J. Carib. Ornithol. 23:19–30, 2010

NATURAL HISTORY NOTES ON THE LOGGERHEAD KINGBIRD (*TYRANNUS CAUDIFASCIATUS*)

JAMES W. WILEY[1,2], ORLANDO H. GARRIDO[3], AND ARTURO KIRKCONNELL[4]

[1]*Western Foundation of Vertebrate Zoology, 439 Calle San Pablo, Camarillo, CA 93012 USA;*
[2]Mailing address: *PO Box 64, Marion Station, MD 21838-0064, USA;* e-mail: *jwwiley@umes.edu;*
[3]*Calle 60 no. 1706 %17 y 19, Marianao 13 (Playa), La Habana, Cuba;* [4]*Museo Nacional de Historia Natural de Cuba, Obispo no. 61, Plaza de Armas, La Habana 10100, Cuba*

Abstract: We present natural history data on a Bahamas and Greater Antilles endemic, the Loggerhead Kingbird (*Tyrannus caudifasciatus*), based on published reports and our personal observations. Nesting is generally within the period of February–July, but occasional nests have been reported as early as November and as late as August. Mean nest tree height among all populations was 10.9±4.7 m, with nests placed an average of 4.6±1.9 m high (48.9±22.1% of tree height). Eggs vary in coloration and size among the populations, with eggs of Bahamian (Abaco) birds averaging larger than in other islands, and eggs from Dominican Republic averaging smaller than those in other populations. Clutch size is generally reported as 2–4 eggs. We found an average of 3.09±0.49 eggs for 68 clutches among six populations. Of 19 nests we monitored closely in east-central Puerto Rico, 57.9% were successful; the mean clutch size was 2.95±0.52, the mean number of newly hatched chicks was 2.05±1.22, and the mean number of older chicks was 1.16±1.24. Loggerhead Kingbirds feed on animal and plant foods. We found a difference between adult food (56.2% plant) and foods brought by adults to nestlings (57.4% animal). Loggerhead Kingbird and Gray Kingbird (*T. dominicensis*) inhabit different habitats during most of the year, but where Gray Kingbird migrates off-island, the loggerhead expands into the habitats normally occuppied by the Gray Kingbird until that species returns. Microhabitat use by Loggerhead Kingbird varies among island populations. Cuban loggerheads prefer lower perch strata than those in Hispaniola and Puerto Rico. Also, behavior varies among populations, with Loggerhead Kingbirds in Hispaniola and Puerto Rico being more sluggish and remaining motionless for longer periods than populations in the other islands.

Key words: Abaco Island, breeding biology, Cayman Islands, Cuba, diet, Dominican Republic, Isla de Pinos, Jamaica, Loggerhead Kingbird, natural history, Puerto Rico, *Tyrannus caudifasciatus*

Resumen: HISTORIA NATURAL DEL PITIRRE GUATÍBERE (*TYRANNUS CAUDIFASCIATUS*). Presentamos datos sobre la historia natural del Pitirre Guatíbere (*Tyrannus caudifasciatus*), especie endémica de las Bahamas y Las Antillas Mayores. La información es basada en reportes publicados y nuestras observaciones. La época reproductiva es generalmente en el período comprendido entre febrero y julio, pero ocasionalmente ha sido reportado en fecha tan temprana como noviembre y tan tardía como agosto. La media de la altura de los árboles donde nidifican fue 10.9±4.7 m, con el nido construido a una altura promedio de 4.6±1.9 m (48.9±22.1% de la altura del árbol). Los huevos varían en coloración y tamaño entre las diferentes poblaciones, donde los huevos de las poblaciones bahamense (Abaco) son más grandes como promedio, y los huevos de las poblaciones de la República Dominicana son más pequeños que el resto de las poblaciones caribeñas. El tamaño usual de la puesta es 2–4 huevos. Para 68 puestas de 6 poblaciones encontramos un promedio de 3.09±0.49 huevos. De los 19 nidos monitoreados en el este y centro de Puerto Rico, el 57.9% fueron exitosos; la media del tamaño de puesta fue 2.95±0.52, la media del número de pichones recién eclosionados fue 2.05±1.22, y la media del número de pichones ya crecidos fue 1.16±1.24. El Pitirre Guatíbere se alimenta de animales y material de origen vegetal. Se encontraron diferencias entre la alimentación de los adultos (56,2% de origen vegetal), y todos los alimentos acarreados por los adultos a los pichones (57,4% de origen animal). El Pitirre Guatíbere y el Abejero (*T. dominicensis*) ocupan diferentes tipos de hábitats durante la mayor parte del año, pero cuando el Pitirre Abejero emigra, el Pitirre Guatíbere se expande dentro de aquellos hábitats ocupados con regularidad por el Pitirre Abejero hasta que esta especie retorna. El microhábitat utilizado por el Pitirre Guatíbere varía entre las diferentes poblaciones de las islas. Los pitirres guatíberes en Cuba prefieren los estratos con perchas más bajas a diferencia de los individuos en La Española y Puerto Rico. Igualmente, la conducta varía entre las poblaciones, siendo los de La Española y Puerto Rico más inactivos donde permanecen sin movimientos por períodos más largos que los individuos de poblaciones de otras islas.

Palabras clave: alimento, biología reproductiva, Cuba, historia natural, Isla Abaco, Isla de Pinos, Islas Caimán, Jamaica, Pitirre Guatíbere, Puerto Rico, República Dominicana, *Tyrannus caudifasciatus*

Résumé : NOTE D'HISTOIRE NATURELLE SUR LE TYRAN TETE-POLICE (*TYRANNUS CAUDIFASCIATUS*). Nous présentons des données basées sur des publications et nos propres observations sur l'histoire naturelle d'une espèce endémique des Bahamas et des Grandes Antilles, le Tyran tête-police (*Tyrannus caudifasciatus*). La nidification se déroule généralement entre février et juillet mais des nids ont été trouvés ponctuellement depuis novembre et jusqu'en

août. La hauteur moyenne de tous les nids observés était de 4,6 ± 1.9 m sur des arbres d'une hauteur moyenne de 10.9 ± 4.7 m, c'est à dire à 48.9 ± 22.1 % du sommet. La coloration et la taille des œufs étaient variable selon les populations, ceux des Bahamas (Abaco) étant en moyenne les plus gros et ceux de République Dominicaine les plus petits. La taille des pontes était généralement de 2 à 4 œufs, la moyenne générale de 68 couvées de 6 populations étant de 3.09 ± 0.49 oeufs. Dans la zone centre-est de Porto Rico, 19 nids ont été suivis attentivement ; 57.9% ont réussi, la taille moyenne étant de 2.95 ± 0.52. Le nombre moyen d'éclosions était de 2.05 ± 1.22, et celui des poussions plus âgés de 1.16 ± 1.24. Le Tyran tête-police a une alimentation animale et végétale. Nous avons observé une différence entre la nourriture des adultes, d'origine végétale à 56,2 %, avec celle amenée aux oisillons à 57,4 % d'origine animale. Le Tyran tête-police et le Tyran gris (*T. dominicensis*) habitent des habitats différents la majeure partie de l'année mais, lorsque le Tyran gris migre ailleurs, le Tyran tête-police élargit son habitat aux zones habituellement occupées par le Tyran gris jusqu' à son retour. Le microhabitat utilisé par le Tyran tête-police varie selon les populations insulaires. Les oiseaux cubains préfèrent une strate de perchoir plus basse qu'à Hispaniola ou Porto Rico. Leur comportement varie aussi entre les populations, les oiseaux de Hispaniola et Porto Rico étant plus apathiques et restant calmes pendant de plus longues périodes que dans les autres îles.

Mots-clés : alimentation, biologie de la reproduction, Cuba, histoire naturelle, Isle Abaco, Ile des Pins, Iles Cayman, Jamaïque, Porto Rico, Republique Dominicaine, Tyran tête-police, *Tyrannus caudifasciatus*

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, American Ornithologists' Union 1998:414). Based on plumage, morphometrics, distribution, and vocalizations, Garrido *et al.* (2009) recently separated populations in Puerto Rico and Isla Vieques (*T. taylori*) and Hispaniola (*T. gabbii*) as distinct species, and suggested subspecific distinction to populations in Cuba, Isla de Pinos, and Cuban satellites (*T. c. caudifasciatus*); Cayman Islands (*T. c. caymanensis*); Jamaica (*T. c. jamaicensis*); and the Bahamas (*T. c. bahamensis*). Although the species is common in the Greater Antilles and Bahamas, remarkably little information has been published on the natural history of Loggerhead Kingbirds, especially concerning breeding biology (Gosse 1847, Gundlach 1893, Todd 1916, Wetmore and Swales 1931, Bond 1936, Lack 1976, Dod 1978, Raffaele 1989, Phillips 1994). Authors generally agree in their observations on behavior and feeding techniques, but their remarks are rather superficial, and do not make comparisons among populations. For example, Bond (1936:245) states: "the nesting site, nest, number and color of the eggs (25×18 mm) are the same as those of the Gray Kingbird" (*Tyrannus dominicensis*), a closely related, but distinct species. Natural history characteristics are valuable diagnostic tools in determining species limits of birds, just as are morphometric, plumage, vocal, and molecular differences. As we gathered information on the comparative behavior and ecology among populations from published sources, however, we were struck with the paucity of such data. Thus, we were unable to further evaluate species limits based on most natural history characteristics of Loggerhead Kingbird populations (Garrido *et al.* 2009). Here we summarize published information and present data gathered in our field studies of *Tyrannus caudifasciatus*.

Table 1. Localities, years of study, and numbers of nests of Loggerhead Kingbird (*Tyrannus caudifasciatus*) studied in six islands, 1973–2009.

Location	Years	No. of Nests Studied
Bahamas: Abaco Island	1981, 1995, 2004	7
Cuba: Ciénaga de Zapata	2006–2009	13
Isla de Pinos: Los Indios	1995–1998, 2000, 2006, 2007	9
Cayman Islands: Cayman Brac	1990–1992	7
Dominican Republic: Pilancón and Sabana de la Mar	1976–1978, 1982, 1989, 1996, 2000–2002, 2004	19
Puerto Rico: Ceiba and Cidra	1973–1986	25

STUDY AREAS AND METHODS

Data were collected in the Dominican Republic; Cuba, including Isla de Pinos (Isla de la Juventud) and Cayo Coco, Archipiélago Sabana–Camagüey; Cayman Brac, Cayman Islands; Abaco Island, Bahamas; and Puerto Rico incidental to other work from 1973 to 2009 (Table 1). Observations of behavior, including foraging and diet, were made from blinds placed near nests in east-central Puerto Rico (Ceiba and Cidra) and northeastern Dominican Republic (Pilancón and Sabana de la Mar). Egg measurements (length and width) were taken to the nearest 0.1 mm with dial calipers. We include data from Schönwetter and Meise (1979) in addition to our egg measurement data. Diet data were collected during the kingbird's breeding season.

We present summary descriptive statistics (mean, SD, and range) for measurements. Unpaired *t*-tests were used to test for equality of measurements among populations. We used Bonferroni's correction in conducting multiple tests of means. Further, we used ANOVA analyses to determine if differences exist among island populations. The hypothesis of separation of egg measurements among populations was tested using discriminate function analysis (DFA) (Kleinbaum and Kupper 1978). Statistical computations were performed using the software package Minitab (2000), with the level of significance set at 0.05.

Botanical names follow Integrated Taxonomic Information System (2009).

RESULTS AND DISCUSSION

BREEDING

The earliest Loggerhead Kingbird nest we encountered was in Los Haitises, Dominican Republic, on 20 March 1976, whereas the latest nest initiation we observed was at Ceiba, Puerto Rico on 1 August 1975. Raffaele *et al.* (1998) reported Loggerhead Kingbird nesting mainly occurs from February to July, but others have noted nesting as early as November (Jamaica, Downer and Sutton 1990; Hispaniola, Keith *et al.* 2003) and as late as August (Cayman Islands, Bradley 1995).

Males and females vocalize constantly during pairing, with rattle calls and other loud calls, and chase one another persistently. Both sexes are involved in the pair's nest site selection. The pair glides low over the selected site, then the female perches on the site, pressing her body onto the support branch, turning in a circle while constantly moving her wings and vocalizing. Thereupon, the male joins in vocalizing, while erecting his otherwise hidden, brightly colored crown feathers. The female is the first to gather nesting materials, mostly small twigs, but males assist in collecting and delivering materials to the nest. The nest is a cup-shaped woven structure, loosely formed of dry twigs, rootlets, hair, tendrils, and stems, with a slight cup usually unlined or only lightly lined with horsehair, plant fibers, or small leaves. Nests are placed in a wide variety of tree species, usually at mid- to low-height (Table 2). Among all populations, nest trees averaged 10.9±4.7 m (n = 80, range = 3.5–24.0 m) in height, with nest positions averaging 4.6±1.9 m (n = 80, range = 2.1–13.9 m) high, or at 48.9±22.1% (n = 80, range = 13.8–92.7%) of tree height. Nests were typically placed at a moderate distance from the trunk: 2.3±1.1 m (n = 80, range = 0–4.6 m).

Clutch sizes are generally reported as 2–4 for most island populations, with Jamaica the exception at 4–5 eggs per clutch (Table 3). Kerr-Jarrett (1964) and Downer (1991), however, reported only three chicks from each of two nests in Jamaica. The average clutch size at 68 nests we examined in Abaco, Cuba, Isla de Pinos, Cayman Brac, Dominican Republic, and Puerto Rico was 3.09±0.49 (range = 2–4) eggs. Loggerhead Kingbird eggs vary in size among populations (Table 4). Eggs from the Abaco population were larger than those from Isla de Pinos (length [L] and width [W]), Cuba (W), Hispaniola (L and W), Puerto Rico (W), and Cayman Brac (L and W) (all $P < 0.05$; two-sample *t*-tests; Table 5). Eggs from the Dominican Republic population were smaller ($P < 0.05$) than those of other populations (Table 5). A linear discriminant analysis yielded an overall proportion correct for assigning egg specimens to island populations of 0.513 (n = 40 of 78), with only Puerto Rico (0.600), Hispaniola (0.667), and Bahama Islands (1.000) showing proportions greater than 0.500. Thus, egg size provides further support for species status for Puerto Rican and Hispaniolan populations (Garrido *et al.* 2009). Although Loggerhead Kingbird eggs from Abaco Island were found to differ in size from those from other populations, other evidence suggests the Bahamian population is separable at the subspecies level (Garrido *et al.* 2009).

Egg color shows moderate variation among populations, with Cuban birds generally producing the lightest-colored eggs and Hispaniolan birds the darkest (Table 3).

We monitored nest success and productivity of 19 nesting attempts in Puerto Rico (Ceiba and Cidra), finding an overall nest success of 57.9% (apparent

Table 2. Nest tree species and characteristics, and nest placement qualities in six populations of Loggerhead Kingbird (*Tyrannus caudifasciatus*), 1974–2009.

Population [*n* nests]	Tree Species [*n* nests]	Nest Tree Height (m)	Nest Height (m)	Nest Height/ Tree Height (%)	Distance of Nest from Trunk (m)
Abaco [7][a]	Honduras pine *Pinus ellottii* var. *elliottii* [5]	10.8±3.6	4.4±0.9	46.6±21.9	1.5±0.9
		5.7–15.4	2.9–5.1	18.8–78.9	0.3–2.6
	Florida poisontree *Metopium toxiferum* [1]	6.8	6.1	89.7	1.6
	Gumbo-limbo *Bursera simaruba* [1]	13.3	5.1	38.3	2.1
Cuba [13]	Gregorywood *Bucida buceras* [5]	12.0±2.3	3.6±0.4	31.3±8.5	3.5±1.0
		9.2–15.3	3.1–4.0	21.6–43.5	0–2.5
	Narrow trumpet tree *Tabebuia angustata* [3]	14.4±1.9	4.1±0.3	28.9±3.8	1.5±0.9
		12.3–15.6	3.9–4.5	25.0–32.5	1.0–2.5
	Royal poinciana *Delonix regia* [2]	8.1±0.6	3.9±0.1	48.3±5.1	3.7±0.3
	Gumbo-limbo *Bursera simaruba* [1]	12.3	4.1	33.3	3.1
	Pond-apple *Annona glabra* [1]	12.3	3.5	28.5	2.1
	Kapoktree *Ceiba pentandra* [1]	20.0	3.9	19.5	3.5
Isla de Pinos [9]	Caribbean pine *Pinus caribaea* [5]	12.3±3.0	6.8±4.7	54.7±30.3	1.7±1.0
		9.2–15.4	2.1–13.9	13.8–90.3	0–2.5
	Cuban royal palm *Roystonea elata* [1]	7.7	3.8	49.4	1.5
	Pond apple *Annona glabra* [1]	12.4	3.9	31.5	2.9
	Grapefruit *Citrus X paradisi* [1]	6.2	3.7	59.7	1.9
	Red manjack *Cordia glabra* [1]	5.9	4.0	67.8	2.0
Cayman Brac [7]	Gumbo-limbo *Bursera simaruba* [3]	12.4±0.1	3.4±0.1	27.2±1.1	2.8±1.0
		12.3–12.5	3.3–3.5	26.4–28.5	1.7–3.6
	Mango *Mangifera indica* [1]	6.2	4.5	72.6	2.7
	Cayman ironwood *Chionanthus caymanensis* [1]	9.2	4.1	44.6	1.5
	Jamaican walnut *Picrodendron baccatum* [1]	12.3	3.9	31.7	3.6
	False mastic *Sideroxylon foetidissimum* [1]	13.3	3.5	26.3	3.6
Dominican Republic [19][a]	Matchwood *Schefflera morototonii* [5]	8.8±2.6	3.8±0.4	47.5±18.5	2.4±0.6
		5.8–11.5	3.3–4.3	31.4–69.4	1.5–3.0

[a]Some nests were not included in other calculation because contents were not determined

Table 2 continued.

Population [*n* nests]	Tree Species [*n* nests]	Nest Tree Height (m)	Nest Height (m)	Nest Height/ Tree Height (%)	Distance of Nest from Trunk (m)
Dominican Republic [19][a]	Kapoktree *Ceiba pentandra* [4]	15.7±2.7	5.0±0.9	32.6±7.3	3.6±0.9
		12.0–18.3	3.9–5.8	23.1–39.2	2.5–4.6
	White cedar *Tabebuia heterophylla* [3]	4.0±0.2	3.7±0.2	92.4±0.3	1.5±0.5
		3.8–4.1	3.5–3.8	92.1–92.7	1.0–2.0
	Spanish cedar *Cedrela odorata* [2]	22.7±1.9	4.9±0.9	21.7±5.9	2.9±0.8
		21.3–24.0	4.2–5.5	17.5–25.8	2.3–3.4
	Florida clusia *Clusia rosea* [2]	11.0±1.3	5.8±2.1	54.2±25.6	1.8±0.4
		10.1–11.9	4.3–7.3	36.1–72.3	1.5–2.0
	Corcho bobo *Pisonia albida* [2]	3.8±0.4	3.0±0.1	78.2±10.6	2.0±0.1
		3.5–4.1	2.9–3.0	70.7–85.7	1.9–2.0
	Fourleaf buchenavia *Buchenavia tetraphylla* [1]	7.1	3.2	45.1	3.0
Puerto Rico [25][a]	Lead tree *Leucaena leucocephala* [8]	5.6±0.8	3.8±0.3	69.5±12.6	1.6±0.9
		4.6–6.3	3.3–4.3	53.2–87.0	0.4–3.1
	Gumbo-limbo *Bursera simaruba* [3]	10.6±0.2	4.8±0.6	45.4±5.2	2.3±0.7
		10.5–10.8	4.3–5.5	40.6–50.9	1.5–2.8
	Matchwood *Schefflera morototonii* [3]	14.4±0.9	6.3±2.4	43.4±5.2	3.2±0.3
		13.8–15.4	4.9–9.1	35.5–59.1	3.0–3.5
	Rose-apple *Syzygium jambos* [3]	4.8±0.2	3.5±0.5	74.0±12.7	2.2±1.4
		4.6–5.0	3.0–3.9	60.0–84.8	1.0–1.8
	Bulletwood *Manilkara bidentata* [2]	15.4±8.7	4.8±0.1	36.7±20.4	3.0±1.2
		9.2–21.5	4.7–4.8	22.3–51.1	2.1–3.8
	White pricklyash *Zanthoxylum martinicense* [2]	13.9±6.6	6.0±2.5	43.7±2.9	3.0±0.7
		9.2–18.5	4.2–7.7	41.6–45.7	2.5–3.5
	Puerto Rico royal palm *Roystonea borinquena* [1]	15.4	13.5	87.7	0.0
	Australian pine *Casuarina equisetifolia* [1]	16.9	3.3	19.5	2.5
	Shortleaf fig *Ficus citrifolia* [1]	16.9	7.1	42.0	4.3
	Common bamboo *Bambusa vulgaris*[1]	15.7	6.5	41.4	0.0
Overall $\bar{x}$±SD for all populations and tree species		10.9±4.7	4.6±1.9	48.9±22.1	2.3±1.1
Comprehensive range (n = 80) for all populations and tree species		3.5–24.0	2.1–13.9	13.8–92.7	0–4.6

[a]Some nests were not included in other calculation because contents were not determined

Table 3. Clutch sizes and egg coloration in seven populations of Loggerhead Kingbird (*Tyrannus caudifasciatus*) as determined from the literature and the present study.

Population	Clutch Size[a]	Egg Coloration	Source
Abaco Island	3.40±0.55; 3–4 [5]	Cream foundation, with pinkish hue; heavily marked with dark reddish-brown, brown, and gray, particularly at large end.	Present study
Cuba	2–4	White with reddish hue, with crown of ashy-violet markings, more or less clear brown and reddish-brown.	Thienemann 1857, Gundlach 1872, 1876, 1893
		Pinkish-cream, with dark brown and gray markings.	Valdés Miró 1984
		Salmon-colored, with reddish-brown and violet markings at broad end.	Garrido and Kirkconnell 2000
	3.00±0.58; 2–4 [13]		Present study
Isla de Pinos	3.22±0.44; 3–4 [9]	Light to medium salmon foundation, with reddish-brown, brown, and grayish-violet at broad end.	Present study
Jamaica	4–5	Drab hue or reddish-white, with blotches of reddish-brown and bluish irregularly intermixed, but chiefly arranged in the form of a crown around the larger end.	Gosse 1847
Cayman Islands	2–4		Bradley 1995
Cayman Brac	3.00±0.00; 3 [7]	Light salmon-cream foundation, with dark reddish-brown and gray markings.	Present study
Hispaniola	2–4	Reddish-brown with darker brown and violet markings at the broad end.	Keith *et al.* 2003, Latta *et al*. 2006
	3.17±0.58; 2–4 [15]		Present study
Puerto Rico	2–3	Salmon-colored with brown and violet markings at the broad end.	Gundlach 1878, Raffaele 1989
	2–4		Oberle 2006
	3.00±0.47; 2–4 [19]		Present study

[a]Descriptive statistics, where available, include mean ± SD; range [*n*]

nest success from observed nests). Clutch size averaged 2.95±0.52 eggs (range = 2–4), whereas the average number of hatchlings was 2.05±1.22 (range = 0–3) and of older chicks was 1.16±1.24 (range = 0–3). At nests where cause of failure could be determined (n = 5), depredation accounted for 60% of those failures.

Shiny Cowbird (*Molothrus bonariensis*) has been established for more than 25 yr in three of our study areas (Puerto Rico: established 1955, Grayce 1957; Dominican Republic: 1972, Bond 1973; Cuba: 1982, Garrido 1984), but we found no evidence of brood parasitism at any of the Loggerhead Kingbird nests examined (n = 80), although the cowbird was regularly seen in each of our study areas. As is characteristic of Gray Kingbird, Loggerhead Kingbird is quite aggressive toward intruding birds about its nest and this behavior may, in part, account for the absence of cowbird parasitism. Only one of 61 (1.6%) Gray Kingbird nests examined in eastern Puerto Rico was parasitized by the Shiny Cowbird (Wiley 1985).

DIET AND FORAGING

Loggerhead Kingbirds are opportunistic foragers, feeding on berries and seeds, as well as animal matter, including invertebrates and small vertebrates (Table 6). Oberle (2006) noted that berries comprised about a quarter of the kingbird's diet, with seeds, insects, and small vertebrates making up the remainder of its food. Stomachs of four kingbirds collected by us in Cuba contained fruits (three stomachs), seeds (two stomachs), Hymenoptera (fam. Sphecidae: eight individuals, one stomach; fam. Formicidae: two individuals, one stomach), beetles (one stomach), and unidentified insect remains (one stomach). Our observations revealed about equal proportions of plant and animal foods in the combined diets of adult and nestling kingbirds, but we found a difference in the proportions of these diet components between those eaten by adults (56.2% plant) and those brought to nests (57.4% animal) to

Table 4. Mensural characteristics (mean ± SD [*n*]; range) for Loggerhead Kingbird (*Tyrannus caudifasciatus*) eggs from seven populations.

Population	Length (mm)	Width (mm)	Mass (g)
Abaco, Bahama Islands	26.0±0.57 [6]; 25.0–26.5	19.6±0.50 [6]; 19.0–20.3	2.95 [3][a]; 2.9–3.0
Cuba	25.2±1.12 [11]; 23.8–27.2	18.3±0.50 [11]; 17.5–19.0	2.43 [7][a]; 2.2–2.6
Isla de Pinos	25.2±1.01 [15]; 23.8–27.5	18.1±0.27 [15]; 17.7–18.8	–
Jamaica[a]	25.5 [15]; 24.1–27.8	18.4 [15]; 17.8–19.0	2.60 [15]; 2.4–3.0
Cayman Brac, Cayman Islands	24.8±0.37 [6]; 24.3–25.3	18.2±0.20 [6]; 17.9–18.4	–
Dominican Republic	24.0±0.66 [15]; 23.1–25.0	18.1±0.25 [15]; 17.8–18.5	2.23 [4][a]; 2.0–2.4
Puerto Rico	25.3±1.17 [25]; 23.1–27.3	18.4±0.26 [25]; 17.9–18.9	2.33 [4]; 2.0–2.9

[a]From Schönwetter and Meise (1979)

provision nestlings (χ^2 = 19.72, df = 1, $P < 0.001$; Table 7). Similarly, Downer (1991) reported the majority of items delivered to nestlings were animals (lizards).

Loggerhead Kingbirds forage by sallying from low- to medium-elevation perches to capture animals, usually by plucking them off the ground or from a leaf or twig rather than in mid-air as does Gray Kingbird, although the Loggerhead Kingbird also snatches flying insects in mid-air. Lack (1976) characterized the Loggerhead Kingbird's foraging technique as "pouncing," where most of its prey was taken by flying from a woods-edge perch to take prey from the ground. Loggerhead Kingbirds snatch fruits in flight or by alighting and gleaning.

Loggerhead Kingbird sometimes forages in a manner similar to woodpeckers, perching vertically on a trunk and probing for insects in small holes in the bark. In Cuba, Loggerhead Kingbirds commonly follow foraging West Indian Woodpeckers (*Melanerpes superciliaris*) and Cuban Green Woodpeckers (*Xiphidiopicus percussus*), mimicking their techniques of probing for prey in tree trunk crevices and holes. Further, loggerheads have been observed following foraging Northern Flickers (*Colaptes auratus*) closely, mimicking the flicker's probing movents and inserting their bills in the same sites already probed by the flicker (Kirkconnell 2000).

Loggerhead Kingbird occasionally uses the "beater effect" of opportunistic foraging; i.e., one animal's flushing prey by its movements, thus making prey more vulnerable to capture by a predator (Wittenberger 1981:613). The kingbird perches near a woodpecker, particularly West Indian Woodpecker, as the latter probes for prey in bromeliads. Insects flushed by the woodpecker are captured in the air by the Loggerhead Kingbird as it sallies from its

Table 5. Comparisons of egg dimensions among six populations of Loggerhead Kingbird (*Tyrannus caudifasciatus*). Two-sample *t*-tests used, two-tailed, with Bonferroni's correction for multiple comparisons. Significance level set at 0.05.

Paired Comparisons Between Populations [*N*]	*t*-values (df) and Levels of Significance	
	Length	Width
Abaco Island [5]		
Cuba	-2.11 (14)	-5.14 (10)[c]
Isla de Pinos	-2.28 (16)[a]	-6.94 (6)[c]
Cayman Brac	-4.37 (8)[b]	-6.34 (6)[c]
Dominican Republic	-7.06 (10)[c]	-6.65 (6)[c]
Puerto Rico	-2.08 (16)	-5.52 (5)[b]
Cuba [13]		
Isla de Pinos	-0.16 (20)	1.18 (14)
Cayman Brac	0.92 (13)	0.52 (14)
Dominican Republic	3.08 (15)[b]	0.74 (13)
Puerto Rico	0.43 (20)	0.90 (12)
Isla de Pinos [9]		
Cayman Brac	1.35 (18)	-1.00 (12)
Dominican Republic	3.94 (24)[c]	-0.77 (27)
Puerto Rico	0.31 (33)	3.87 (28)[c]
Cayman Brac [7]		
Dominican Republic	-3.63 (16)[b]	-0.32 (11)
Puerto Rico	1.85 (26)	2.41 (9)[a]
Dominican Republic [15]		
Puerto Rico [19]	4.61 (37)[c]	3.17 (29)[b]

[a]$P < 0.05$
[b]$P < 0.01$
[c]$P < 0.001$

Table 6. Reported food items of the Loggerhead Kingbird (*Tyrannus caudifasciatus*) throughout its range. Vernacular and scientific names of plant and animal foods are presented as in the original publication when no standard equivalent could be determined.

Food	Location	Source
Plant		
"Aurelia" (berries)	Jamaica	Black 1982
"Bird pepper" (fruit)	Jamaica	Taylor 1955
Orange-jessamine *Murraya paniculata*	Jamaica	Black 1989
"Privet tree" (seeds)	Jamaica	Levy 1987
Allspice *Pimenta dioica* (berries)	Jamaica	Panton 1953
"Milkwood tree" [= *Plumeria*?]	Jamaica	Paterson 1965
Gumbo-limbo *Bursera simaruba* (seeds)	Jamaica	Gosse 1847
"Jamaican birch" [=*Bursera simaruba*] (seeds)	Jamaica	Taylor 1955
Puerto Rico royal palm *Roystonea borinquena*	Puerto Rico	Sierra-Bracero 1973, Pérez-Rivera 1984
Achiotillo *Alchornea latifolia*	Puerto Rico	Sierra-Bracero 1973
Bread and cheese *Paullinia pinnata*	Puerto Rico	Sierra-Bracero 1973
Granadillo bobo *Miconia prasina*	Puerto Rico	Sierra-Bracero 1973
West Indian gherkin *Cucumis anguria*	Puerto Rico	Sierra-Bracero 1973
Prickly yellow *Zanthoxylum caribaeum*	Puerto Rico	Sierra-Bracero 1973
Shortleaf fig *Ficus citrifolia*	Puerto Rico	Sierra-Bracero 1973
Purple nightshade *Solanum americanum*	Puerto Rico	Sierra-Bracero 1973
Fruits	Range-wide	Raffaele *et al.* 1998
	Bahamas	Brudenell-Bruce 1975
	Cuba	Garrido and Kirkconnell 2000
	Hispaniola	Latta *et al*. 2006
	Puerto Rico	Danforth 1936, Oberle 2006
Seeds	Puerto Rico	Oberle 2006
Animal		
Insects	Range-wide	Raffaele *et al.* 1998
	Bahamas	Brudenell-Bruce 1975
	Cuba	Gundlach 1876, Garrido and Kirkconnell 2000
	Jamaica	Robinson *in* Gosse 1847, Taylor 1955, Lack 1976
	Hispaniola	Latta *et al*. 2006
	Puerto Rico	Danforth 1936, Biaggi 1983, Oberle 2006
Termites (?; at termitaria)	Jamaica	Chen Sue 1975
Cuban leaf-cutting ant *Atta insularis*	Isla de Pinos	Todd 1916
Cicada	Cuba	Kirkconnell and Posada Rodríguez 1987
Cicada, dragonflies, beetles	Jamaica	Gosse 1847, Taylor 1955
Honeybees	Jamaica	Salmon 1992, Taylor 1955
Beetle *Cetonia* sp.	Jamaica	Gosse 1847
Insects (stomach filled with Hymenoptera and Coleoptera, including *Buprestis*)	Jamaica	Gosse 1847
Lepidoptera (micro- and macrolepidoptera)	Cuba	Kirkconnell (pers. obs.)
Crabs *Sesarma* sp.	Bahamas	Burchsted and Chambers 1989
Centipede	Jamaica	Lack 1976
Reptiles	Puerto Rico	Biaggi 1983
Lizards	Range-wide	Raffaele *et al.* 1998
	Bahamas	Brudenell-Bruce 1975
	Cuba	Gundlach 1876, Kirkconnell and Posada Rodríguez 1987, Garrido and Kirkconnell 2000
	Jamaica	Robinson, *in* Gosse 1847; Taylor 1955; Lack 1976; Hughes 1992; Davis 1993
	Hispaniola	Latta *et al*. 2006
	Puerto Rico	Danforth 1936, Oberle 2006
Frogs	Puerto Rico	Biaggi 1983, Oberle 2006
Nestling birds	Cuba	Gundlach 1876

Table 7. Observations of food brought to nests (n = 6) and captured by adult pairs (n = 6) of Loggerhead Kingbird (*Tyrannus caudifasciatus*) in the Dominican Republic (Sabana de la Mar and Pilancón) and Puerto Rico (Cidra and Ceiba), 1974–1985.

	Number (%)		
Food Class	Brought to Nests[a]	Eaten by Adults[b]	Combined
Plant[c]			
Fruits	243 (34.6)	205 (48.0)	448 (39.7)
Seeds	56 (8.0)	35 (8.2)	91 (8.1)
Total plants	*299 (42.6)*	*240 (56.2)*	*539 (47.7)*
Animal			
Lizards	41 (5.8)	11 (2.6)	52 (4.6)
Beetles	35 (5.0)	11 (2.6)	46 (4.1)
Orthopterans	73 (10.4)	23 (5.4)	96 (8.5)
Odonata	87 (12.4)	23 (5.4)	110 (9.7)
Bees and wasps	24 (3.4)	14 (3.3)	38 (3.4)
Caterpillars	35 (5.0)	28 (6.6)	63 (5.6)
Unidentified insects	87 (12.4)	62 (14.5)	149 (13.2)
Centipedes	6 (0.9)	2 (0.5)	8 (0.7)
Scorpions	2 (0.3)	2 (0.5)	4 (0.4)
Spiders	5 (0.7)	3 (0.7)	8 (0.7)
Mollusks	8 (1.1)	8 (1.9)	16 (1.4)
Total invertebrates	*362 (51.6)*	*176 (41.2)*	*538 (47.7)*
Total animal	*403 (57.4)*	*187 (43.8)*	*590 (52.3)*
Total items	*702 (100)*	*427 (100)*	*1129 (100)*

[a]Total observation time at nests = 124 hr

[b]Incidental observations of adults capturing prey, which they ate

[c]Plant species included *Tournefortia hirsutissima, Marcgravia trinitatus, Roystonea borinquena, Trema lamarckianum, Ficus citrifolia, Coccoloba uvifera, Ocotea floribunda, Guajacum officinale, Zanthoxylum martinicense, Bursera simaruba, Metopium toxiferum, Solanum torvum, Miconia prasina, Schefflera morototonii, Myrsine coriacea,* and *Cordia nitida*

nearby perch (Kirkconnell 2000). MacDonald and Henderson (1977) reported the beater effect as an important foraging strategy for tyrannids in mixed flocks.

HABITAT USE AND GENERAL BEHAVIOR

Throughout its range, Loggerhead Kingbird consistently uses more interior and denser forest and wooded areas than Gray Kingbird, but the Loggerhead Kingbird's use of habitat varies among islands. Loggerhead Kingbirds are often found in open lowland scrub habitat in Cuba, whereas that habitat is only uncommonly used by the species in other islands. Brudenell-Bruce (1975) suggested that pine woods are essential to its survival in the Bahamas. In the Bahama Islands, Cuba, Jamaica, and Cayman Islands, Gray Kingbird migrates off-island from November to March, during which time Loggerhead Kingbird expands its habitat to include gardens, settled areas, and open forests not used in other periods of the year when its congener is present (Brudenell-Bruce 1975, White 1998).

Loggerhead Kingbird populations in Cuba prefer lower strata in trees than populations in Hispaniola and Puerto Rico, with Cuban birds especially using low perches while foraging. Also, Puerto Rican and Hispaniolan birds are more sluggish, remaining motionless for longer periods of time, than Cuban birds. In these characteristics, Puerto Rican and Hispaniolan Loggerhead Kingbirds resemble Cuban Giant Kingbirds (*Tyrannus cubensis*), which also most often use taller trees and remain still for longer periods as compared with Cuban Loggerhead Kingbirds. Loggerhead Kingbird is quite active at dawn,

but becomes much less active than other flycatchers later in the day. In the Cayman Islands, the Loggerhead Kingbird is obvious in Grand Cayman, but notably shyer on nearby Cayman Brac (Bradley 1995; pers. obs.).

CONCLUDING REMARKS

Even with the resurgence of interest in the taxonomy of the Antillean avifauna, we still have little natural history information on West Indian birds, particularly regional and island endemic species. Although considerable advances in knowledge have been made for some aspects, including vocal behavior (e.g., Reynard 1969, 1981, Hautcastel *et al.* 1987, 1990, Benito-Espinal *et al*. 1988, Reynard and Garrido 1988, Reynard and Sutton 2000), our understanding of native bird ecology and behavior is still in its infancy in the islands. It is also important to point out that biogeographical investigations in the West Indies have only begun to evaluate speciation. Today, the acquisition of natural history data, along with other information, is an increasing need, as wild populations in the West Indies are clearly decreasing. Now that biodiversity has become a leading theme of conservation, it is important to have a solid base for the taxonomic status of populations. The best means of determining species limits is through a combination of assay methods. For the most part, the morphological and natural history studies of early observers led to good assessments of species limits in the West Indies (e.g., those of Ridgway, Cory, Wetmore, and Danforth). Those methods will remain to be important in evaluating species limits among populations, and should continue to be evaluated alongside mitochondrial DNA and other evolving molecular techniques. Some of the preliminary data we report here reveal differences among Loggerhead Kingbird populations (e.g., egg characteristics, habitat use), which may provide further support for defining species limits among those populations. We hope these data will stimulate detailed studies of this West Indian endemic.

ACKNOWLEDGMENTS

Garrido's work was supported by a Chapman Grant from the American Museum of Natural History and by the RARE Center for Tropical Conservation. Wiley's fieldwork was supported by the Puerto Rico Department of Natural Resources, U. S. Department of Agriculture–Forest Service, U. S. Fish and Wildlife Service, U. S. Geological Survey, Wildlife Preservation Trust International, World Parrot Fund, National Science Foundation, and the International Crane Foundation. Kirkconnell was supported by BirdLife International. Roy Woodbury (deceased) helped in identifying plant parts. We thank Storrs Olson, Gary Graves, and John Faaborg for critical comments that improved the manuscript.

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