

TAXONOMY OF THE LOGGERHEAD KINGBIRD (*TYRANNUS CAUDIFASCIATUS*) COMPLEX (AVES: TYRANNIDAE)

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ABSTRACT.—We examined the complex of populations of the Loggerhead Kingbird (*Tyrannus caudifasciatus*), a West Indian endemic. We separate populations in Puerto Rico and Isla Vieques (*T. taylori*), and Hispaniola (*T. gabbii*) as distinct species. Subspecific distinction is assigned to populations in Cuba, Isla de Pinos, and Cuban satellites (*T. caudifasciatus caudifasciatus*); Cayman Islands (*T. c. caymanensis*); Jamaica (*T. c. jamaicensis*); and the Bahamas (*T. c. bahamensis*) on the basis of differences in plumage coloration and pattern, size, vocalizations, and distribution. Received 1 December 2008. Accepted 27 June 2009.

The Loggerhead Kingbird (*Tyrannus caudifasciatus*) is endemic to the Bahama Islands and Greater Antilles, although occasionally stragglers have been reported in southern Florida (Bond 1978:3, Robertson and Woolfenden 1992, AOU 1998: 414). *Tyrannus caudifasciatus* was originally described from Cuba by d'Orbigny in 1839 in the genus *Tyrannus*. Subsequent authors used the genus *Pitangus* and, later, *Tolmarchus* Ridgway (1905) with *T. taylori* of Puerto Rico as the type species. The morphological differences that separate *Tolmarchus* from *Tyrannus* are slight. Both groups are generally similar in voice and nesting behavior and, according to Bond (1956:105), in not having the outer primaries attenuated at their tips. Meise (1949), Bond (1958), and later authors merged *Tolmarchus* with *Tyrannus*. Smith (1966) presented characteristics of vocalizations of some species of *Tyrannus*, including the Loggerhead Kingbird, suggesting there were four species groups within the genus. Some workers, however, maintain *T. caudifasciatus* in a monotypic subgenus *Tolmarchus* (Bond 1967). Lack (1976: 297), comparing *T. caudifasciatus* with the other two Greater Antillean *Tyrannus* species (Giant Kingbird [*T. cubensis*] and Grey Kingbird [*T. dominicensis*]), noted, "the relationships of these three species to each other and to *T. tyrannus* are not clear."

Cory (1889, 1892) considered the then-known forms of the Loggerhead Kingbird to be separable at the species level, recognizing *Pitangus caudifasciatus* from Cuba, Jamaica, and Grand Cay-

man; *P. taylori* from Puerto Rico, *P. bahamensis* from the Bahamas, and *P. gabbii* from Hispaniola. Sharpe (1901) separated *T. jamaicensis* of Jamaica. Ridgway (1907:677–678) noted differences among populations of Loggerhead Kingbird based on several characteristics, including the extent to which the bases of the toes are united: in *T. bahamensis* and *T. caudifasciatus* half of basal phalanx of the middle toe is united to the outer toe, whereas in *T. taylori* more than half of the basal phalanx is united to the outer toe. Cory and Hellmayr (1927) and Bond (1936, 1956) considered *Tyrannus caudifasciatus* to be a polytypic species with the subspecies *T. c. caymanensis* (Nicoll 1904) designated for the Cayman Islands, *T. c. jamaicensis* (Chapman 1892) for Jamaica, *T. c. taylori* (Sclater 1864 in Taylor 1864) for Puerto Rico and Isla Vieques, *T. c. bahamensis* (Bryant 1864) for some of the northern Bahama Islands, *T. c. caudifasciatus* for Cuba and Isla de Pinos, and *T. c. gabbii* (Lawrence 1876) for Hispaniola. Wetmore and Swales (1931:305), however, wrote, "We do not agree with [Cory and] Hellmayr (1927) in considering *gabbii* a subspecies of *Tolmarchus caudifasciatus* as its characters seem to entitle it to specific recognition." Parkes (1963) separated the Isla de Pinos population from *T. c. caudifasciatus* under the subspecies *T. c. flavescens*, an arrangement followed by Traylor (1979). Dickinson (2003) maintained the subspecific level for all populations of *T. caudifasciatus*, including *T. c. flavescens* of Isla de Pinos.

Little has been written concerning the taxonomy of the *Tyrannus caudifasciatus* complex with the exception of Ridgway (1907), Wetmore and Swales (1931), and Parkes (1963). We present the results of our comparison of morphology and vocalizations among populations in an effort to establish species limits within the Loggerhead Kingbird.

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METHODS

We measured 711 Loggerhead Kingbird specimens in 11 United States and Cuban institutions. Specimens from the Cuban cays included cayos Cinco Leguas, Francés, Las Brujas, Santa María, Coco, Paredón Grande, Guajaba, and Sabinal in the Archipiélago Sabana–Camagüey. All specimens were measured with a ruler and dial calipers to the nearest 0.1 mm following Baldwin et al. (1931). Only adult specimens ($n = 674$) were used in comparing morphometrics within and among populations. Chord measurements were made with the wing flattened against the ruler. Culmen measurements are of the exposed portion (without cere). Most mass data were obtained from post-mortem birds. We include mass data of Steadman et al. (1980) and Olson et al. (1981) in addition to our mass data.

We present summary descriptive statistics (mean, SD, and range) for the specimens. Unpaired t -tests were used to test for equality of weights among populations. We used Bonferroni's correction in conducting multiple tests of means and ANOVA analyses to test differences among island populations. Body measurements were plotted to assess the pattern of spatial segregation among populations. The hypothesis of separation derived from the plots of body measurements was tested using discriminate function analysis (DFA) (Kleinbaum and Kupper 1978). Statistical computations were performed using the software package Minitab (2000) including DFA and cluster analyses. We used the single linkage method and squared Euclidean measure to conduct cluster analyses. Level of significance was set at 0.05.

Most recordings of vocalizations were obtained by Reynard and are deposited in his private collection. Additional vocalization recordings were obtained from the Macaulay Library of the Cornell Laboratory of Ornithology and from Bruce Sorrie. Vocalizations were analyzed using Raven (Version 1.0) software.

RESULTS

Plumage Characters.—Ridgway (1907:678) split the taxa into two groups based on: (Group 1) “Inner webs of rectrices with basal third, or more, abruptly yellowish white; tail tipped with pale brownish gray or whitish” (the former important character was completely overlooked by subsequent authors); and (Group 2) “Inner

webs of rectrices passing gradually into dull whitish at extreme base; tail not tipped with brownish gray or whitish.” Ridgway further split this second group, using the following characters: “Smaller...; rectrices edged conspicuously with rusty” (= *T. gabbii*); and “Larger...; rectrices not edged with rusty” (= *T. taylori*). Another important character, overlooked by Ridgway, is the shape of the tail, which is obviously notched at the end (although not as much as in the Grey Kingbird, *T. dominicensis*) in *taylori*, and less so in *bahamensis*, whereas the rest of the taxa have square-tipped tails.

We present a comparative diagnosis of the plumage of the taxa, as well as a synopsis of some of these characters (Table 1) based on examination of 711 specimens.

Tyrannus caudifasciatus bahamensis (Bahamas).—Head with a browner tinge and not as black as in other forms, clearly contrasting with the grayish upperparts, which show a brownish suffusion. Concealed crown patch generally a mix of orange and yellow. Underparts, including axillae, with considerable yellow (more than in any other population). No brown suffusion on breast. Edge of wing coverts grayish. The blotches of the inner rectrices yellowish, and more restricted than in *caudifasciatus*, *jamaicensis*, or *caymanensis*. Bahamian birds have a rusty rump, a character not found in other populations of *caudifasciatus*. Tail slightly notched, although not as much as in *taylori*, and tipped with buff, not white or gray.

Tyrannus c. caudifasciatus (Cuba, Isla de Pinos, and cays).—Head blackish, strongly contrasting with the brownish-sepia upperparts. Concealed crown patch variable yellow, orange, or a mix of both colors; individuals displaying the three color types may occur in the same population. Edge of wing coverts whitish. Tail rather squared at tip, tipped in white or light gray, without rust color. Inner rectrices with well-developed whitish-yellow blotches. No brownish tinge on breast. Populations in Cuba, Isla de Pinos, and the cays all share these characters.

Tyrannus caudifasciatus caymanensis (Cayman Islands).—Head sooty-slate, rather than black, contrasting with the brownish-gray upperparts, which are more olivaceous than in *T. c. caudifasciatus*. Concealed crown patch between yellow and orange in color. More suffusion of yellow on the underparts than in other populations with the exception of *bahamensis*. We noted that birds

TABLE 1. Plumage characteristics of Loggerhead Kingbirds (*Tyrannus caudifasciatus*) in eight populations. Bold data highlight patterns of similarity.

Plumage character	Population							
	Bahamas	Cuba	Isla de Pinos	Cuban cays ^a	Jamaica	Cayman Islands	Hispaniola	Puerto Rico
Tip of tail ^b	B	W	W	W	W	W	N	N
Shape of tail ^c	HN	S	S	S	S	S	S	N
Crown patch ^d	M	Y-O	Y-O	Y-O	Y	Y-O	Y	Y
Breast feathers ^e	A	A	A	A	A	A	P	A
Inner rectrices ^f	P	P	P	P	P	P	A	A
Rectrices ^g	NR	NR	NR	NR	NR	NR	R	NR
Yellow on underparts ^h	L	N	N	N	N	M	N	N

^a Cuban cays include cayos Cinco Leguas, Francés, Las Brujas, Santa María, Coco, Paredón Grande, Guajaba, and Sabinal in the Archipiélago Sabana-Camagüey.

^b Tip of tail: W = tipped with whitish, B = tipped with buff, N = not tipped.

^c Shape of tail end: N = notched, HN = half notched, S = square.

^d Crown patch: Y = yellow, O = orange, M = mixed yellow and orange.

^e Breast feathers: P = brown tinge present, A = brown tinge absent.

^f Inner rectrices: P = blotches present, A = blotches absent.

^g Rectrices: R = rusty, NR = not rusty.

^h Yellow on underparts: L = large amount, M = moderate amount, N = none or little.

from Cayman Brac show less suffusion of yellow on the underparts and axilla than specimens from Grand Cayman. No brownish tinge on breast, but with a faint suffusion of grayish. Edges of wing coverts whitish or grayish. Tip of tail whitish and squared. Blotches on the inner rectrices well developed and more yellow than in *caudifasciatus*; no rusty edges on rectrices.

Tyrannus caudifasciatus jamaicensis (Jamaica).—Head blackish, contrasting with the upperparts, which are brownish-black with a suffusion of gray, especially toward the rump. Concealed crown patch yellow. Edges of wing coverts whitish or grayish; not as white as in *caudifasciatus*. Almost no yellow on the underparts. No brown tinge on breast. Tail tip square with a broad white band. Blotches on inner rectrices as in *caudifasciatus*. No rust color on the edge of rectrices.

Tyrannus caudifasciatus gabbii (Hispaniola).—Head brownish-black rather than black. Upperparts darker, brownish-sepia (even browner than in *caymanensis*), offering less contrast between pileum and neck. Concealed crown patch yellow and extensive. Chest grayer than the belly and undertail coverts with a suffusion of brown. Edge of wing coverts conspicuously rufous. Immatures of all populations of *T. caudifasciatus* show some cinnamon on the wings, but this color is an ontogenetic character that disappears with age in the other populations, whereas in *gabbii* the cinnamon coloration persists. Edges of rectrices are also rufous or cinnamon. Tail tip square and lacking a light terminal tip, as in *taylori*. Yellowish

blotches of inner rectrices lacking, as in *taylori*. Birds from Haiti are somewhat less whitish on the underparts with the dark tinge of the chest even more conspicuous; the upperparts are less brown and the pileum is not as dark, compared with birds from the Dominican Republic.

Tyrannus caudifasciatus taylori (Puerto Rico).—Head blackish, with a tinge of brown, contrasting less with the brownish upperparts, which also show a tinge of blackish. Concealed crown patch yellow, and extensive, as in *gabbii*. Immatures, especially juveniles, lack the concealed crown patch. Underparts grayish, with a brown suffusion on the sides of the neck, but not on the chest. Wing coverts are edged with grayish-white, with a tinge of cinnamon. Upper tail coverts are edged with rusty. No light band at the tip of tail, which is more notched than in *bahamensis*. Lacks the yellow blotches on inner rectrices; edges of rectrices not rufous.

We summarize these characters. Upperparts: the grayest birds are *caudifasciatus* (including “*flavescens*”); followed by *bahamensis*, which has a tinge of olive; then *caymanensis* with a hue of olive-brown; whereas *jamaicensis* is more brownish than grayish, but less so than *taylori* and *gabbii*, which are definitely brownish. Compared with *gabbii*, *taylori* is lighter brown; some individuals of *gabbii* show little demarcation or contrast between the occiput and the back, because the pileum is dark brown rather than blackish. Pileum: populations displaying the most contrast in the pileum are *caudifasciatus* (includ-

TABLE 2. Mensural characteristics (mean \pm SD, [n], range) for wing chord, tail, exposed culmen, tarsus, and mass for 674 adult specimens of Loggerhead Kingbird (*Tyrannus caudifasciatus*).

Locality	Measurements (mm)					Mass (g)
	Wing	Tail	Culmen	Tarsus		
MALES						
Bahamas	110.6 \pm 3.7 [38] 103–119	85.5 \pm 3.1 [51] 80–91.5	23.5 \pm 1.4 [51] 21.2–28.0	22.6 \pm 1.0 [52] 20.8–25.5	44.4 \pm 3.3 [5] ^a 41.3–49.5	
Cuba	107.0 \pm 3.1 [128] 99–116	86.1 \pm 3.9 [116] 76–98	23.7 \pm 1.5 [122] 20–30	23.0 \pm 1.5 [102] 20–28	42.6 \pm 3.1 [26] 35–48	
Isla de Pinos	107.0 \pm 2.9 [25] 102–114	85.9 \pm 2.9 [26] 81–91	23.5 \pm 1.3 [25] 21–26	22.7 \pm 0.8 [24] 21.3–24.2		
Cuban cays ^b	106.1 \pm 3.0 [28] 98–112	87.0 \pm 3.6 [13] 81–94	24.7 \pm 2.6 [11] 22–30	25.6 \pm 1.9 [13] 22.3–29	38.1 \pm 2.0 [7] 36.5–42	
Jamaica	102.7 \pm 3.4 [52] 95–108	82.5 \pm 2.7 [50] 77–89	24.1 \pm 1.3 [52] 21–29	21.9 \pm 1.2 [50] 19.9–24.8		
Cayman Islands	105.7 \pm 3.8 [22] 96–112	88.3 \pm 4.3 [23] 80–98	25.7 \pm 2.2 [23] 22.9–31	22.8 \pm 1.2 [23] 21–25.5	45.7 \pm 5.5 [6] ^c 38.5–52.0	
Hispaniola	104.6 \pm 3.9 [19] 100–111	81.5 \pm 2.3 [20] 74–85	22.1 \pm 1.2 [19] 21.2–28	21.2 \pm 1.5 [18] 20.8–25		
Puerto Rico	114.3 \pm 3.9 [19] 104.5–119	91.4 \pm 4.1 [26] 88–96	24.6 \pm 1.8 [25] 22.5–30	23.8 \pm 1.4 [25] 20.4–24.9		
FEMALES						
Bahamas	108.0 \pm 3.9 [33] 96.5–118	83.6 \pm 2.6 [37] 80–91	23.0 \pm 1.0 [35] 21–25	22.5 \pm 1.6 [37] 20.1–26	44.8 [1] ^a	
Cuba	103.6 \pm 3.5 [82] 95–111	84.4 \pm 4.0 [73] 75–106	23.6 \pm 1.6 [79] 20.3–27	22.5 \pm 1.6 [64] 19–26	41.5 \pm 2.4 [25] 33.3–45.0	
Isla de Pinos	102.0 \pm 3.2 [21] 96–108	84.3 \pm 3.0 [19] 77–89	23.1 \pm 1.6 [20] 21–29	22.0 \pm 0.9 [21] 19.9–24.8		
Cuban cays ^b	102.7 \pm 3.5 [15] 95–111	84.8 \pm 4.8 [17] 75–106	24.1 \pm 2.2 [19] 20.3–27	24.4 \pm 2.2 [15] 19–26	34.0 \pm 1.4 [5] 32.2–36	
Jamaica	99.6 \pm 3.7 [51] 89–108	81.0 \pm 2.3 [53] 77–89	24.0 \pm 0.8 [52] 22.5–26.7	22.4 \pm 1.2 [47] 20.3–26		
Cayman Islands	102.2 \pm 2.8 [51] 96–108	84.3 \pm 3.1 [21] 79–94	24.6 \pm 1.6 [21] 22–28	23.0 \pm 1.6 [20] 21–25	42.1 \pm 4.8 [5] ^c 34.5–46.0	
Hispaniola	102.8 \pm 3.2 [17] 98–110	80.9 \pm 3.2 [18] 76–88	21.7 \pm 0.7 [18] 20.4–23.1	21.5 \pm 1.4 [16] 19.2–23.5		
Puerto Rico	110.9 \pm 2.6 [17] 104–116	89.6 \pm 2.4 [37] 84–96	23.6 \pm 0.8 [38] 21.5–25.7	23.9 \pm 1.5 [36] 20.4–27.5		

^a After Steadman et al. 1980.^b List of Cuban cays included in Table 1.^c After Olson et al. 1981.

ing “*flavescens*”), which clearly shows the difference between the gray of the back and the black head; followed by *caymanensis* and *jamaicensis*. The pileum color of *caudifasciatus* and “*flavescens*” could be considered blackish, as could the pileum of *caymanensis*, although it is less dark in the latter taxon. The pileum of *bahamensis* is substantially lighter, offering much less contrast to the back, that area being more brownish than blackish. Finally, the pileum of *taylori* is dark brown, as in *gabbii*, but the latter is even darker, with a blackish hue in some specimens. Underparts: among the taxa, *taylori* has the grayest underparts, whereas *gabbii* and

jamaicensis have the whitest, followed by *caudifasciatus* (Table 1). Overall, Cuban (including mainland, Isla de Pinos, and the cays), Cayman Islands, and Jamaican populations were most similar in plumage with Puerto Rican, Hispaniolan, and Bahamian populations showing more distinctiveness in plumage coloration and pattern (Table 1).

Morphometrics.—We measured 711 Loggerhead Kingbirds, but include here only adult specimens ($n = 674$) (Table 2). Comparisons were made within gender because of the moderate sexual size dimorphism observed in *T. caudifasciatus* (Table 3). All populations showed some

TABLE 3. Size variation of males and females in eight populations of Loggerhead Kingbirds (*Tyrannus caudifasciatus*). Comparisons made using unpaired *t*-tests. A parametric test was used if population showed normal distribution; if not, Welch's approximate *t* is shown, which assumes Gaussian populations with different SDs.

Population	Measurement	Mean \pm SD mm (<i>n</i>)		<i>t</i>	df	<i>P</i> ^a
		Males	Females			
Bahama Islands	Wing	110.6 \pm 3.7 (38)	108.0 \pm 3.9 (33)	2.20	50	0.033*
	Tail	85.5 \pm 3.1 (51)	83.6 \pm 2.6 (37)	1.91	66	0.060
	Culmen	23.5 \pm 1.4 (51)	23.0 \pm 1.0 (35)	0.72	62	0.474
	Tarsus	22.6 \pm 1.0 (52)	22.5 \pm 1.6 (37)	0.19	55	0.851
Cuba	Wing	107.3 \pm 3.1 (128)	103.6 \pm 3.5 (82)	6.71	85	<0.001***
	Tail	86.1 \pm 3.9 (116)	84.4 \pm 4.0 (73)	2.21	72	0.300
	Culmen	23.7 \pm 1.5 (122)	23.6 \pm 1.6 (79)	1.34	61	0.186
	Tarsus	23.0 \pm 1.5 (102)	22.5 \pm 1.6 (64)	2.34	27	0.027*
Isla de Pinos	Mass	42.6 \pm 3.1 (26)	41.5 \pm 2.4 (25)	0.89	10	0.395
	Wing	107 \pm 2.9 (25)	102.0 \pm 3.2 (21)	4.54	31	<0.001***
	Tail	85.9 \pm 2.9 (26)	84.3 \pm 3.0 (20)	2.37	30	0.024*
	Culmen	23.5 \pm 1.3 (25)	23.1 \pm 1.6 (20)	0.70	27	0.488
Cuban cays ^b	Tarsus	22.7 \pm 0.8 (24)	22.0 \pm 0.9 (20)	1.87	31	0.071
	Wing	106.1 \pm 3.0 (28)	102.7 \pm 3.5 (15)	2.70	11	0.021*
	Tail	87.0 \pm 3.6 (13)	84.8 \pm 4.8 (17)	1.41	14	0.180
	Culmen	24.7 \pm 2.6 (11)	24.1 \pm 2.2 (19)	1.19	18	0.251
Jamaica	Tarsus	25.6 \pm 1.9 (13)	24.4 \pm 2.2 (15)	1.03	18	0.319
	Mass	38.1 \pm 2.0 (7)	34.0 \pm 1.4 (5)	1.27	6	0.250
	Wing	102.7 \pm 3.4 (52)	99.6 \pm 3.7 (51)	5.11	93	<0.001***
	Tail	82.5 \pm 2.7 (50)	81.0 \pm 2.3 (53)	5.17	97	<0.001***
Cayman Islands	Culmen	24.1 \pm 1.3 (52)	24.0 \pm 0.8 (52)	0.37	93	0.713
	Tarsus	21.9 \pm 1.2 (50)	22.4 \pm 1.2 (47)	-1.83	87	0.071
	Wing	105.7 \pm 3.8 (22)	102.2 \pm 2.8 (51)	2.86	40	0.007**
	Tail	88.3 \pm 4.3 (23)	84.2 \pm 3.1 (21)	3.25	44	0.002**
Hispaniola	Culmen	25.7 \pm 2.2 (23)	24.6 \pm 3.1 (21)	1.87	43	0.069
	Tarsus	22.8 \pm 1.2 (23)	23.0 \pm 1.6 (20)	-1.03	42	0.308
	Wing	104.6 \pm 3.9 (19)	102.8 \pm 3.2 (17)	2.88	36	0.007**
	Tail	81.5 \pm 2.3 (20)	80.9 \pm 3.2 (18)	2.27	33	0.030*
Puerto Rico	Culmen	22.1 \pm 1.2 (19)	21.7 \pm 0.7 (18)	0.97	36	0.337
	Tarsus	21.2 \pm 1.5 (18)	21.5 \pm 1.4 (16)	-0.28	26	0.784
	Wing	114.3 \pm 3.9 (19)	110.9 \pm 2.6 (17)	2.94	38	0.006**
	Tail	91.4 \pm 4.1 (26)	89.6 \pm 2.4 (37)	1.61	35	0.117
	Culmen	24.6 \pm 1.8 (25)	23.6 \pm 0.8 (38)	2.15	35	0.038*
	Tarsus	23.8 \pm 1.4 (25)	23.9 \pm 1.5 (36)	0.58	55	0.562

^a * = <0.05, ** = <0.01, and *** = <0.001.

^b List of Cuban cays included in Table 1.

sexual size dimorphism, especially in wing chord. Cuban populations displayed sexual size differences in one of the four measurements taken, whereas in each of the seven other populations males and females differed in two body measurements (Table 3).

There were greater differences in wing and tail lengths than in other body parts examined among populations (Table 4). Puerto Rican birds had the greatest differences from other populations, followed by Hispaniolan, Jamaican, and Bahamian populations. Birds from Cuban cays, Cayman Islands, Cuban mainland, and Isla de Pinos had the fewest differences compared with other popu-

lations. We found little difference among Isla de Pinos and other Cuban populations, except tarsus length of both males and females differed substantially between Isla de Pinos and the Cuba cays populations (Table 4). All other comparisons revealed differences among populations: all Cuban populations (Isla de Pinos, Cuba, Cuban cays) had modest (all vs. Bahamas) to substantial differences (Cuba vs. Hispaniola) among populations (Table 4). Bahamas populations were considerably different in all or most measurements compared to Hispaniolan, Puerto Rican, and Cayman Islands birds. Measurements of Hispaniolan populations differed most with Cuba, the Cuban cays, Puerto

TABLE 4. Morphometric comparisons among eight populations of Loggerhead Kingbirds (*Tyrannus caudifasciatus*). ANOVA with Tukey-Kramer Multiple Comparisons Test used, except for mass, where unpaired *t*-tests were used. *q* values > 4.322 are significant at the 0.05 level. Sample sizes same as in Table 2.

Population compared with	<i>q</i> values and levels of significance ^a									
	Males					Females				
	Wing	Tail	Culmen	Tarsus	Mass (g)	Wing	Tail	Culmen	Tarsus	Mass (g)
Bahama Islands										
Cuba	8.404***	1.686	1.090	2.508		8.872***	1.739	3.140	0.000	
Isla de Pinos	6.029***	0.672	0.000	0.433		8.934***	1.088	0.379	1.722	
Cuban cays ^b	7.792***	1.954	3.281	10.337***		7.075***	1.797	4.102	5.840**	
Jamaica	15.963***	5.196**	2.767	3.776		15.629***	5.324**	4.860*	0.428	
Cayman Islands	7.888***	4.512*	7.961***	0.853		8.075***	1.124	6.160***	1.695	
Hispaniola	9.209***	6.136***	4.734*	5.470**		7.240***	4.122	4.763*	3.144	
Puerto Rico	5.679**	9.909***	4.095	5.268**		5.066*	11.321***	2.721	5.626**	
Cuba										
Isla de Pinos	0.000	0.560	0.828	1.413		2.719	0.170	2.123	1.870	
Cuban cays ^b	1.860	1.107	2.887	9.433***	3.181**	1.332	0.652	2.079	6.231***	4.826***
Jamaica	11.276***	7.833***	2.195	6.808***		9.323***	8.265***	2.380	0.490	
Cayman Islands	2.429	3.724	7.996***	0.926		2.184	0.177	4.328	1.836	
Hispaniola	4.210	7.857***	5.896**	7.523***		1.248	5.835**	7.730***	3.366	
Puerto Rico	12.805***	9.699***	3.726	3.830		15.462***	11.304***	0.000	6.322***	
Isla de Pinos										
Cuban cays ^b	1.411	1.311	3.014	8.998***		0.861	0.657	3.317	6.679***	
Jamaica	7.619***	4.937*	2.241	3.442		3.848	5.414**	3.635	1.434	
Cayman Islands	1.918	3.393	6.921***	0.366		0.255	0.000	5.102**	3.011	
Hispaniola	3.401	5.988***	4.181	5.140**		1.019	4.535*	4.579*	1.417	
Puerto Rico	10.344***	8.026***	3.535	4.113		13.605***	8.238***	1.923	6.510***	
Cuban cays^b										
Jamaica	6.255***	5.260**	1.643	12.698***		4.387*	5.981***	0.396	6.345***	
Cayman Islands	0.606	1.516	2.479	8.662***		0.587	0.672	1.678	3.856	
Hispaniola	2.176	6.248***	6.237***	12.916***		0.117	5.059*	7.754***	7.591***	
Puerto Rico	11.897***	5.243**	0.251	5.624**		11.178***	7.187***	1.891	1.531	
Jamaica										
Cayman Islands	5.087**	8.615***	5.807**	3.817		3.859	5.614**	2.466	2.114	
Hispaniola	3.057	2.261	6.781***	2.721		4.749*	0.161	8.937***	2.925	
Puerto Rico	11.600***	14.205***	1.867	8.288***		21.918***	17.611***	1.992	6.371***	
Cayman Islands										
Hispaniola	1.515	9.002***	10.554***	5.432**		0.727	4.644*	9.594***	4.207	
Puerto Rico	11.842***	4.383*	3.460	3.698		12.393***	8.510***	3.908	3.036	
Hispaniola										
Puerto Rico	12.893***	13.472***	7.466***	8.987***		11.539***	13.281***	7.056***	7.515***	

^a * = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$.

^b List of Cuban cays included in Table 1.

Rico, and Cayman Islands. Puerto Rican kingbirds had substantial difference in size compared with Jamaican specimens, and Jamaican birds showed difference from Cayman Island birds.

We used linear discriminant analysis to classify specimens into groups ("Island": Bahamas; Cuba, including Isla de Pinos and cays; Cayman Islands; Jamaica; Hispaniola; and Puerto Rico)

using lengths of chord, tail, culmen, and tarsus as predictors. The analysis produced a true group classification of 0.750 for male Bahama specimens, 0.604 for Cuban specimens, 0.850 for Cayman Island specimens, 0.643 for Hispaniolan specimens, 0.720 for Jamaican specimens, and 0.833 for Puerto Rican individuals, for an overall proportion correct of 0.709 (127 of 179) (Wilks'

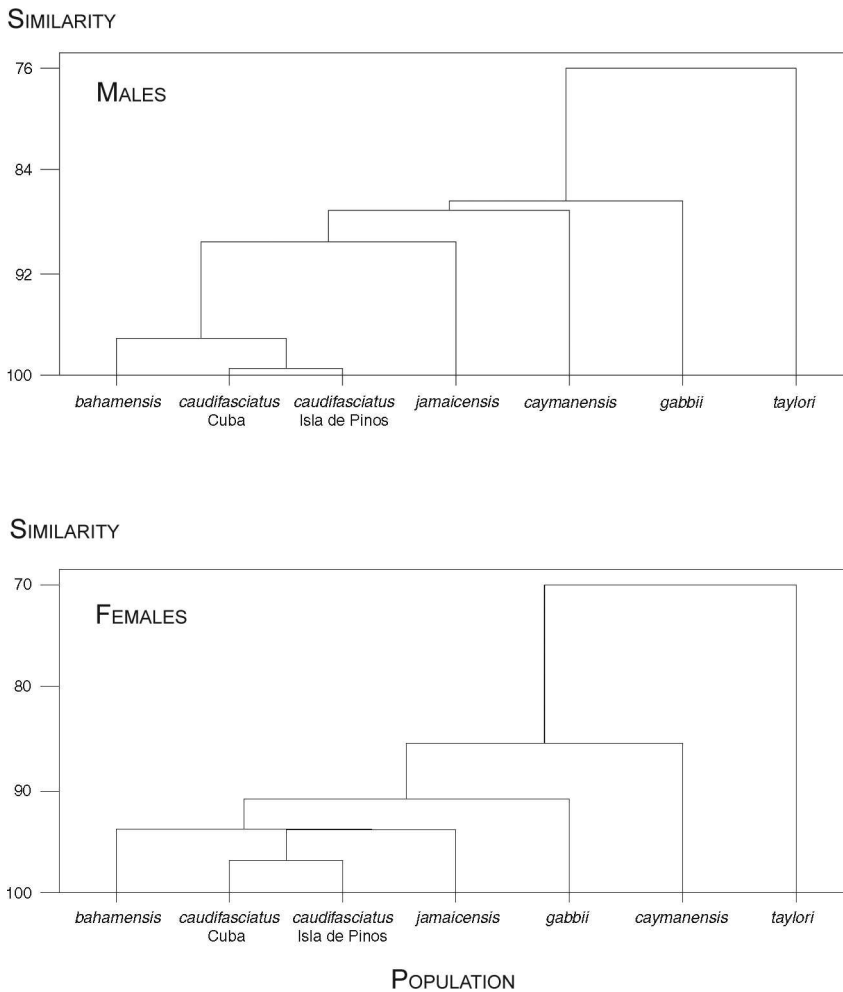


FIG. 1. Cluster analysis of relationships among seven populations of male and female Loggerhead Kingbirds (*Tyrannus caudifasciatus*) based on morphometric measurements (wing chord, and tail, culmen, and tarsus length). The single linkage method and squared Euclidean measure were used in the analysis.

lambda = 0.353; df = 12, $P < 0.01$). True group proportions for females were 0.667 for Bahama specimens, 0.500 for Cuban specimens, 0.533 for Cayman Island specimens, 0.900 for Hispaniolan specimens, 0.750 for Jamaican specimens, and 0.875 for Puerto Rican individuals, for an overall proportion correct of 0.713 (102 of 143) (Wilks' lambda = 0.473; df = 12, $P < 0.01$).

Cluster analysis of populations of Bahamian and Greater Antillean Loggerhead Kingbirds showed close relationship with two Cuban populations (Cuban mainland and Isla de Pinos), and among those two Cuban population and the Bahamian population (Fig. 1). Females had closer similarity within the Bahamian–Cuban *caudifas-*

ciatus grouping than did males. Puerto Rican populations had the least similarity compared with other island populations.

Vocalizations.—The Loggerhead Kingbird has a wide variety of songs and calls including advertisement (dawn) song, alarm calls, and defense calls. These vary among islands. We present variation in one of these vocalizations, the advertisement (“Dawn”) song, to illustrate differences among populations.

Advertisement songs varied considerably among populations (Tables 5, 6), including in number of song elements, duration of song, and length of individual song elements. Hispaniolan birds had the longest songs, whereas Jamaican and

TABLE 5. Characteristics of advertisement/dawn songs of six populations of Loggerhead Kingbirds (*Tyrannus caudifasciatus*). Measurements are for fundamental tones only.

Population	Mean \pm SD [<i>n</i>] (range)				
	Total duration of song (sec)	Duration of song elements (sec)	No. of song elements	Frequency (Hz)	
				Low	High
Bahama Islands	1.08 \pm 0.29 [4] (0.80–1.77)	0.16 \pm 0.04 [41] (0.07–0.26)	4.10 \pm 0.32 [4] (4–5)	2215.5 \pm 263.3 [4] (1887–2801)	4161.5 \pm 359.9 [4] (3735–5820)
Cuba	1.46 \pm 0.04 [5] (1.41–1.51)	0.087 \pm 0.03 [55] (0.04–0.16)	11.0 \pm 0.00 [5] (11)	1506.6 \pm 71.9 [5] (1460–1634)	4187.4 \pm 56.4 [5] (4113–4250)
Jamaica	0.61 \pm 0.08 [4] (0.54–0.69)	0.06 \pm 0.03 [20] (0.03–0.12)	5.00 \pm 0.00 [4] (5)	1703.5 \pm 32.4 [4] (1676–1739)	3870 \pm 214 [4] (3659–4148)
Cayman Islands	1.36 \pm 0.30 [7] (0.89–1.83)	0.067 \pm 0.43 [58] (0.01–0.14)	9.83 \pm 2.93 [6] (4–12)	1648.7 \pm 179.8 [6] (1418–1903)	4939 \pm 760 [6] (1459–1789)
Hispaniola	2.63 \pm 1.09 [4] (1.58–3.58)	0.038 \pm 0.30 [106] (0.01–0.29)	26.50 \pm 10.15 [4] (16–39)	1848 \pm 457 [7] (1229–2302)	4203 \pm 395 [7] (3575–4629)
Puerto Rico	0.68 \pm 0.33 [7] (0.26–1.17)	0.05988 \pm 0.0343 [51] (0.02–0.19)	7.29 \pm 2.69 [7] (4–11)	1635.1 \pm 87 [7] (1524–1727)	4066 \pm 280 [7] (3844–4319)

Puerto Rican birds gave the shortest sequences (Fig. 2). The individual song elements also showed significant differences among populations (Table 6); i.e., mean element lengths were distinct

among all populations except Cayman Islands compared with Puerto Rico and Jamaica, and Puerto Rico with Jamaica. Individual song elements ranged from 0.16 \pm 0.04 sec in duration

TABLE 6. Analysis of differences among advertisement/dawn songs of six populations of Loggerhead Kingbirds (*Tyrannus caudifasciatus*) from measurements in Table 5. *P* values are for unpaired two-sample *t*-tests with Bonferroni's correction for multiple comparisons. Significance level set at *P* < 0.05.

Population compared with	<i>t</i> -values, (df), and levels of significance ^a				
	Total duration of song (sec)	Duration of song elements (sec)	No. of song elements	Frequency (Hz)	
				Lowest	Highest
Bahama Islands					
Cuba	4.03 (9)***	−9.37 (69)***	69.00 (9)***	−13.58 (21)***	0.42 (41)
Jamaica	−4.81 (11)***	−9.91 (49)***	−32.64 (11)***	−11.58 (40)***	−2.41 (4)
Cayman Islands	1.91 (12)	−10.83 (85)***	−18.14 (13)***	−6.74 (8)***	2.46 (5)
Hispaniola	2.81 (3)	−16.73 (54)***	4.41 (3)**	2.07 (6)	0.26 (7)
Puerto Rico	−2.58 (11)*	−12.35 (74)***	−21.32 (12)***	−11.02 (28)***	−0.080 (9)
Cuba					
Jamaica	20.06 (4)***	2.74 (33)**	181.1 (6)***	−5.47 (5)**	2.88 (3)
Cayman Islands	0.85 (6)	2.92 (104)**	0.99 (5)	−1.77 (6)	−2.41 (5)
Hispaniola	−2.16 (3)	9.46 (104)***	−3.05 (3)	−1.94 (6)	−0.10 (6)
Puerto Rico	6.13 (6)***	4.29 (101)***	3.65 (6)**	−2.80 (9)*	1.11 (6)
Jamaica					
Cayman Islands	6.31 (7)***	0.24 (44)	4.04 (5)**	−0.73 (5)	3.25 (6)*
Hispaniola	3.72 (3)*	−3.34 (25)**	4.24 (3)*	0.83 (6)	1.81 (8)
Puerto Rico	0.58 (7)	−0.53 (36)	2.25 (6)	−1.87 (8)	1.30 (7)
Cayman Islands					
Hispaniola	2.29 (3)	−4.42 (87)***	3.20 (3)*	1.06 (8)	−2.14 (7)
Puerto Rico	4.02 (11)**	0.91 (105)	1.62 (10)	0.17 (6)	2.66 (6)*
Hispaniola					
Puerto Rico	3.50 (3)*	−3.83 (88)***	3.71 (3)*	1.21 (6)	0.75 (10)

^a * = *P* < 0.05, ** = *P* < 0.01, *** = *P* < 0.001.

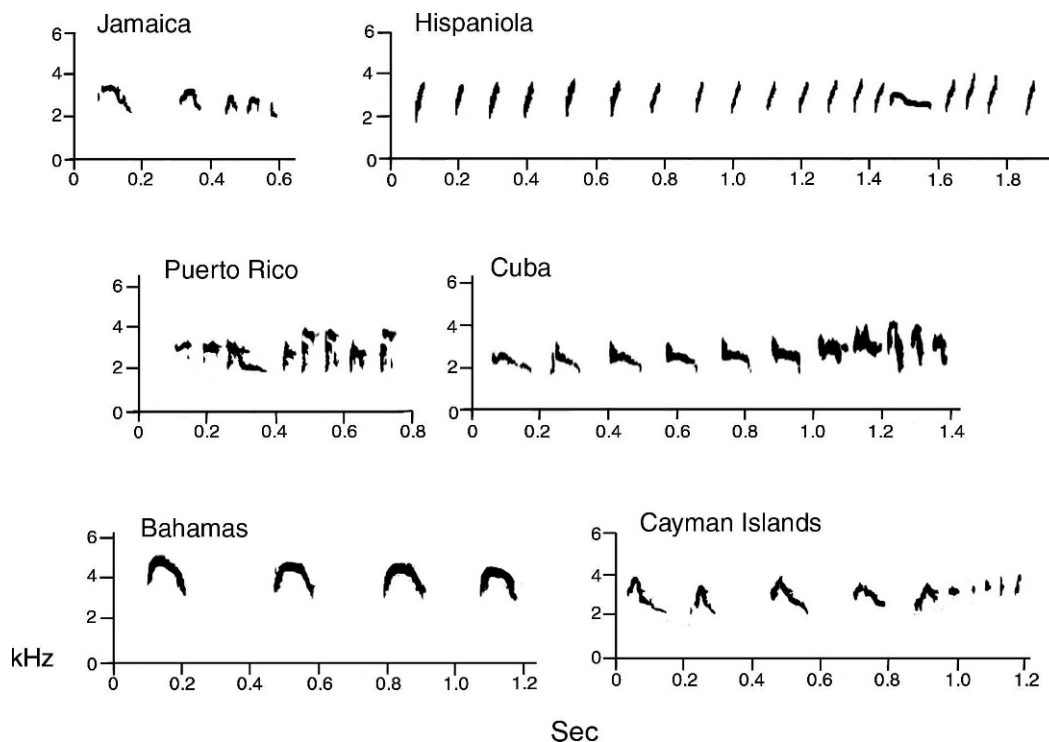


FIG. 2. Sonograms of advertisement/dawn song in six populations of Loggerhead Kingbird (*Tyrannus caudifasciatus*). Localities and source – Jamaica: Montego Bay (Reynard J127-8); Hispaniola: La Descubierta, Dominican Republic (Reynard H139-2); Puerto Rico: Guánica (Reynard PR37-1); Cuba: Playa Larga (Reynard CB208-5); Bahama Islands (Macaulay 115967); and Cayman Islands: Grand Cayman (Reynard J127-1).

in Bahamian birds to 0.038 ± 0.301 sec in Hispaniolan kingbirds (Table 5). Number of elements in song segments ranged from 26.5 ± 10.15 ($n = 4$, range = 16–39) in Hispaniolan birds to 4.10 ± 0.316 ($n = 4$, range = 4–5) in Bahamian birds with Bahamian and Cuban birds differing most in number of elements from other populations (Table 6).

Hispaniolan birds have long songs with rapidly repeated series of many short staccato notes, similar to the shorter segment of Cuban birds. Songs of Cuban and Cayman Island populations were of moderate duration with moderate element length and number. Puerto Rican and Jamaican populations had songs of short total length and moderate element length, but Puerto Rican birds differed in having more song elements than those in Jamaica. Bahamian birds had distinctive songs of moderate length with fewer, but longer, elements than songs of other populations.

Systematics and Distribution

Differences in plumage coloration and pattern, body size, vocalizations, and distribution among Loggerhead Kingbird populations led us to reevaluate its taxonomic status confirming, in part, the species limits presented by several early workers; e.g., Ridgway (1907), Cory and Hellmayr (1927), Wetmore and Swales (1931), and Bond (1945). We concur with Buden and Olson (1989), who concluded that *flavescens*, described from the Isla de Pinos, is not distinct from *caudifasciatus*. We found no differences in measurements between Cuban and Isla de Pinos populations, although both males and females had significant differences in tarsus length between Cuban cays and Isla de Pinos (Table 4). Populations inhabiting Cuban cays share the same characters as specimens from the main island of Cuba, but varied more from Cuban birds than did the population of Isla de Pinos.

We propose the following systematic arrangement based on plumage, morphometric, and vocalization data:

Tyrannus caudifasciatus bahamensis Bryant, 1864.—Northern Bahama Islands (Grand Bahama, Abaco, Andros, and New Providence).

Tyrannus caudifasciatus caudifasciatus d'Orbigny, 1839.—Cuba, Isla de Pinos, and the following cays: Cayo Cinco Leguas, Cayo Tío Pepe, Cayo Lanzanillo, Cayo Frágoso, Cayo Francés, Cayo Las Brujas, Cayo Santa María, Cayo Coco, Cayo Guillermo, Cayo Paredón Grande, Cayo Guajaba, Cayo Romano, Cayo Sabinal in the Archipiélago Sabana—Camagüey; Cayo Saetía (Bahía de Nipe), Cayo Loma, Cayo Blanco, Cayo Cabeza del Este, and Cayo Grande in the Archipiélago Jardines de la Reina.

Tyrannus caudifasciatus jamaicensis Chapman, 1892.—Jamaica.

Tyrannus caudifasciatus caymanensis Nicoll, 1904.—Cayman Islands (Grand Cayman, Cayman Brac, and Little Cayman [at least formerly]).

Tyrannus gabbii Lawrence, 1876.—Hispaniola (Haiti and Dominican Republic).

Tyrannus taylori Sclater, 1864.—Puerto Rico and Isla Vieques.

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