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BREEDING BIOLOGY OF THE GREAT CRESTED FLYCATCHER IN CENTRAL FLORIDA

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Abstract.—A breeding biology study of the Great Crested Flycatcher (*Myiarchus crinitus*) in central Florida was conducted from 1979 to 1989 on individuals using wood nest boxes. Data were collected from 46 nests; 38 produced completed clutches. Males arrived in late March followed by females 7–12 d later. Both sexes vigorously defended the nest and surrounding area. Forty-three percent of the 46 nests were begun between 16–30 April. Females built the nest, incubated the eggs for 13–15 d, and brooded the young for about 6 d. Clutch size ranged from 4–6 eggs; 5 was the most common. One brood was produced each nesting season; in 5 pairs renesting occurred after the first nest was destroyed. Total daytime attentiveness during incubation was 68%. At least 12 clutches required more than 1 d to hatch. Hatching and fledging successes for 38 completed clutches were 71% and 72%, respectively. Hatching success was lower in April nests than in May and June nests, but fledging success was higher in April nests than in May and June nests. Both adults fed and defended the nestlings and fledglings and removed fecal sacs. Insects were the major food items fed to the young flycatchers. The nestling period ranged from 13–15 d. Adults and fledglings remained together as a family group in the nesting area for at least 3 weeks after fledging occurred. By August, vocalizations of both young and adults had practically ceased and the birds became unobtrusive.

BIOLOGÍA REPRODUCTIVA DE *MYIARCHUS CRINITUS* EN LA PARTE CENTRAL DE FLORIDA

Sinopsis.—Desde el 1979 al 1989 estudiamos la biología reproductiva de individuos de *Myiarchus crinitus* que anidaron en cajas de madera. Se recopiló data de 46 nidos que produjeron 38 camadas completas. Los machos llegaron al área de estudio al final de marzo y las hembras de 7–12 días más tarde. Ambos miembros de la pareja defendieron el nido y sus alrededores. El 43% de los nidos (n = 46) fueron comenzados entre el 16–30 de abril. Las hembras construyen los nidos, incuban los huevos por un lapso de 13–15 días y cubren a los pichones unos 6 días. La camada es de 4–6 huevos, siendo 5 la frecuencia más alta. Las parejas produjeron una pollada por cada época reproductiva; 5 parejas reanidaron al perder su primer intento. Durante el período diurno, las aves dedicaron el 68% del tiempo a la incubación. Al menos 12 camadas necesitaron más de un día para eclosionar. El éxito de eclosionamiento y de dejar el nido los pichones resultó ser de 71% y 72%, respectivamente (n = 38). El éxito de eclosionamiento resultó ser más bajo en nidadas producidas en abril que en mayo y junio. Sin embargo, más pichones dejaron el nido en abril que en los otros dos meses. Ambos adultos alimentan a los pichones, defienden a neonatos y volantones y remueven el material fecal producido por los pichones. Los pichones permanecen en el nido por espacio de 13–15 días y son alimentados principalmente con insectos. Adultos y volantones permanecen unidos en los alrededores del área de anidamiento por 3 semanas adicionales luego de los pichones abandonar el nido. Para agosto, la vocalización tanto en adultos como pichones cesa y las aves se notan impasibles.

Although the Great Crested Flycatcher (*Myiarchus crinitus*) is a common summer resident in Florida and ranges throughout eastern North America, many aspects of its breeding biology have not been thoroughly studied. Kendeigh's (1952) observations of 1 nest in Illinois and Bancroft's (1981, 1984, and 1986) observations of a nesting pair for 5 summers in

Winnipeg, Manitoba, are the major writings on the flycatcher's breeding biology since Bent (1942).

Since 1979 we have studied the breeding biology of the flycatcher in central Florida. Results on 46 nests are reported herein.

METHODS AND MATERIALS

All of our birds used wooden nest boxes. Thirty-three of 46 nests were built in boxes located in pine flatwoods and sandhill communities on the University of Central Florida campus east of Orlando. The remaining boxes were located in residential areas and a freeze-damaged orange grove.

The boxes were 18 × 20 × 28 cm with backs 41 cm tall. Each box entrance was at the front and 5 cm in diameter. A metal plate, containing a hole 5 cm in diameter, was placed over the entrance of boxes built after 1985 to prevent squirrels from enlarging the hole. The slanted flat roof was 18 × 20 cm and attached with hinges to allow access into the box. All boxes had drain holes and air vents. Boxes were nailed to trees (over 90% pines) at various compass directions and at heights ranging from 2.1–3.4 m ($\bar{X}$ 2.8, SD 2.9, $n = 30$).

Most boxes were checked weekly and 18 nests were visited daily after the eggs hatched. Eight pairs were observed daily from the time males arrived until the young fledged. For 2 of the 7 nests at least 1 member of the pair was color banded.

Nestlings were weighed to the nearest 0.1 g on an Ohaus triple beam balance. When the nestlings became 1 week old, they were banded with U.S. Fish and Wildlife Service aluminum bands and plastic color bands.

Sexes were distinguished by both plumage coloration and behavioral traits. Females were slightly duller than males. Males were more vocal, aggressive, and erected their crests more often than did females. Color banding of 2 pairs and video taping confirmed our observations.

RESULTS

The breeding season commenced when males returned to their territories from the wintering grounds. Males called daily, producing the familiar loud *wheep* and grating *rurr* calls. Females arrived 7–12 d after males appeared.

Arrival dates, based on when the first vocalization was heard, were 31 March 1980, 23 March 1982, 4 April 1983, 24 March 1984, 25 March 1985, 29 March 1986, 25 March 1987, 1 April 1988, and 24 March 1989.

Nest box inspection.—Males visited the boxes before females arrived. After females arrived, both sexes inspected the box.

As the female inspected the box, the male watched her and produced loud vocalizations. When she terminated an inspection bout and flew from the nest tree, the male followed.

Territorial and nest defense.—Great Crested Flycatchers vigorously defended the nest and surrounding area. Not one instance was observed where an intruding flycatcher was ignored. Rapid chases, bill snaps,

repeated *wheeps,* loud *whit* calls, and body attacks were given to the intruder, especially by the defending male. Young-of-the-year flycatchers were attacked as vigorously as were adults.

Percent attacks by defending flycatchers to intruders in the nesting area are as follows: House Sparrow, *Passer domesticus* (100%), Red-winged Blackbird, *Agelaius phoeniceus* (100%), European Starling, *Sturnus vulgaris* (100%), Red-bellied Woodpecker, *Melanerpes carolinus* (100%), Common Flicker, *Colaptes auratus* (100%), Blue Jay, *Cyanocitta cristata* (90%), Northern Mockingbird, *Mimus polyglottos* (80%), Common Grackle, *Quiscalus quiscula* (70%), Northern Cardinal, *Cardinalis cardinalis* (67%), Carolina Wren, *Thryothorus ludovicianus* (50%), Brown Thrasher, *Toxostoma rufum* (50%), American Redstart, *Setophaga ruticilla* (0%), and Cape May Warbler, *Dendroica tigrina* (0%). All gray squirrels (*Sciurus carolinensis*) that came in the nest tree were attacked.

In 1988, a pair of flycatchers attacked a Red-bellied Woodpecker that had taken a box for roosting. After repeated attacks for several days, the woodpecker abandoned the box, which was used by the flycatchers for nesting.

Two of the most severe attacks by flycatchers to intruders occurred against a one-eyed Common Flicker and a European Starling. The male flycatcher, upon seeing the flicker, immediately dashed to the bird. During the chase, the flycatcher clung to the flicker's back for a few seconds and delivered severe pecks to the flicker's head causing feathers to fly. Loud *wheep* and intensified *whit* calls were given by the flycatcher during the entire episode.

A starling entered a box that contained 2, 9-d-old flycatcher nestlings; the adults were away. Upon returning to feed, they flew to the box and immediately attacked the starling. The male flycatcher, perched on the lower rim of the hole, severely pecked the starling's head. *Wheep* calls and bill snaps were given almost constantly. The flycatcher's aggressive actions intensified when the starling did not leave the box immediately. It appeared the flycatcher attempted to pull the starling from the box with its bill. When the starling flew from the box, both flycatchers inflicted violent blows forcing the intruder to the ground. After the starling regained flight and flew away the flycatchers chased behind. Similar flycatcher-starling conflicts involving 1 or both flycatchers occurred at this box.

On 25 June at 09:00 loud, rapid and constant *wheep, rurr,* and *whit* calls came from a nesting female. The *wheeps* were given as she flew down and toward a banana leaf. The banana plant grew near the pine tree that supported the box with 3 young when last checked on 24 June. This pine had a 61-cm-wide shield of aluminum flashing wrapped around the trunk.

As the calling female flew downward, her feet were extended out from her body while fluttering in midair. This behavior was repeated. The intense vocalizations attracted a Northern Mockingbird, Blue Jay, unpaired flycatcher, and Northern Cardinals who sounded protests. The resident female as soon as she saw the intruding flycatcher, chased it away.

She immediately returned to the banana leaf area and resumed the calling and fluttering behavior. When the male arrived to feed the young, he joined the protest. A 56-cm-long rat snake (*Elphae obsoleta obsoleta*) was lying stretched out on a branch of a small bush below the banana leaf. The snake had a 6-d-old nestling in its stomach. Most of the nestling's body was intact, except for its covering of feathers. The snake had crawled on top of the banana leaf to the box above the aluminum flashing.

Two days prior to this incident, another young had disappeared from the nest. More than likely this snake took both nestlings and because of its small size, could not eat all nestlings at once. Also, the snake's small size allowed it to be supported by the banana leaf.

Nest building.—Females built the nest, contrary to Bendire's (1895) report that both sexes assisted in nest-building. In over 50 hours of observations on nest building the male never carried nesting material. Flights to and from the nest site were typically led by the female with the male following behind. The female nearly always landed in the nest tree or on top of the box before taking the nesting material inside. After placing the materials and exiting the box, she usually flew away immediately and the male, if present, followed behind. Occasionally the male flew to the box and inspected the nest while hanging onto the lower rim of the hole. In contrast to the very vocal male during nest building, the female was less vocal.

Most of the nest was built in 2–3 d. Large mouthfuls of materials were carried by females. On the second day of building at one May nest, the female averaged 1.7 trips every minute. After most of the nest was completed, the female worked on the structure 2 or more days, but at a much slower rate. Trips to the nest were more frequent in the early morning and late evening than at other times. Finer items, like feathers, were added to the nest during egg laying, incubation, and brooding of the young.

Of 46 nests, 32 were commenced in April, 12 in May, and 2 in June. The earliest and latest building dates were 13 April and 5 June, respectively. Both June nests were renests from pairs whose first nest was destroyed. Forty-three percent of the 46 nests were begun between 16–30 April.

Nests.—Nesting materials included grasses, pine fasicles, leaves, plant fibers, fruiting plant parts, spanish moss, green moss, sphagnum, pieces of cloth, string, paper, cellophane, small gastropod and bivalve shells, feathers (*Gallus, Quiscalus, Columba, Chordeiles, Bubo,* and *Parus*), a Tufted Titmouse's wing (*P. bicolor*), ends of tails from gray squirrels (*Sciurus carolinensis*), and animal fur (gray squirrel; rabbit, *Sylvilagus floridanus*; opossum, *Didelphis virginiana*; and house cat, *Felis domesticus*), and snakeskins of *Coluber, Masticophis,* and *Thamnophis.*

All nests contained one or more pieces of snakeskin. The skin varied from 1 to over 35 cm in length and was incorporated into the nest cup and outer layer. The skin was placed in some nests on the first day of building.

Mean dry weight of 23 nests was 90 g (42–154.0, SD 30.3). The lightest nest was mainly composed of dried leaves and pine fasicles, whereas the heaviest nest contained a large amount of heavy plant fibers. In all 46 nests, the nest cup was located off-center, near the back of the box.

Multiple usage of boxes.—Ten boxes were used more than once by flycatchers. Five were used twice, 3 boxes 3 times, 1 box 4 times, and 1 box 5 times. Why these boxes were preferred is unknown.

Number of broods and renesting.—Our flycatchers raised 1 brood to fledging each year (see also Bendire 1895, Mengel 1965, Sprunt and Chamberlain 1970, and Potter et al. 1980). Renestings occurred 5 times when the first nest was destroyed and removed from the box. Mean elapsed time for the renestings was 4 d (1–7 d). All nests commenced after 15 May were renests.

Site fidelity for the Great Crested Flycatcher has been mentioned by Middleton (1936) who had a banded pair in Pennsylvania nest in a box for 3 consecutive years. One of our color banded females nested in the same area (twice in the same box) for 3 consecutive years, although she had a different mate each year.

Copulation.—Copulation or attempted copulations occurred from nest building to hatching of the eggs. A number of times during nest building the male tried to copulate with the female holding a mouthful of nesting material. Males were especially vocal during copulation. Copulation was a few seconds long. The latest date copulation was observed on 22 May.

Egg laying.—From 2–11 d ($\bar{X}$ 4.8 d, SD 2.9) elapsed between nest completion and laying of the first egg in 12 nests. The first egg was laid between 16–30 April in 19 nests, 1–15 May in 14 nests, 16–31 May in 4 nests, and 1–15 June in 2 nests. The earliest egg date was 19 April and the latest date was 7 June.

The female laid 1 egg daily until the clutch was completed. Other than during a laying session, adults were seldom seen at the nest tree during the egg-laying period.

When commencing to lay, the female came to the nest alone or was accompanied by the male. She quietly flew to the box entrance, paused for a few seconds hanging on the hole's lower lip, looked cautiously around, gave peeping sounds as she faced the entrance, and silently slipped into the box. If the male were present, he remained a few minutes, but then flew away.

Before leaving the box after laying, the female stuck her head or the anterior part of her body through the hole, peering and turning her head in all directions for up to 3 seconds before flying away. This same behavior was observed during nest building, incubation, and brooding.

Eggs and clutch size.—Most eggs had dark-brown streaks distributed evenly. In a clutch of 4 eggs found on 14 May, 2 eggs each had pigment in a dark concentric ring approximately 5 mm wide at the larger end. These eggs did not hatch, but the 2 normal-pigmented eggs produced young. Runt eggs were not found.

TABLE 1. Great Crested Flycatcher clutches when completed.

Clutch sizes	April	May	June	Totals
4	2	4	2	8
5	8	8	3	19
6	7	4	0	11
Totals	17	16	5	38

Of the 46 nests studied, 38 had completed clutches. The remaining clutches were destroyed before completion. Harrison (1975) gave clutch range for this species from 4–8 eggs. Our data supports Bent's (1942) remarks that 5 eggs is the most common number laid. Thirty-eight clutches segregated by months in which they were completed are in Table 1. Three of 5 pairs that renested after their first clutch was destroyed had 1 or 2 eggs less in the renest compared to the first attempt.

Incubation.—The female incubated the eggs even though at least some males may have an incubation patch. One of our males banded on 6 June 1985 had an incubation patch similar to that described by Parkes (1953).

As occurred during nest building and egg laying, the male often accompanied the female to the nest to commence an attentive period. She typically arrived at the tree first; when the male landed, the birds exchanged *ki-dee* calls. The female's behavior before entering the box was similar to that during egg laying. The male, with crest erect, sometimes remained silently at the nest tree for as long as 10 minutes after the female entered the box.

While the female incubated, the male foraged, produced loud vocalizations and bill snaps, and chased intruders in the area. The female while in the box did not answer the calling male in the distance. On several occasions he came to the nest tree and waited for her to leave the nest; at times he seemed to call her off the nest. Occasionally the male flew to the box entrance and peered into the opening after the female flew.

When the birds flew from the box, they typically dipped down, lowering the height of flight, and flew low to the ground before regaining height some distance from the nest tree. This same flight pattern was observed during nest building, egg laying, incubation, brooding, and feeding of the young.

Once a female Northern Cardinal and a Common Grackle attempted to perch on the hole while the female flycatcher was inside incubating. The flycatcher gave rapid bill snaps and lunged her head through the hole, causing the birds to fly away.

Contrary to Gillespie's (1924) report that males fed incubating females, we never observed this behavior nor did Kendeigh (1952).

Two female flycatchers were observed for 29.6 hrs during incubation from the time the last egg was laid to the first day of hatching (Table 2). The 35 attentive periods averaged 35.0 minutes and ranged from 10–70

TABLE 2. Attentiveness in minutes of 2 female Great Crested Flycatchers during incubation from 9–20 May.

Day of incub.	Time period	Total minutes observed	Percent attentive
0	1131–1355	144	54.2
0	1749–1816	27	—
1	0807–0925	78	74.3
1	1341–1446	65	80.0
2	0707–0915	128	85.1
2	1040–1306	146	74.0
4	1422–1737	195	64.6
5	0633–0815	102	62.0
5	1122–1308	106	64.1
5	1807–1905	58	52.0
6	0655–1020	205	65.4
6	1359–1537	98	60.2
7	0814–0918	64	60.9
7	0912–1024	72	54.2
8	0735–0959	144	68.8
8	1259–1333	34	—
8	1507–1559	52	—
11	0630–0728	58	60.3
Totals		1766	68.1

minutes. The 25 inattentive periods averaged 23.0 minutes with a range of 7–45 minutes. Kendeigh (1952), reporting on the attentive behavior of a female for 5 d at 1 nest, gave a mean attentive period of 21.3 minutes and a mean inattentive period of 13.0 minutes. He remarked that the attentive rhythm was fairly slow in this flycatcher with only 25 attentive periods per day, but the percentage of total daytime attentiveness was normal and averaged 61.2. Our birds averaged 68% total daytime attentiveness.

Incubation period.—Although the incubation period was calculated as the time between laying of the last egg and hatching of that egg, at least 8 females began incubating when the next to last egg was laid. In the nest Kendeigh (1952) studied, the adult incubated the afternoon before the last egg was laid.

The incubation period was 13 d (3 nests), 14 d (7 nests), and 15 d (1 nest). These data agree with those of Burns (1915), Gillespie (1924), and Kendeigh (1952).

Hatching and the nestlings.—At least 12 clutches required more than 1 d to hatch. In one May clutch, 3 d were required for all eggs to hatch. For 2 nests all eggs hatched the same day.

The altricial young at hatching had natal down to the capital, spinal, ventral, and humeral tracts. The white rictal flanges contrasted with the yellow lining of the mouth. Begging and soft peeps were given on the first day of hatching. Mean weights for 12 nestlings, still wet from hatching, was 3.0 g (SD 0.32, 2.5–3.5).

TABLE 3. Feeding of Great Crested Flycatcher nestlings by female (F) and male (M).

Age in days	Minutes observed	Trips to nest		Trips w/food		Fecal sac removal	
		F	M	F	M	F	M
0	165	12	3	11 (10)	0 (0)[a]	1	0
1	113	15	5	13 (12)	1 (0)	0	0
2	176	13	2	12 (11)	1 (1)	0	0
3	135	5	5	4 (4)	3 (2)	0	0
4	234	19	18	14 (13)	16 (16)	1	2
5	146	12	8	12 (12)	8 (8)	1	2
6	141	15	12	15 (13)	10 (9)	3	2
7	121	9	9	9 (9)	4 (4)	2	0
8	200	22	11	22 (22)	9 (9)	2	0
9	92	12	7	12 (12)	6 (5)	2	0
10	8	2	0	2 (2)	0 (0)	1	0
11	195	22	12	22 (22)	12 (12)	5	1
12	60	2	6	2 (2)	5 (5)	1	2
13	70	8	2	8 (8)	2 (1)	0	0
14	85	16	10	16 (16)	9 (9)	5	1
15	41	7	7	7 (7)	7 (7)	2	1
Totals	1982	191	117	181 (175)	93 (88)	26	11

[a] Numbers in parentheses are actual feedings to nestlings.

Brooding.—The female brooded the nestlings for about 6 d. Her behavior was similar to that observed in incubation. Sometimes the female took food to the young and nesting material when commencing an attentive period.

In 19 hours of observation, the female brooded 6.2 hours (32.2%). The brooding periods ranged from 2–28 minutes. Mean brooding time of the female prior to 06:00 in the morning was 11.8 minutes (SD 7.6, $n = 23$ sessions), whereas mean brooding time after 10:00 was 7.0 minutes (SD 3.2, $n = 14$ sessions).

Feeding of nestlings and nest sanitation.—Both sexes fed the young (Table 3). During 35 hours of feeding observations from day 0 through 15 of the nestling period, adult flycatchers made 343 trips to the nest. This equals 1 trip every 6.2 minutes. Mousley (1934), in 45 hours of observation, reported 1 feeding trip every 11.5 minutes. He found that the female fed 74% of the time. In 33.0 hours of our observations where at least 1 adult was color banded, the female made 66% of the 274 trips with food (Table 3). After the nestlings became older, the male's feeding trips increased and at times his feeding efforts equaled that of the female.

When both sexes arrived together or if one adult arrived with the other already at the nest tree, vocalizations were typically exchanged. The adults usually perched before entering the box to feed. The female typically fed first when both adults were waiting to feed even if the male arrived first.

When an adult, most often the male, flew to the box entrance to feed the young while the other adult was inside, the incoming adult fluttered

in midair for a few seconds in front of the hole, emitted a soft "twirl" call, and returned to the perch. After the attending adult left the box, the other adult fed the young. Crossovers occurred when an adult attempting to feed hung onto the lower rim of the hole as the adult inside left the nest box.

Insects were the main items fed to the nestlings. Insects from 7 orders were identified: dragonflies (Odonata), crickets and katydids (Orthoptera), moths and butterflies (Lepidoptera), stinkbugs (Hemiptera), beetles (Coleoptera), flies (Diptera), and wasps (Hymenoptera). The only non-animal foods fed to the nestlings were fruits of elderberry (*Sambucus canadensis*), wild black cherry (*Prunus serotina*), and blackberry (*Rubus cuneifolius*).

The nest was kept clean of fecal sacs, egg shells, and uneaten parts of insects. Both sexes removed fecal sacs (Table 3). Each adult typically had its own direction for exiting from the box. Seldom did an adult eat a fecal sac while perched on the box.

Hatching success.—Hatching success (percent of eggs hatched of those eggs laid) for 46 complete and incomplete clutches was 65% (138/211). For the 38 completed clutches, hatching success was 71% (138/193). Seventeen nests with completed clutches in April had a lower (62%) hatch success than did 21 nests completed in May and June (80%). Nests (n = 8) with clutches of 4 eggs had a 63% hatching success compared to nests (n = 19 and 11) with clutches of 5 and 6 eggs that had a hatching success of 71% and 77%, respectively.

All eggs hatched in 16 nests. Of these, 3 in April and 2 in May held 6 eggs. Three nests in April, 4 in May, and 1 in June contained 5 eggs. One May nest and 2 June nests contained 4 eggs.

Egg loss.—Seventy-three eggs from 26 nests did not hatch. Unhatched eggs resulted from being infertile or addled (21), being deserted (13), being broken (11), disappeared (8), taken by snakes (9), and being destroyed by flying (6) and gray (5) squirrels when they took over the nest box. Fifteen of 21 (71%) addled eggs in 12 nests were never removed from the nest. On 16 May 1983, a 1.3 m-long, yellow rat snake (*Elaphe obsoleta quadrivittata*) was coiled in a box 2.9 m up a pine tree. The snake was palpitated and all 4 eggs plus the incubating adult were revealed. At another box located 3.2 m off the ground, a 0.45 m-long corn snake (*E. guttata*) was inside the box and had swallowed the clutch of 5 eggs.

Nestling period.—The nestling period ranged from 13–15 d: 17 young remained in the nest for 13 d, 14 young for 14 d, and 3 young for 15 d. These times differ from the extreme days of 12 and 18 mentioned by Bent (1942).

Fledging success.—Fledging success (birds fledged per number of eggs hatched) for 38 nests was 72%. In 17 nests where the first egg was laid in April, 44 young fledged (79%), whereas in 21 May and June nests, 55 young fledged (67%). Nests (n = 8) with clutches of 4 eggs had an 83% fledging success, whereas nests (n = 19 and 11) with clutches of 5 and 6 eggs had a fledging success of 72% and 66%, respectively.

Nestling loss.—Nestling loss was due to snake predation (5 young), death while in the nest (15), death on the ground (1), and disappearance of individuals (18). Snakes climbed the nest tree and ate the young from 2 boxes. A 1.8 m-long Indigo Snake (*Drymarchon corias*) ate 3 banded, ready-to-fledge young along with 3 addled eggs. The other instance, previously described, involved a rat snake. Snake predation probably accounted for young that disappeared suddenly from the nest.

At 5 nests, 1 or more nestlings died in the nest. Some died the day of hatching. Deaths of 3, ready-to-fledge nestlings were probably related to pesticides sprayed in the area. All 5 nestlings in 1 nest died over a 2-d period. The male of this pair had disappeared and apparently the female could not feed the 8- and 9-d-old young. The female removed each dead nestling by holding a leg in her bill and carrying the bird from the box, similar to removing a fecal sac. Young in 4 nests were heavily parasitized by the tropical fowl mite (*Ornithonyssus bursa*) and *Protocalliphora* larvae.

Fledging.—Fledging of the young was observed in 2 nests. In neither case did all young leave the box together. The adults continued to feed the young left in the box as well as the fledglings. Neither the fledglings nor adults returned to the box for roosting.

Parental care of the fledglings.—After fledging, the young and adults remained as a family group, staying in the nesting area for up to 3 weeks. During this time, the adults provided food and defended the fledglings. Vocalizations, especially *wheeps,* were given by both adults and young for maintaining contact.

By August, vocalizations of young and adults had practically ceased and the birds once more became unobtrusive. The last call heard from a flycatcher was a single *rurr* given on 21 September 1988.

DISCUSSION

The breeding season of the Great Crested Flycatcher is prolonged because of the species' wide-ranging, latitudinal distribution. Individuals in central Florida generally arrive the last week of March, whereas in Manitoba, Canada, near the northernmost breeding limit, the flycatchers arrive during late May (Bent 1942, Bancroft 1981). Because of this marked difference in arrival times for breeding activities, the central Florida flycatchers have practically ceased nesting activities by the time individuals in Manitoba have commenced to nest. Based on nesting dates given by Bent (1942) and Bancroft (1981) for the northern flycatchers, the time interval between arrival on the territories and beginning of nest building is greatly shortened compared to that of the central Florida birds. Three to 4 weeks elapsed from the time central Florida birds arrived until they began nest building. Bancroft (1981) found this interval for Manitoba birds to be 6 days. Despite this difference in timing of breeding activities, the basic aspects of the breeding biology between northern and southern individuals are similar.

Nearly every written account on the flycatcher's breeding biology mentions the habit of using snakeskins in the nest. Vaiden (in Bent 1942)

found 14 of 37 nests in Mississippi to have the skin. Brooks (in Bent 1942), working in West Virginia, reported all nests except 1 had a snakeskin. All of our nests had 1 or more pieces of snakeskin. All of the Canadian studies on the flycatcher report the absence of the snakeskin in the flycatcher's nest (Bancroft 1984, 1986; Lawrence, in Bancroft 1984; Mousley 1934). Perhaps snakeskins are less readily available to individuals in the northern areas compared to the southern birds.

Our study indicates that only the female flycatcher builds the nest and not both sexes as stated by Bendire (1895), Gillespie (1924), Kendeigh (1952), and Harrison (1975). We have no evidence to support Gillespie's (1924) observation that the male flycatcher feeds the female on the nest and that it takes 10 d or more for the female to complete the nest (Bendire 1895, Harrison 1975). We found that most of the nest is built in 2 or 3 d, although females will occasionally bring finer materials to the nest during egg laying, incubation, and brooding.

Nestling periods of 18 d (Knight in Bent 1942, Mousley 1934), 25 d (Gillespie 1924), and 3 weeks (Dickey in Bent 1942) are much too long for this species. It would be nearly impossible for 5, 18-d-old flycatchers to occupy the nest. The nestling period for the species is 13–15 d which is the same for the incubation period.

Kendeigh's (1952) study on 1 female and our observations are the only data on attentive and inattentive behavior during incubation for the species. Average percentage of daytime attentiveness for our birds was about 7% higher than that observed by Kendeigh (1952).

Our data supports those of Bent (1942) and Harrison (1975) that 5 eggs is the most common number laid for the species.

Our flycatchers had a relatively high nesting success, which might be attributed to the birds using nest boxes. There are, however, no studies on nest success in individuals using natural cavities from which to make comparisons on nesting success. Birds using nest boxes certainly are not free from predators, including snakes that climb to a box 3 m off the ground. Predation by snakes to nesting birds in boxes may be higher than expected.

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