual molt. Hence, the crowns of fall *chrysocaulosus* are quite gray, while those of fall Florida *auratus* are more or less suffused with brown. As a result of retention of brown in some spring birds, plus introgressive effects from hybridization between the gray-crowned *auratus* and brown-crowned *cafer* groups (Short, 1965), spring and summer specimens of Florida *auratus* show a greater incidence of brown in the crown than do comparable specimens of *chrysocaulosus*. In table 3 crown color scores range from 0 (gray crown) through 0.5 (slight brown traces) to 1 (definite brown coloring in a portion of the crown). Only 2 *chrysocaulosus* specimens score 0.5 and none score 1, while 3 Florida *auratus* score 0.5 and 16 score 1. Occasional specimens of *chrysocaulosus* exhibit a faint olive wash on their crowns, not seen, or marked by brownish in Florida birds. One *chrysocaulosus* male (MCZ 80790) has rusty crown feather edges; this bird also has red on its back. Another male (USNM 177495) has melanic tips on its crown feathers, with tiny red areas within the black. Melanic effects were not otherwise noted in crowns of Cuban birds, though two Florida *auratus* specimens exhibit blackish-gray coloring of some crown feathers. No sexual differences in crown color were apparent among these forms, and no geographical variation was detected among Cuban samples.

HYBRID INDEX: In view of the modifications *chrysocaulosus* shows in some characters used in the hybrid index devised (Short, 1965) to analyze effects of interbreeding between the *auratus* and *cafer* subspecies groups on various flicker populations, hybrid index analysis of the Cuban birds is relatively unimportant. However, this information is presented for the sake of treating all forms of *C. auratus* completely with one set of standards. The hybrid index characters are: crown color, throat color, ear covert color, extent of nuchal patch, malar color (males) and shaft color. Scores for each character range from 0 for the *auratus* (subspecies group) condition to 4 for the *cafer* (subspecies group) condition: Possible hybrid index values thus range from 0 for an individual registering like *auratus* in all 6 (or 5 in the case of females) characters to 24 for a male bird like *cafer* in all characters, and 20 for such a female. Hybrid index values range in Florida

auratus (both sexes) from 0 to 3.5, and in *chrysocaulosus* (also samples for both sexes) from 0 to 3. Statistical treatment of the data follows:

	Males			Females		
	N	X ± 2 SE	SD	N	X ± 2 SE	SD
Florida *auratus*	37	1.35 ± 0.36	1.08	36	1.22 ± 0.34	1.02
chrysocaulosus	35	1.90 ± 0.22	0.66	37	1.57 ± 0.22	0.66

Only presumed breeding Florida *auratus* and late winter and spring specimens of *chrysocaulosus* were used. The sexual difference shown is due largely to the additional malar color character in the male hybrid index. The higher index shown by *chrysocaulosus* is chiefly due to the shaft color difference between the forms. Florida *auratus* shows lower scores than *chrysocaulosus* only in shaft color. The two forms show similar ear covert scores, but the Florida birds score higher in nuchal patch (females only), throat color, malar color, and crown color (table 3). These differences are probably the result of introgressive effects from interbreeding between the *auratus* and *cafer* subspecies groups on the Florida flicker population (Short, 1965: 361 ff).

BARRING ANTERIOR TO BREAST PATCH: Several uncommon color pattern features, such as reddish back color, and melanic tendencies in crown and nuchal areas, have been mentioned above. One not previously noted is the tendency, more common in juvenile flickers, for small bars to develop anterior to the breast patch. Only 2 Florida specimens of 41 show a single fine bar anterior to the breast patch; 6 *chrysocaulosus* specimens have barring anterior to the breast patch, including 2 with 2 bars.

YELLOW AND TAN CAST OF UNDERPARTS: A characteristic feature of the *auratus* subspecies group is the presence on the underparts of a tan or vinaceous tan cast over the feathers, especially those of the sides of the breast. This is especially pronounced in fresh plumaged fall birds, which also have pale yellow about the tips of the feathers, especially on the lower breast and abdomen. Both the yellow and tan fade and, as fading occurs during the year, feather wear also diminishes the extent of yellow and tan color. The *chrysocaulosus* group exhibits a similar though paler and less extensive tan cast below, but shows more yellow. The yellow color is sufficiently bright and extensive to be retained into the spring and is even discernible in worn summer specimens. Specimens from the vicinity of Trinidad, Cuba, are especially yellow below. No sexual difference was noted in this character.

Colaptes auratus gundlachi Cory 1886

GENERAL DIAGNOSIS. Resembles *C. a. chrysocaulosus,* but differs from that form as follows:

a) breast patch relatively shallower
b) color of underwing and tail surfaces yellow, about as in *auratus* subspecies group and not golden as in *chrysocaulosus*
c) wings shorter (no overlap)
d) tail actually and relatively shorter
e) bill shorter
f) tarsometatarsus shorter

WING LENGTH: This race has the shortest wings of any population of *Colaptes auratus;* measurements show no overlap with *C. a. auratus* or with *chrysocaulosus* (table 1). The slightly greater mean wing length of females is probably an effect of small sample size.

TAIL LENGTH: The tails of Cayman flickers average 15% shorter than those of *chrysocaulosus* (table 1) with no overlap. A slight overlap is apparent between *gundlachi* males and Florida *auratus* males; 3 of 13 *gundlachi* overlap 2 of 33 *auratus.* The mean tail/wing ratio of 22 male and female *gundlachi* is .715 (range .65 to .74), in between the .695 for Florida *auratus* and the .754 for *chrysocaulosus,* though closer to *auratus.* Thus although having a tail slightly longer in proportion to its wing than *auratus,* perhaps because of its shorter wings, *gundlachi* is more like *auratus* than *chrysocaulosus.* One would expect that if factors associated with insularity are responsible for the shorter wings and longer tail of *chrysocaulosus,* the Grand Cayman Island flicker might exhibit the effects even more markedly than it does.

BILL LENGTH: Grand Cayman flicker bills are 10-12% shorter than those of Cuban birds (table 1) and the shortest of all forms of *Colaptes auratus.* Bills of females average 3.9% shorter than those of males.

TARSAL LENGTH: The tarsal length of *gundlachi* is about 9-10% less than that of *chrysocaulosus* (table 1). Females average 2% shorter tarsi than do males. The tarsal length/bill length ratio of *gundlachi* averages .961 (range = .87-1.05), with a range and mean closely approaching that of *chrysocaulosus.*

WING SHAPE AND LENGTH OF 10TH PRIMARY: As in *chrysocaulosus,* the very short wings of *gundlachi* are due to reduction in size of the longer primaries. The 6th primary is usually longest in *gundlachi,* and P2 and P3 are usually longer than P9. Thus, the inner primaries, P5-8, are proportionally longer than the central ones. Despite the very small size of *gundlachi,* its outer (10th) primary is nearly as long as in southern Florida birds (table 1). The close similarity in wing shape in

chrysocaulosus and *gundlachi* is shown by expressing the lengths of the outer two primaries and wing length of *gundlachi* as percentages of the same measurements in both southern Florida *auratus* and Cuban *chrysocaulosus*:

	Wing length	P9	P10
Florida *auratus*	88%	94%	98%
chrysocaulosus	90%	91%	89%

These percentages are the averages for both sexes combined. Thus the outer primaries, as well as total wing length of *gundlachi*, are 9-11% shorter than those of *chrysocaulosus*. Though *gundlachi* has 12% shorter wings than *auratus*, its P10 is but 2% and its P9 6% shorter. Both *gundlachi* and *chrysocaulosus* differ from Florida *auratus* in having relatively longer inner and outer primaries, but shorter central primaries.

BREAST SPOTTING: The breast spots of *gundlachi* are similar in shape to those of *chrysocaulosus*, but tend to be larger; they average .35 mm deeper and .26 mm wider despite *gundlachi's* much smaller size. The spots are thus bar-like in averaging 1.30 millimeters broader than deep in the males and 1.60 millimeters broader in females (see *chysocaulosus* breast spotting section). No individual *gundlachi* had spots deeper than broad, as was found in 5% of *chrysocaulosus* and 32% of Florida *auratus* specimens. Half of the *gundlachi* specimens (6 of 12) checked for shape of the abdominal markings showed chordate bars, while the rest had regular bars.

BREAST PATCH: As in *chrysocaulosus* the breast patch of *gundlachi* is non-crescentic, but it is relatively narrower than in the Cuban bird (table 2). In both sexes of *gundlachi* the breast patch averages more than 20% narrower than in *chrysocaulosus*, while the size differences between them would appear to warrant only about a 15% difference. The breast patch of the Grand Cayman birds is slightly deeper, and hence is relatively deeper, than that of the larger Florida *auratus*, though not nearly so deep as in *chrysocaulosus*. Females average 7% narrower patches than males.

MALAR PATCH: 6 of 24 *gundlachi* males showed some red in their otherwise black malar patches, though no individual showed enough red to score higher than 1. The mean score (table 3) does not differ significantly from that of *chrysocaulosus* and Florida *auratus*. None of the females examined had black malar traces. Male Grand Cayman flickers have a small tan or tan and gray area anterior to the black malar, which is larger than in *chrysocaulosus* and about as in *auratus*. Of 13 females 5 had gray and tan malar regions.

BACK BARRING: The back bars of *gundlachi* average between those of *chrysocaulosus* and *auratus* in depth (table 2). Considering the smaller size of *gundlachi*, the bars are hence relatively deeper than in *auratus*, thus being similar to those of *chrysocaulosus*. Females show broader bars than males.

BACK COLOR: The backs of Grand Cayman flickers are similar in color to those of *chrysocaulosus*, but tend to be a trifle darker. Seasonal changes are similar in the two forms. The yellow-green cast of the back feathers resembles that in *chrysocaulosus*; 3 of 40 adults show definite green color on their backs, and one (MCZ 68281) has some reddish feathers.

RUMP: The rump markings of *gundlachi* are more often in the form of spots than those of *chrysocaulosus*. Males have whiter, less marked rumps than males of *chrysocaulosus* (table 2). Although females score about as in *chrysocaulosus*, the tendency for the markings to be less bar-like and more spot-like makes their rumps look whiter than those of *chrysocaulosus* females. Of the 11 out of 41 adults that score 2 or 3, only 1 was a female.

UPPER TAIL COVERT PATTERN: Only 1 of 27 *gundlachi* specimens exhibits an entire pattern not of the barred type; 4 others either have one of the central covert feathers barred and one horseshoe-tipped (patterns 15 and 7, respectively—1 specimen), or show partial barred and horseshoe-tipped or v-striped patterns (combinations of patterns 18 and 7, 16 and 1, 18 and 1, in 3 individuals). Thus all but one of the Grand Cayman flickers show a barred or partially barred pattern (see fig. 1 and table 4). This form shows less variation from the barred condition than *chrysocaulosus* or races of the *auratus* and *cafer* subspecies groups. Three specimens of *gundlachi* exhibit strong asymmetry in tail covert pattern, showing composite patterns of numbers 15 and 7 (noted above), and 15 and 18 (2 specimens). No sexual differences were noted.

AMOUNT OF BLACK IN TAIL: Like *chrysocaulosus*, *gundlachi* has somewhat less black in its tail than does Florida *auratus* (table 2). This is due to the more attenuate central rectrices of *gundlachi* and *chrysocaulosus*. These rectrices are lanceolate and the edges of the vanes at the feather tips grade in a long gently concave arc into the vanes toward the feather cases. In *auratus* the vanes of the pointed tips of the central rectrices have more sharply concave margins, which make the tips less attenuate and the shape of the feathers less lanceolate. The shafts of the central rectrices are slightly more rigid in *gundlachi* than in *C. a. auratus*.

TABLE 4. UPPER TAIL COVERT PATTERNS OF WEST INDIAN FLICKERS*

Pattern	*auratus*	*chrysocaulosus*	*gundlachi*		
1	0.5	0.5	1.0		
2	2.5	—	—		
3	1.0	—	—	*auratus*	— 7.0 = 22%
4	0.5	1.0	—	*chrysocaulosus*	— 3.5 = 7%
5	2.0	1.5	—	*gundlachi*	— 0.0 = 0%
6	1.0	1.0	—		
7	0.5	4.0	1.0		
8	1.5	—	—		
9	—	—	1.0	*auratus*	— 6.5 = 21%
10	—	1.5	—	*chrysocaulosus*	— 8.5 = 16%
11	3.0	—	—	*gundlachi*	— 2.0 = 7%
12	1.5	3.0	—		
13	3.5	6.0	—		
14	—	5.5	1.0		
15	—	5.0	6.0		
16	0.5	5.5	3.0	*auratus*	— 17.0 = 55%
17		(*fernandinae* pattern)		*chrysocaulosus*	— 39.5 = 76%
18	3.0	16.5	13.5	*gundlachi*	— 24.0 = 89%
19	8.5	1.0	—		
20	1.5	—	0.5		
N	31.0	52.0	27.0		

* Including breeding sample from southern Florida (*C. a. auratus*). See fig. 1 for patterns. Adults of both sexes are included in the table.

TAIL BARRING: The tail of *gundlachi* averages even more barred than that of *chrysocaulosus*. The number of bars on the central rectrices ranges from 2 to 5 in 14 adults, about as in *chrysocaulosus*, while the number of outer tail bars averages more than in *chrysocaulosus*, the difference being significant in the case of females (table 2). All rectrices of *gundlachi* have at least one bar present, including the 2nd rectrix which is usually unbarred in *chrysocaulosus*. No sexual difference in extent of barring was noted.

NUCHAL PATCH: The color and extent of the nuchal patch in *gundlachi* are similar to those of *chrysocaulosus*. Very extensive nuchals, as seen in a few *chrysocaulosus*, were not found in the *gundlachi* specimens. Effects of increased melanism in the nuchal patch, noted in *chrysocaulosus*, are also evident in *gundlachi*. None of the Grand Cayman flicker specimens has a reduced nuchal area.

THROAT COLOR: As in *chrysocaulosus* (table 3).

COLOR OF EAR COVERTS: Scoring for this feature (table 3) indicated a slightly lower tendency for gray to appear in the posterior auricular feathers of *gundlachi* than in *C. a. auratus* and *C. a. chrysocaulosus*. Caymanian birds, like Cuban *chrysocaulosus*, exhibit deeper vinaceous ear covert color than Florida birds.

COLOR OF UNDER WINGS AND TAIL: Unlike *chrysocaulosus*, *gundlachi* has shafts colored essentially yellow, as in the continental population of the *auratus* subspecies group. Shaft color scores attained by the Grand Cayman birds range from 0 to 1 (table 3). Only 23% of the *chrysocaulosus* specimens score below 1, while 79% of the *gundlachi* specimens do so.

CROWN COLOR: Fall specimens of *gundlachi* have the gray crown feathers tipped with dark gray or blackish melanin which gives them a dull, barred effect. These dark edges show traces of red in a few individuals. Also evident is a strong tendency for black to occur along the feather shafts from the basal gray areas up to the centers of the feathers, where the black often spreads into the barbs. These melanic effects are not taken into account in the scoring results (table 3). During the year the crown feather edges wear away, leaving the crown quite gray. How the brown color effects seen in *auratus* are related to the melanic tendencies in *gundlachi* is not clear. If there is simply a replacement or a change in frequency of the kinds of melanins present, then the scoring in table 3 may not represent the correct situation.

Hybrid Index: Its low scores for throat, ear covert and shaft color, and scores similar to those of *chrysocaulosus* for nuchal patch, malar color and crown color, give *gundlachi* a very low hybrid index. The values obtained are as follows:

	N	X ± 2 SE	SD
Males	23	0.89 ± 0.32	0.78
Females	19	0.50 ± 0.28	0.60

Colaptes fernandinae Vigors 1827

Although Vigors put it in the genus *Colaptes*, this species was later placed in the monotypic genus *Nesoceleus* Sclater and Salvin (1873) erected for it. The characters of the genus as Ridgway (1914) lists them occur in other *Colaptes*, except for *fernandinae's* streaked crown, lack of black in the tail, completely barred tail, and lack of feather covering over the nostrils. The genus is largely based on the last mentioned feature, which is also found in the related woodpecker genera *Celeus* (including *Micropternus*) and *Meiglyptes*. In other picid genera the prefrontal feathers usually extend anteriorly more

or less to obscure the nostrils. The genera *Picus* (species *erythropygius* only), *Dinopium, Chrysocolaptes* and *Blythipicus* have the nostrils variably exposed with prefrontal feathers reduced in size and/or number. Considerable interspecific and even intraspecific variation in this condition is encountered in *Chrysocolaptes* and *Blythipicus*. It is noteworthy that *Picus, Dinopium, Chryosocolaptes* and *Blythipicus* are directly or indirectly related to *Celeus* (Bock, 1963: 277), and through that genus to colaptine woodpeckers. As the function of the feather covering is not clear, the significance of its loss cannot be evaluated, especially as it is absent in both specialized (= arboreal, strongly woodpecking) woodpeckers, like *Blythipicus* and generalized (= limited or weakly woodpecking, arboreal or terrestrial) woodpeckers such as *Celeus*.

Bond (1950: 92) has noted the close relationship of *Nesoceleus* to *Colaptes*. Fernandina's flicker has the general appearance of a flicker; it is largely terrestrial, moreso than *Colaptes auratus chrysocaulosus*, and does not differ markedly in habits from other flickers. Mayr, Linsley, and Usinger (1953: 50-51) stress that the size of the gap between genera ought to be in inverse ratio to the size of the unit being considered, in order to prevent the recognition of unjustified monotypic genera. They further state (p. 30) that the essential property of a genus is its morphological distinctness, usually correlated with occupation of a distinctly different ecological niche. I consider these points well taken, and find that this species does not merit generic separation from other flickers. It does differ sufficiently, however, to warrant maintaining it in a separate subgenus.

The flickers of this subgenus resemble other flickers in having yellow or red shafts, particularly of the rectrices and remiges, a relatively long, pointed bill not highly modified for woodpecking, legs, feet, and tail relatively unspecialized for arboreal habits, a strongly barred dorsal pattern, much barring in the tail, sexual recognition dependent upon a malar patch, and terrestrial foraging habits. Features distinguishing this from other subgenera are:

1) streaked crown
2) lack of black area in the completely barred tail
3) nostrils not covered by prefrontal feathers

GENERAL DIAGNOSIS: Diagnostic features of the species are those of the subgenus *Nesoceleus*. Resemblance to the *auratus* and *chrysocaulosus* groups of *Colaptes auratus* is shown by the generally similar body shape and bill, and by the similarities of *fernandinae* to other flickers noted above. Fernandina's flicker differs from *C. a. chrysocaulosus* in these features:

a) tail completely barred
b) underparts barred, not spotted
c) no breast patch
d) throat streaked, including malar area of female
e) ear coverts cinnamon-white, not vinaceous
f) dorsal dark bars broader, more numerous
g) nuchal patch absent, or traces only
h) crown streaked cinnamon-buff rather than solid gray
i) rump buff and dark barred as back, with no indication of white patch
j) longer wings, somewhat more rounded
k) longer tail, no black area present
l) longer bill, base of maxilla flattened (between nostrils)
m) longer tarsus
n) longer outer (10th) primaries

WING LENGTH: The wings of *fernandinae* are relatively short, but longer than in flickers of the *chrysocaulosus* group and southern Florida *auratus* (table 1). The birds are quite variable, with a range of variation in males encompassing the entire range of both *C. a. chrysocaulosus* and Florida *auratus*. Females average 2% shorter wings than males. Central Cuban birds average shorter wings than those from both eastern and western Cuba; in the total male wing length range of 138 to 157 mm, all birds with wings above 148 mm come from eastern and western Cuba, and all those with wings below 144 mm are central Cuban birds. Comparable values for females are: range 139 to 152 mm; only eastern and western Cuban females over 147 mm; and only central Cuban females below 143 mm. Despite these apparent differences, samples from different parts of Cuba are too small for them to be significant.

TAIL LENGTH: The tails of Fernandina's flickers average 10 to 13 mm longer than those of *chrysocaulosus* (table 1). Since *fernandinae* appears only slightly larger than *chrysocaulosus* in body size, though its longer bill and tail make it seem considerably larger, its tail is thus proportionally much longer, as the tail/wing ratios show (includes males and females):

	Range	Mean
Florida *auratus*	.63 - .74	.695
chrysocaulosus	.70 - .82	.754
fernandinae	.77 - .87	.806

The difference between *chrysocaulosus* and *fernandinae* is due to *fernandinae's* longer tail and to a lesser extent to its proportionally

shorter wings. The central rectrices of *fernandinae* are protracted as in *chrysocaulosus*, but the feathers and shafts are less sturdy. When viewed from the side the rectrices of *fernandinae* are nearly straight and barely curve downward over their entire length; those of *chrysocaulosus* curve perceptibly over their length, and curve downward markedly near their tips. Presumably these differences are correlated with the more arboreal habits of *chrysocaulosus* and more terrestrial habits of *fernandinae*. Geographic variation in tail length follows that described for wing length. Central Cuban *fernandinae* males have tails ranging in length from 110 to 121 mm, females from 111-121 mm. Males from eastern and western Cuba range from 114 to 128 mm., females from 116-130 mm. Again, the small sample sizes, 23 adults from eastern and western Cuba and 16 from central Cuba, render the difference less than significant, but similar differences in both characters, and in both sexes for each, show the central Cuban birds to be generally smaller than those from eastern and western Cuba.

BILL LENGTH: The bill is longer in *fernandinae* (table 1) than in any populations of *Colaptes auratus* except those of the *cafer* subspecies group from northwestern North America. Males in samples of the two Cuban species show no overlap in bill length, while females barely do so. Bills of females average 4% shorter than those of males. That central Cuban Fernandina's flickers tend to have shorter bills than those of eastern and western Cuba is suggested by these data:

	Males		Females	
	N	Mean	N	Mean
Eastern Cuba	9	32.76 mm.	14	31.76 mm.
Western Cuba	6	33.40 mm.	4	32.15 mm.
Central Cuba	8	32.05 mm.	9	30.77 mm.

The long curved bill of this form is similar in shape to that of *Colaptes auratus*. However, the ridge of culmen is reduced, especially posterior to the nostrils, and the dorsal surface of the bill between the nostrils and the forehead is thus considerably flattened. This feature is exhibited by another long-billed flicker, *Colaptes rupicola* of the South American Andes.

TARSAL LENGTH: As might be expected from its larger size, *fernandinae* has a longer tarsometatarsus than *chrysocaulosus* and Florida *auratus* (table 1). Its tarsal meaurements are similar to those of comparably sized northern North American *Colaptes auratus*. Females average 3% shorter tarsi than males. Tarsal length in *fernandinae* individuals is rarely as great as, and never more than bill length. The range in tarsal length/bill length ratios for 44 adults of this species

is .80-1.00, with a mean of .904. Means for the three races of *Colaptes auratus* considered in this report are .951, .961 and .973 for *chrysocaulosus, gundlachi,* and Florida *auratus,* respectively. This difference is due to the fact that, although bill length and tarsal length are relatively similar in the two species, the bill of *fernandinae* tends to be longer for its size than are its tarsometatarsi. The tarsus/wing length ratio of adult *C. fernandinae* compares with those of *chrysocaulosus, gundlachi* and Florida *auratus* as follows:

	N	Mean	Range
fernandinae	39	.198	.18 - .22
chrysocaulosus	52	.185	.17 - .20
gundlachi	29	.186	.17 - .20
Florida *auratus*	65	.182	.17 - .20

Tarsal length shows some geographical variation, with central Cuban *fernandinae* having longer tarsi in contrast to shorter wings, tails, and bills than birds from eastern and western Cuba. The following data suggest this variation, which again is not great enough, considering the size of the samples, to be statistically significant:

	Males		Females	
	N	Mean	N	Mean
Eastern Cuba	11	29.05 mm.	17	28.22 mm.
Western Cuba	6	29.48 mm.	4	28.48 mm.
Central Cuba	8	30.09 mm.	9	29.50 mm.

WING SHAPE AND LENGTH OF 10TH PRIMARY: The wings of Fernandina's flicker are more rounded and about 4% longer than those of *chrysocaulosus.* The longest primary of *fernandinae* is P5 or P6; primaries 3-8 approach each other in length, with P3 nearly as long as P8 and P4 longer than P8. In *chrysocaulosus,* where P6 is longest, P3 and P4 are considerably shorter than P8, the 1st and 2nd primaries are shorter than P9, and P3 is about as long as P9, while *fernandinae* has primaries 2 and 3 longer than P9 and P1 slightly shorter or equal to P9. The total effect in *fernandinae* is that of an evenly graded, rounded wing. *Chrysocaulosus's* wing seems longer and more pointed, and the longer feathers appear foreshortened. Data on wing length, length of P9 and length of P10 in table 1 show that Fernandina's flicker has wings 4% longer than *chrysocaulosus* and about 2% longer than Florida *auratus,* and the 9th primary proportionally (8-9%) longer than in *auratus,* and relatively similar in length (about 5% longer compared with 4% greater wing length) to the elongate 9th primary of *chrysocaulosus.* The outermost primary (P10) is proportionally about 20%

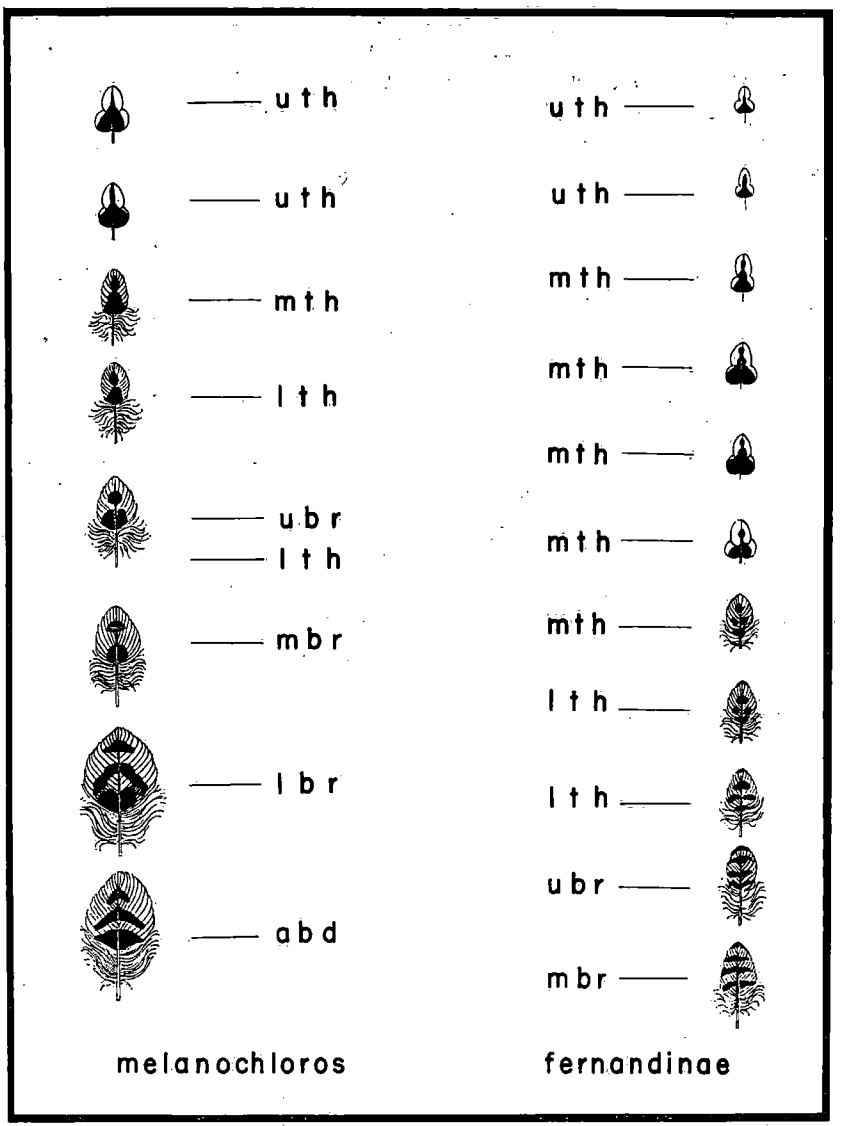
longer than in *chrysocaulosus* and 33% longer than in Florida *auratus*. This is evident also from the P10/P9 ratio, which is .49 in *fernandinae*, .43 in *chrysocaulosus*, and .40 in Florida *auratus*. Hence the elongate outer primary of *fernandinae* which is not only longer, but has a relatively broader vane than in *Colaptes auratus*, contributes to the more rounded shape of its wings.

MARKINGS ON UNDERPARTS: *Colaptes fernandinae* is barred rather than spotted on its breast and abdomen and has a streaked throat. This is in contrast to the unmarked throat, breast patch, and spotted lower breast and abdomen of *Colaptes auratus*. The relationship between ventral barring and spotting can be demonstrated in several ways. A tendency toward the barred condition in *Colaptes auratus* is shown by: 1) occasional barring above the breast patch in juvenile North American flickers and even in a few adults; 2) the less spot-like and more bar-like spots of certain forms of this species, notably the *chrysocaulosus, chrysoides* and *mexicanoides* subspecies groups; and, 3) the barring all races of this species frequently exhibit on the lower abdomen. Also, spots are present to a greater or lesser extent where the throat streakings meet the barring of the breast in *C. fernandinae*. The change from streaks to bars involves narrowing of the basal portion of the streak, broadening of the distal portion, separation of the distal portion so that it appears spot-like, and final broadening of the original distal portion, which has now become a bar (fig. 2). The area of changeover is restricted to the middle and lower throat in *fernandinae*. *Colaptes melanochloros* also has a streaked throat and barred belly, but in this species the area of changeover has become much deeper, so that most of the breast is characterized by spotting (fig. 2). Thus genetic control of these markings is rather plastic. By restricting or broadening the areas over which one type or another occurs, any pattern or combination of bars, spots, and streaks can develop. Combinations of these are notable features in *Colaptes*, the related genus *Campethera*, and to a lesser extent in *Dendrocopos* and other picid genera. The bars on the breast of *fernandinae* in the same area where spots are measured in *C. auratus* are narrow (table 2) compared with the depth of the spots in *chrysocaulosus* (mean depth 4.35 mm in males, 4.16 mm in females) and Florida *auratus* (4.39 mm in males, 4.52 mm in females). The bars tend to be much narrower on the lower abdomen, and deeper on the flanks than on the breast.

MALAR PATCH: The malar patch of male *fernandinae* seems longer than in *C. auratus* because the rear edge of the patch grades into the throat streaking and thus appears to taper off to the rear; actually it is comparable in extent to that of *C. auratus*. Thirteen or 43% of *fern-*

Figure 2

PATTERNS ON FEATHERS OF THE UNDERPARTS OF TWO FLICKERS, *COLAPTES FERNANDINAE* AND *C. MELANOCHLOROS*



The streaked pattern anteriorly is modified into spots, then bars posteriorly. Letters indicate the abdomen (abd), breast (lower breast = lbr., middle breast = mbr., upper breast = ubr) and throat (lower throat = lth, middle throat = mth, upper throat = uth).

andinae males show traces of red (score = 1) in the malar region, compared with 11% of *chrysocaulosus* males, 25% of *gundlachi* males and 18% of *auratus* males from southern Florida. The larger number of *fernandinae* males that show some red in the malar area probably reflects a retention of the genes responsible for red coloring in the malar patches of ancestral flickers. Males of species of the subgenera *Soroplex* and *Chrysoptilus* typically have predominantly black malars with considerable red also present. Feathers at the anterior end of the malar patch in *fernandinae* males tend to be streaked like the throat feathers. Females of this species have their malar region streaked and indistinguishable from the throat region. Streaked malar patches are not restricted to *fernandinae,* for females of some races of *Colaptes punctigula* and *C. melanochloros* have fully streaked malars, and males of *C. pitius* and *C. campestris* also tend to exhibit streaks.

BACK BARRING: The back bars of Fernandina's flicker are nearly 50% deeper than in *chrysocaulosus* and Florida *auratus.* The sexual difference (deeper bars in females) found in *C. auratus* is not evident in *C. fernandinae,* nor is any geographic variation in this feature worthy of note. The number of bars per feather averages about 3.5 in both sexes (range 2-2/3 to 4), 50% to 100% greater than in *chrysocaulosus, gundlachi,* and Florida *auratus.* The number and depth of the bars in *Colaptes fernandinae* is similar to that found in the *Soroplex* group of *Colaptes.* Within *C. auratus* the *mexicanoides* subspecies group shows an approach toward the deeper, more numerous bars of these flickers.

BACK COLOR: The deep back bars render the back mostly dark blackish brown, but the narrower interspaces impart a buffy-white to buffy-yellow background. No geographical variation and no sexual differences were noted. Some individuals, especially fall birds, show greenish in their back feathers. These closely approach specimens of *Colaptes melanochloros melanolaimus* in extent and color of marking and in the dull greenish color of the interspaces.

RUMP: One of the anomalies in this highly terrestrial species is the total lack of a rump patch, which all other strongly terrestrial forms of *Colaptes* have. The only suggestion of a patch in *fernandinae* is in the lighter, often white interspaces between bars on the rump feathers. The bars themselves are very narrow, but the feathers are much smaller than those of the upper back, so this is to be expected.

UPPER TAIL COVERT PATTERN: The pattern of the upper tail coverts of *fernandinae* is shown in figure 1, pattern 17. Variation from this pattern involves the number of complete bars (10-16), the width of the bars and in 5 specimens the merging or breaking up of bars. These variations are minor, and even those tail coverts showing breakup or

merging of some bars are predominantly barred in a normal fashion. Hence, within *Colaptes auratus,* even *C. a. chrysocaulosus* exhibits far greater variation in tail covert pattern than does *C. fernandinae.*

TAIL BARRING: As noted above, the tail of Fernandina's flicker is barred and has no black area. The nearest it comes to a black-tipped tail is the partial merger of the last two or three bars of the central rectrices in a few specimens (*e.g.,* USNM 453930), in which the bars are joined slightly along the rhachis. Bars vary slightly in depth, and the number per feather varies from 11 to 19. A few individuals show slight tendencies for several bars to break up near the rhachis, forming a short streak.

NUCHAL PATCH: No female *fernandinae* shows traces of a red nuchal patch, but 5 males exhibit slight indications of red suggesting that the ancestors of *fernandinae* had nuchal patches, as do most members of the genus *Colaptes* and the closely related genus *Piculus.*

THROAT COLOR: The throat region bears feathers with black central streaks bordered by white outer margins. The streaks are broadest to the sides and rear and narrowest anteriorly. They become constricted in feathers of the lower throat, where they give way to spots and then bars. As noted above, the malar region of females is streaked and not distinctly separated from the throat.

COLOR OF EAR COVERTS: The ear coverts vary from cinnamon to buffy white. They tend to be more cinnamon, approaching rufous posteriorly, and more buffy white anteriorly, much as in *Colaptes rupicola.* The rear edge of the auriculars may be slightly or even moderately streaked like the crown. No sexual difference is manifest.

COLOR OF UNDER WINGS AND TAIL: The flight feathers and the body feathers as well are strongly yellow-shafted. The upper sides of the flight feather shafts are dark, as they are partially in *Colaptes pitius.* Although the under wing surface is barred more strongly than in *C. auratus* and the tail is heavily barred, the lower surfaces of the wing and tail have enough yellow in the feather barbs and shafts to present a bright yellow surface in displays. Three of 30 adults show yellow-orange shaft color (score = .5); the others are light lemon yellow. No sexual difference in shaft color is apparent. The under wing coverts below the "wrist", usually spotted or spot-barred in *auratus,* are finely barred in *fernandinae.*

CROWN COLOR: The crown of *fernandinae* ranges from dark cinnamon-chestnut through light cinnamon to pale buffy white. This considerable variation is associated with variation in color of the posterior ear coverts. The crown is streaked with black along the feather shafts. These streaks vary considerably in width, the broader ones

generally occurring in individuals with paler crown color. They occasionally form streak-spots by reduction of the black color in the central portion of the crown feather shafts. Posteriorly the central black areas along the feather shafts gradually lessen in extent and the feathers become tipped with black. Across a few rows of feathers these black tips become bars, and then the nape feathers give way to the barred back feathers. No sexual differences in crown color were noted, nor any apparent geographical variation. Although the streaked cinnamon crown of *fernandinae* is unique in *Colaptes* several species (*loricatus, grammicus, undatus*) of the related genus *Celeus* exhibit similar crown color and markings.

DISCUSSION

The West Indian populations of *Colaptes auratus* exhibit distinctive features typical of geographical isolates. The largely clinal variation evident in the continental races *auratus* and *luteus* of the *auratus* subspecies group does not simply continue into the Cuban and Caymanian populations. Members of the *chrysocaulosus* group exhibit discordant variation in their proportionally longer tails, rounder wings, bar-like breast spots, less crescentic breast patch, yellow or yellow-green cast dorsally and ventrally, heavily barred and spotted rumps, more barred tails and upper tail coverts, and golden shaft color compared with the *auratus* subspecies group. This discordant variation and the arboreal specialization of the *chrysocaulosus* group reflected by its strong feet and more rigid tail are best indicated by recognizing the races *chrysocaulosus* and *gundlachi* as comprising a subspecies group separate from the *auratus, cafer, chrysoides* and *mexicanoides* groups of *C. auratus*.

The *chrysocaulosus* and the *mexicanoides* groups, and to a lesser extent the *chrysoides* group, share several distinctive features, believed to be primitive. These features, bar-like breast spots and a deep, less crescentic breast patch, may have characterized the continental flicker population ancestral to the *chrysocaulosus* group. The rounded wings, yellow-green cast above and below, heavily marked rump, more barred tail and upper tail coverts, gold shaft color, and reduced black in the tail appear to have developed in the *chrysocaulosus* group after it reached Cuba. The whiter rump and yellower, less golden shafts in the well-differentiated race *gundlachi* suggest that it originated from pre-*chrysocaulosus* stock at a time when that stock was more yellow-shafted and white-rumped.

The major characteristics of *C. a. gundlachi* are those associated

with its small size. The differences in measurements between *gundlachi* and *chrysocaulosus* are considerable, with no overlap in wing length or tail length and only slight overlap in bill length and tarsal length. Other differences, the shallower breast patch, less golden shafts, and whiter rump of *gundlachi*, are minor, and do not obscure the close relationship between the two races. Mayr (1963: 320-321) has commented on the generalization often made that insular populations are of smaller body size than adjacent mainland populations. If the Cuban *chrysocaulosus* be considered a mainland population, *gundlachi* is indeed much smaller. Murphy (1938) noted that insular races of birds frequently have larger bills than their closest mainland relatives. The Grand Cayman flicker is smaller than *chrysocaulosus* and has a smaller bill; *chrysocaulosus*, considered as an insular form, has a barely longer bill than that of the smaller mainland *C. a. auratus*. Excessive sexual dimorphism in bill length noted by Selander and Giller (1963) for some insular woodpeckers is not evident in *C. a. gundlachi* (Short, 1964).

As flickers have apparently enjoyed a long history on Cuba and Grand Cayman, the problem arises of why they are absent elsewhere in the West Indies. In reaching Grand Cayman and Guadalupe Island off Baja California, *Colaptes auratus* has exhibited the ability to pioneer islands successfully; hence it is surprising that it has not reached Jamaica or beyond. It is equally surprising that ancestral *Colaptes fernandinae* reached Cuba and apparently underwent a long period of evolution without successfully invading other islands. Neither of these flickers occurs on the nearby Isle of Pines, although *Colaptes auratus* has gone beyond it to Grand Cayman.

I have discussed the history of flickers in continental North America elsewhere (1965: 407ff.). A fossil picid ulna from the Lower Pliocene of Nebraska (Wetmore, 1931), which I have examined, is colaptine and indistinguishable from those of *Colaptes melanochloros* and *Colaptes auratus mexicanoides*. Thus large flicker-like woodpeckers existed in North America about ten million years ago. Although speculative, I suggest that pre-*fernandinae* flicker stock reached Cuba from the north in the middle or late Pliocene. Much later, perhaps in the early Pleistocene, individuals of *Colaptes auratus* invaded Cuba from the Florida region. Probably as a result of competition between the two ground-foraging flickers, the Cuban *auratus* population developed more arboreal habits and attendant morphological specializations, giving rise to *chrysocaulosus*. Still later, in the middle to late Pleistocene, ancestral *chrysocaulosus* stock reached Grand Cayman Island from Cuba and evolved into *gundlachi*.

The *chrysocaulosus* group is thought to have reached Cuba from the north for two chief reasons in addition to the lack of fossil evidence of flickers on other Caribbean islands. The first of these is the relationship of the *chrysocaulosus* group with continental flickers, particularly the *auratus* subspecies group. This relationship is indicated by the general acceptance of *chrysocaulosus* as a race of *Colaptes auratus* in the strict sense (Bond, 1960). Except for several features noted above and best regarded as primitive in the species as a whole, the *chrysocaulosus* group shows no close resemblance to the Central American *mexicanoides* group. The facial patterns of the *chrysocaulosus* and *auratus* groups are nearly identical and different from those of all other subspecies groups of *C. auratus*. Other features especially relating the *chrysocaulosus* group to the continental *cafer* and *auratus* subspecies groups, as opposed to the *mexicanoides* and *chrysoides* groups, are the reduced black areas of its tail, the extent of back barring and size of its back bars, and its upper tail covert variational patterns.

Another reason why the *chrysocaulosus* group is thought to have invaded the West Indies from the north is the shape of its wings. The rounded wings of *chrysocaulosus* and *gundlachi* were most likely derived from longer, more pointed wings in an ancestral flicker having wings very like those of the *auratus* subspecies group. Fernandina's flicker has very rounded wings with primaries in an evenly graded series. The wings of *gundlachi* and *chrysocaulosus*, however, appear rounded only because the longer central primaries have become shorter. Other primaries are unmodified, and comparable in length to those of *C. a. auratus*.

Other continental North American species have apparently reached Cuba from North America (Bond, 1934, 1948, 1960). These include the icterids *Agelaius phoeniceus* and *Sturnella magna*, both of which occur in Central America, throughout continental North America (the eastern *S. magna* replaced in the west by *S. neglecta*), and in Cuba and the Isle of Pines. These two cases are highly relevant, for both species have close relatives in Central and South America, and both could have reached Cuba from the south or west, as well as from the north. Their absence elsewhere in the West Indies strongly suggests that they have reached that region from the north. Two woodpeckers other than the flickers also appear to have reached Cuba from the north. These are the Cuban Ivory-billed Woodpecker, which is regarded (Bond, 1960) as a race of the continental *Campephilus principalis*, and the West Indian Red-bellied Woodpecker (*Melanerpes superciliaris*), the closest relative of which is *Melanerpes carolinus* of the

southeastern United States (Bond, 1960; Selander and Giller, 1963). *Melanerpes superciliaris* occurs in Cuba, the Bahamas, the Isle of Pines, and Grand Cayman, and *Campephilus principalis* in Cuba; neither occurs elsewhere in the West Indies.

Among bird species found on Grand Cayman Island are two shared with Cuba and the Isle of Pines, namely *Amazona leucocephala* and *Melanerpes superciliaris*. One subspecies, *Myiarchus stolidus sagrae* is restricted to Grand Cayman, Cuba, and the Isle of Pines. Another form, *Vireo crassirostris crassirostris*, does not occur on Cuba, but is found in both the Bahamas and the Cayman Islands. Bond (1950: 118) notes that "evidently more Cayman birds have been derived from Cuba than from Jamaica," and the Grand Cayman flicker is undoubtedly one of these. In no way does *C. a. gundlachi* show a tendency toward the Central American *mexicanoides* group and away from *chrysocaulosus*, although it does approach *C. a. auratus* rather than *chrysocaulosus* in several respects noted above.

Until we learn more about fossil flickers in North America and the life history and habits of *Colaptes fernandinae*, little can be said of its history. In the absence of fossil evidence suggesting a past history of flickers elsewhere in the West Indies, it is not unreasonable to assume that the ancestors of *fernandinae* reached Cuba from North America. In its terrestrial habits and in certain color pattern features Fernandina's flicker resembles South American flickers of the subgenera *Soroplex* and *Chrysoptilus* more closely than it does *Colaptes auratus*. I suggest three possible reasons for this resemblance: 1) *C. fernandinae* may have retained ancestral traits still present in South American flickers but since lost in *C. auratus*; 2) *C. auratus* may have diverged farther from a common ancestor than has *C. fernandinae*; and/or, 3) during its long isolation in Cuba, Fernandina's flicker may have reacquired, through back-mutation and the effects of selection and/or genetic drift, ancestral traits like some of those still retained by South American flickers. In this connection it would be interesting to know whether *fernandinae* progresses on the ground by hopping, as does *C. auratus*, or by walking, as do certain South American flickers of the subgenus *Soroplex* (Mitchell, 1957: 121).

SUMMARY

Analysis of the characters of three West Indian flickers, *Colaptes auratus chrysocaulosus* of Cuba, *C. a. gundlachi* of Grand Cayman and *C. fernandinae* of Cuba, indicates that all are well differentiated from related forms. The endemic *Colaptes fernandinae* is morphologically distinctive, but its differences from other species of *Colaptes* are not of sufficient magnitude to warrant maintaining it in the monotypic genus *Nesoceleus*, which is reduced to the status of a subgenus of *Colaptes*. Although probably derived from flickers in continental North America, Fernandina's flicker appears most closely allied to species of South American flickers of the subgenera *Soroplex* and *Chrysoptilus*.

Differences between the two species of Cuban flickers suggest how distinctive flickers must be to coexist. Sympatry among species of *Colaptes* is apparently possible only when the species involved have differentiated to the level of subgenera.

The *chrysocaulosus* group of *Colaptes auratus* differs in a number of respects from the continental *auratus* groups, although the differences by no means justify its recognition as a species. Incipient geographic variation was found in both *C. a. chrysocaulosus* and *C. fernandinae*. The *chrysocaulosus* subspecies group is more arboreal than continental forms of the species.

The Grand Cayman Island flicker, *C. a. gundlachi* is the smallest form of *Colaptes auratus*, and is related in so many ways to *chrysocaulosus* that it seems obviously derived from flickers ancestral to that form. Nevertheless it is completely separable from *chrysocaulosus* in each of several features, and shows a number of other average differences.

West Indian flickers seem to have originated from the North American continent rather than from Central America or other Caribbean islands.

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