Breeding biology of Pale-edged Flycatcher (*Myiarchus cephalotes*) in northeastern Ecuador

Biología reproductiva del Copetón Filipálido (*Myiarchus cephalotes*) en el noreste de Ecuador

Harold F. Greeney[1] & Andrzej Dyrcz[2]

[1]Yanayacu Biological Station & Center for Creative Studies c/o Foch 721 y Amazonas, Quito, Ecuador. ✉ revmmoss@yahoo.com

[2]Department of Avian Ecology, Wroclaw University, ul.Sienkiewicza 21, 50-335 Wroclaw, Poland. ✉ dyrcz@biol.uni.wroc.pl

Abstract

We made observations on the reproductive habits of Pale-edged Flycatcher (*Myiarchus cephalotes*) nesting in nest boxes and under the eaves of human dwellings in northeastern Ecuador. We found a total of six nests, likely built by the same two pairs. Nest construction lasted around 23 days at one nest and was performed only by the female. Most clutches are initiated during the drier months, but there may be some breeding year-round. Clutch size ranged from two to three eggs. Only females incubated and spent the night on the nest. Patterns of attendance during incubation were fairly regular and eggs were covered for 62% of daylight hours. Incubation period was 18 days at two nests. At two nests eggs hatched synchronously and at a third two eggs hatched 24 h prior to the final egg. The nestling period was 18 days. Based on observations of one banded pair in 2008 and 2009, females provide the majority of nestling care (61%). Nestlings were provisioned with a large percentage of adult Lepidoptera and cicadas, with females bringing predominantly Lepidoptera and males favoring cicadas. After leaving the nest, young birds remained with their parents for at least 10 weeks and were still provisioned by them for at least the first nine weeks.

Key words: Ecuador, *Myiarchus cephalotes*, nesting, Pale-edged Flycatcher, parental behavior, reproductive biology.

Resumen

Observamos la reproducción del Copetón Filipálido (*Myiarchus cephalotes*) en nidos artificiales y bajo techos de viviendas humanas en el noreste de Ecuador. Encontramos un total de seis nidos, probablemente de las mismas dos parejas. La construcción del nido duró 23 días en un nido y fue realizada solamente por la hembra. La mayoría de las posturas se iniciaron durante los meses más secos. Las posturas variaron entre dos y tres huevos. Solamente las hembras incubaron y pasaron la noche en el nido. Los patrones de atención durante la incubación fueron bastante regulares y los huevos fueron incubados durante el 62% de las horas de luz. El periodo de incubación fue de 18 días. En dos nidos los huevos eclosionaron el mismo día y en un nido los huevos eclosionaron en un periodo de 24 h. Los pichones permanecieron en el nido 18 días. Según observaciones sobre una pareja anillada en 2008 y 2009, la hembra proporcionaba la mayoría del cuidado parental (61%). Los pichones fueron alimentados con un porcentaje grande de lepidópteros y de cigarras adultas; las hembras entregaron a las crías predominantemente lepidópteros mientras que los machos entregaron más cigarras. Después de dejar el nido los volantones permanecieron con sus padres por lo menos durante 10 semanas y en al menos las primeras nueve recibieron alimentación de parte los adultos.

Palabras clave: Anidación, biología reproductiva, comportamiento parental, Copetón filipálido, Ecuador, *Myiarchus cephalo-*

Introduction

The Pale-edged Flycatcher (*Myiarchus cephalotes*) is an uncommon to locally common Andean flycatcher (Tyrannidae), one of 22 species in the genus (Fitzpatrick 2004). It is found in subtropical and lower temperate zones (800 to 3000 m) in the Andes from northern Venezuela to Bolivia, inhabiting borders of moist and humid forest, clearings, and open woodland (Hilty & Brown 1986, Ridgely &

Greenfield 2001, Fitzpatrick 2004). Though perhaps more forest-based than many of its congeners (Ridgely & Greenfield 2001), this species readily colonizes disturbed areas and in northeastern Ecuador it is most commonly found in relatively open areas. Ecuadorian populations belong to the nominate subspecies and are found along the eastern slope of the Andes at elevations of 1000 to 2275 m (Ridgely & Greenfield 2001, Fitzpatrick 2004). Apart from a partial nest description provided by Lanyon (1978), information on the breeding biology of Pale-edged Flycatcher is lacking, though it is assumed to breed in natural tree cavities like its congeners (Fitzpatrick 2004). Here we present the first description of the nest, eggs, and reproductive biology of this species based on nests studied in northeastern Ecuador.

Materials & Methods

From 2001 to 2010, we made observations on the reproductive habits of Pale-edged Flycatchers in the vicinity of the Yanayacu Biological Station and Center of Creative Studies (00°35'S, 77°53'W), 5 km west of Cosanga (Napo Province, northeastern Ecuador) at elevations of 1950 to 2150 m. For a more complete description of the site, see Valencia (1995).

We took linear measurements of eggs to the nearest 0.1 mm and weighed them periodically during incubation using an electronic balance sensitive to 0.001 g. We equate loss of mass during incubation with loss of water of the embryo (Ar & Rahn 1980). We monitored incubation rhythms at one nest using a thermocouple placed in the nest lining under the eggs, measuring on- and off-bouts by comparing nest temperature to ambient temperatures.

Our observations of nestling care were made at two nests (2008, 2009) built inside nest boxes within 30 m of the Yanayacu Station. One individual of this pair was color banded in 2007. The banded bird was slightly larger than its mate and it was not observed to incubate or brood, so we infer that it was the male (Fitzpatrick 2004). In 2008 we began observations on 17 November, at which time the nest contained three nestlings, *ca*. eight days old. Observations ended on 27 November when all three young successfully left the nest. We gathered observational data by watching the nest from a concealed position, 12 m from the nest, using 10 X 40 binoculars. We collected data on 11 days with observation periods per day ranging from 3 to 6 h (Table 1). Mean observation time across all days was 4.9 h (SD = 1.1 h). We began observations around sunrise (*ca.* 06:00 EST), generally for around 3 h, with the earliest observation starting at 05:40. Most days we also made observations in the afternoon. Across the entire period, we watched the nest for 53.5 h.

In 2009 observations started on 6 November, when the nest contained two three-day-old nestlings, and ended on 23 November when we released the second nestling from the box (see Results). We gathered direct observational data by watching from an unconcealed position, 20 m away. We collected data on 14 days with observa-

Table 1. Provisioning rates at a nest with three nestlings of the Pale-edged Flycatcher (*Myiarchus cephalotes*) in 2008 at the Yanayacu Biological Station, Napo Province, Ecuador. Age was estimated by back-calculating from an 18-day nestling period.

Nestling age (days)	Adult visits	Hours observed	Visits/nestling/h
8	57	6	3.2
9	71	6	3.9
10	80	6	4.4
11	64	5	4.3
12	50	5	3.3
13	64	4.5	4.7
14	61	5	4.1
15	42	3	4.7
16	56	5	3.7
17	48	5	3.2

Table 2. Provisioning rates at a nest with two nestlings of the Pale-edged Flycatcher (*Myiarchus cephalotes*) in 2009 at the Yanayacu Biological Station, Napo Province, Ecuador.

Nestling age (days)	Adult visits	Hours observed	Visits/nestling/h
3	13	3	2.1
4	8	2	2.0
5	9	2	2.2
6	20	3	3.3
8	18	3	3.0
9	16	2	4.0
10	17	3	2.8
13	20	3	3.3
14	38	5	3.8
15	56	5	5.6
16	28	5	2.8
17	27	3	4.5
18	22	2	5.5
19 (1 nestling)	35	4	8.7

tion periods ranging from 2 to 5 h (Table 2). Most observations began after 06:30 h; afternoon sessions began before 14:30 h. We watched the nest for a total of 45 h. At both nests we attempted to identify all food items brought to the nest to order and tested for significant ontogenetic changes in feeding rates using a Spearman's Rank Correlation test (r_s) to examine the association between visits/nestling/h and nestling age.

Results

NESTS.– We studied six nests of Pale-edged Flycatcher. We found the first on 29 September 2002 with an unhatched egg and two nestlings with wing pin-feathers having broken their sheaths and protruding 2-3 mm. We found the second nest on 10 March 2003; the nest was almost complete, but the adults were still adding material. We found a third nest during construction on 6 September 2007. On 10 October 2007 we discovered a fourth nest under construction, and on 17 November 2008 we found a fifth nest containing three ca. eight-day-old nestlings. We discovered the sixth nest on 14 November 2009, the day prior to clutch completion. It is likely that the three nests built in eaves were of the same pair and, based on one banded bird, we assume the three in nest boxes were built by a second pair. Two additional observations from this area include a stub-tailed juvenile on 7 September 2003 and an unmonitored nest under construction on 16 October 2008 (in the eaves of a building). Using the building, incubation, nestling, and fledgling-care data presented in this paper we estimate that one clutch was initiated in March, one in July, two in September, two in October, and two in November.

Three of the nests we studied were built into cavities in the eaves of occupied buildings. The rest were built inside nest boxes placed 2.5 m above the ground on the sides of trees in areas of pasture adjacent to occupied buildings. The outer dimensions of nests in boxes were constrained by the walls (ca. 12 x 12 cm base and 20 cm tall; entrances were round and 6 cm in diameter) whereas those built in eaves were in open, unconstrained areas. One of these was 13 cm wide and 5.5 cm tall outside, with an inner cup of 7 cm wide by 4.5 cm deep. The internal egg-cup (Fig. 1), however, was fairly elastic due to the soft construction materials, generally starting off no wider than 4-5 cm and expanding with use and with nestling growth. Nests were composed of copious amounts of dead leaves and small sticks forming a base on top of which was a cup of soft materials, mostly gathered from the remains of human activities (i.e., hair, cotton and artificial fibers, paper, small pieces of plastic and string). We found no evidence of snake skins in any of the nests.

NEST CONSTRUCTION.– At two nests we observed only one adult building. At one of these it was the female. We followed one nest for 23 days, from the first few additions of material until laying of the first egg. At both nests construction began with miscellaneous, rather large objects such as dead leaves, small sticks, pieces of bark, and large

Figure 1. A nest of Pale-edged Flycatcher (*Myiarchus cephalotes*) with a complete clutch built inside a nest box in November 2007 at the Yanayacu Biological Station, Napo Province, Ecuador.

pieces of cloth. These were haphazardly placed in the cavity at first, but then were carefully arranged into a ring that was built up with subsequent material. After 4-6 days softer material was added, filling the ring and building up the sides of the nest until an egg cup was formed. The male was present during the building period but we never saw him carrying material. During the early part of construction, the female generally gathered material from no further than 2-10 m from the nest. Later, however, she frequently flew over 60 m to collect soft materials from shower drains, bathrooms, and other human-inhabited areas. The female would often go to great lengths to gather large amounts of hair and other soft materials before returning to the nest, even methodically tugging out large quantities of stuffing from pillows or furniture.

NEST SUCCESS.– At one nest with three eggs, one egg failed to develop. At the single nest with two eggs, one egg failed to hatch. In three nests followed to their eventual conclusion, one of the three nestlings died before the age of four days. The second nest successfully fledged three nestlings, as did the third, but one fledgling from the latter disappeared within 10 days.

EGGS.– Clutch size at one nest was two and at four nests was three. At two nests, all three eggs were laid in the morning, roughly 24 h apart. Mean (±SD) size of 8 eggs was 22.2 ± 0.5 by 16.4 ± 0.3 mm. Mean fresh weight of five eggs was 3.3 ± 0.1 g and during incubation seven eggs lost mass at an average rate of 0.9 ± 0.1%/day of their original mass (range = 0.7-1.1%/day).

INCUBATION.– At two nests incubation lasted 18 days, from the laying of the last egg to the hatching of that egg. Only the female incubated. We monitored incubation rhythms at the 2009 nest (in a nest box), beginning mid-way through the ninth day of incubation. The female generally left the nest for the first time around 06:15, and returned for the last time between 16:30 and 18:30, getting back to the nest earlier as incubation progressed

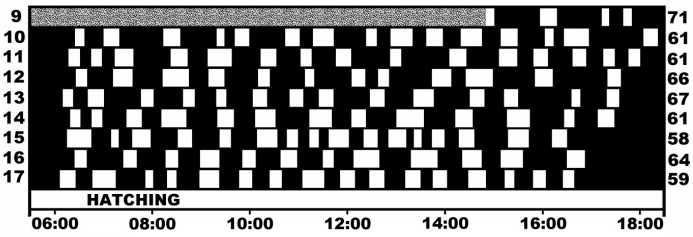

Figure 2. Incubation rhythms of Pale-edged Flycatcher (*Myiarchus cephalotes*) during the latter half of incubation, from 05:30 to 18:30 at the Yanayacu Biological Station, Napo Province, Ecuador. The time of day is shown along the bottom. Estimated day of incubation is shown on the left and % attendance (06:00-18:00) is shown along the right. Stippled areas represent time not monitored, white represents absences from the nest, and black indicates an adult on the nest.

(Fig. 2). Only the unbanded individual, presumably the female, incubated and spent the night on the nest. Patterns of attendance were fairly regular throughout the day during the latter part of incubation (Fig. 2), with the eggs covered 62% of daylight hours (06:00-18:00) across the entire observation period. Mean duration of attendance was 29.7 ± 13.0 min (range = 9-68 min), while mean off bouts were 19.3 ± 6.0 min (range = 10-34 min).

BROODING.– We observed only the female brooding. Three-day-old nestlings were brooded during 21% of 3 h of observations in the afternoon. On subsequent days, nestlings were brooded as follows: day 4, 38.3% (2 h in morning); day 5, 37.5% (2 h in afternoon); day 6, 25.0% (3 h in morning); day 8, 8.9% (3 h in morning). The nestlings were not brooded during any of our observations after the day 9.

NESTLING PROVISIONING.– Before entering the nests, adults usually perched 1-4 m away, allowing us to identify some of the prey items and to record the sex of the attending adult. After leaving the nest, adults perched nearby in a similar location, further allowing confirmation of the presence/absence of bands. Daily patterns of provisioning showed some fluctuation (Fig. 3). The earliest recorded feeding was at 05:53. Highest feeding activity occurred between 06:30-07:30, and the periods with lowest feeding activity were between 09:00 and 09:30 and between 11:30 and 12:00. Feeding rates also decreased before sunset (ca. 18:00). The latest feeding was recorded at 17:39. In 2008, the number of feeding visits/nestling/h did not change significantly with nestling age (r_s= 0.067, n = 10, P = 0.9; Table 1), but did increase significantly in 2009 (r_s= 0.749, n = 13, P = 0.003; Table 2). This does not include days after which the first nestling fledged in 2009 (see below).

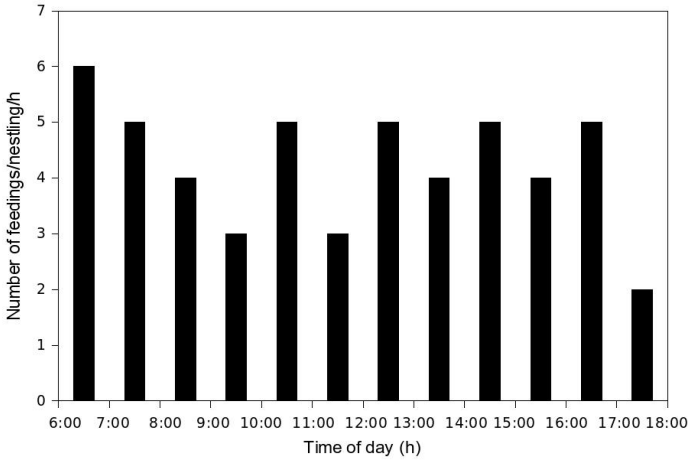

Figure 3. Daily pattern (three days combined) of provisioning rates at a nest of the Pale-edged Flycatcher (*Myiarchus cephalotes*) containing three nestlings 8-10 days old (2008).

Across the entire observation period in 2008 we recorded 593 provisioning visits, 339 (61.8%) by the female, 210 (38.2%) by the male, and in 44 cases sex was undetermined. In 2009 we recorded 298 provisioning visits, 182 (61.1%) by the female and 116 (38.9%) by the male. During the first four days of observation, while the female was occupied with brooding (see above), the number of provisioning visits of both sexes was roughly equal.

NESTLING DIET.– Most of our data are from 2008, when we made observations from a closer position to the nest. Most frequently, adults brought a single prey item, only occasionally bringing several small items in one visit. Adult Lepidoptera and cicadas (Cicadidae) were the dominant prey items fed to nestlings in 2008 (Table 3). A considerable percentage of prey was too small to be identified, however, and it is likely that insects such as flies (Diptera) and wasps (Hymenoptera) were often missed during our observations. Additionally, a black light was in use to attract insects at the nearby station during this period (especially moths but also cicadas), and many of these insects remained perched near the light during the day. Adults generally foraged from this area in the mornings, and thus the proportion of Lepidoptera and cicadas may be different under natural conditions.

We found that the ratio of Lepidoptera to cicadas brought to the nestlings differed between the sexes. The female fed nestlings with 115 Lepidoptera and 39 cicadas (74.7: 25.3%) whereas the male brought 38 Lepidoptera and 94 cicadas (28.8: 71.2%). This difference is highly significant (X^2 with Yates correction = 58.33, $P < 0.001$). During our observations in 2009 entomologists were not running lights at night and lepidopterans were recorded in only 6.7% of provisioning visits, but cicadas still were included in 18.1% of visits (N = 298). Thus, it appears that cicadas may form an important part of the diet of Pale-edged Flycatcher nestlings, even under more natural conditions.

Table 3. Food delivered to nestlings of the Pale-edged Flycatcher (*Myiarchus cephalotes*) in 2008 at the Yanayacu Biological Station, Napo Province, Ecuador.

Prey items brought to nestling	Quantity	%
Adult Lepidoptera	154	25.4
Cicadas (Cicadidae)	132	21.8
True flies (Diptera)	27	4.5
Katydids (Tettigoniidae)	24	4.0
Spiders (Araneae)	14	2.3
Dragonflies (Odonata)	13	2.1
Beetles (Coleoptera)	9	1.5
Larval Lepidoptera	7	1.2
Cocoons (probably Lepidoptera)	3	0.5
Millipedes (Diplopoda)	1	0.2
Unidentified	222	36.6
Total	606	~100

FLEDGING.– At the nest observed in 2008, the adults appeared to coax the nestlings to leave the nest box on the day of fledging. Adults called continuously outside the nest and the female repeatedly entered and left the nest (11 times) with the same adult lepidopteran in its bill. Eventually, at 07:00 the head of the first nestling appeared in the entrance. After a few moments it flew from the entrance and landed *ca.* 10 m from the nest, low to the ground in dense vegetation. Both parents continued to feed the young outside the nest as well as those still in the nest. At 08:35 the next young left the nest and remained *ca.* 2 m from nest box. The final young left the nest at 10:00. Fledgling plumage was very similar to that of adults with the exception of sparse tufts of natal down on the top of the head, short tails, and yellow rictal flanges. Later during the day of fledging and throughout the next 1.5 weeks we were unable to locate the young or the adults in the vicinity of nests. One month later, however, we saw both adults provisioning at least two of the fledglings in the vicinity of the nest.

Our observations were similar the following year. Although we did not observe the fledging event, three nestlings successfully left the nest on the same day. We were unable to locate the family group for nearly three weeks before they returned to the area of the nest, both adults feeding only two fledglings. We never observed the third fledgling, which presumably died. We continued to monitor the activity of the remaining four birds for the next several months. Five weeks after fledging the young were actively being fed by both adults. Seven weeks after fledging the young were fed regularly, but were also foraging on their own. The family group remained together nine weeks after fledging. Although the fledglings continued to beg from adults, and were still occasionally fed, they predominantly foraged on their own. We last observed the pair with their fledglings 10 weeks after leaving the nest. At this time they appeared to be completely independent.

In 2009, the first young left the nest spontaneously on 21 November at 10:12, at an age of 18 days. It flew to a branch 20 m from the nest and, after 3 min, was fed by the male. Subsequently it flew to, and disappeared into, the edge of the forest, covering a distance of ca. 70 m with its second flight. During the remaining part of the day and the entire next day the second nestling was fed intensively (Table 2), predominantly by the female. On the morning of 23 November, two days after the

first nestling fledged, we checked the nest box to find that one leg of the remaining nestling was tangled in artificial nesting material and that it was unable to leave the nest due to its entanglement. When it was freed, it flew immediately into the tall grass nearby, where it was quickly joined by the female.

Discussion

Not surprisingly, like other *Myiarchus* (Belcher & Smooker 1937, Bent 1942, Harrison 1975, Skutch 1960, ffrench 1991) Pale-edged Flycatchers nest in cavities and build cup nests predominantly of soft materials, often including man-made materials. It is one of the few *Myiarchus*, however, which has not been reported to include snake skins in its nest (e.g., Skutch 1960, ffrench 1991, Taylor & Kershner 1991, Kattan *et al.* 2000, Fitzpatrick 2004). Because sample sizes are still low, and considering we lack data from other areas of the range of the Pale-edged Flycatcher and that other species are known to vary geographically in this trait (e.g., *M. crinitus*: Mousley 1934, Bancroft 1984, 1986, Bent 1942, Taylor & Kershner 1991), further information is required before any conclusions can be made. As suggested by Taylor & Kershner (1991) in their explanation of variation in the use of snake skins by *M. crinitus*, snake skins may be lacking or very scarce within the cold, montane habitats of the Pale-edged Flycatcher. Regardless, although authors have proposed various reasons to account for the use of snake skins as nest material (e.g., Strecker 1926), we agree with Skutch (1960) that they likely just represent a handy, soft, pliable material with which to line their nests. As with other *Myiarchus*, and with most tyrannids (Fitzpatrick 2004), only the female constructed the nest in *M. cephalotes*. The 23-day building period reported here, however, is markedly longer than that described for other *Myiarchus* such as *M. crinitus* (2-3 days; Taylor & Kershner 1991).

There are few comparative data available for other Neotropical *Myiarchus* species. Pale-edged Flycatchers laid 2-3 eggs, similar to three other species (*M. panamensis, M. ferox,* and *M. apicalis*) (e.g., Lanyon 1978, Tubelis 1998, Fitzpatrick 2004), but generally fewer than the other nine Neotropical species (2-4 eggs; e.g., Belcher & Smooker 1937, Skutch 1960, ffrench 1991, Fitzpatrick 2004). For the two *Myiarchus* spp. that breed in temperate areas, clutch-size may be considerably higher: (2-7 in *M. cinerascens* and 4-8 in *M. crinitus*; Bent 1942, Harrison 1975, Taylor & Kershner 1991, Fitzpatrick 2004), in keeping with latitudinal patterns of variation in clutch size seen in other groups of birds (Skutch 1985).

Incubation rhythms (duration of on- and off-bouts) and percent attentiveness of Pale-edged Flycatcher are remarkably similar to those reported for the few congeners with these data available (*M. crinitus*; Kendeigh 1952, Taylor & Kershner 1991). Despite this, and a generally smaller clutch, however, an incubation period of 18 days is markedly longer than that known for other *Myiarchus* (Bent 1942, Fitzpatrick 2004).

Similarly, though with not as pronounced a difference, the Pale-edged Flycatcher appears to have a longer nestling period than most *Myiarchus*. In five other *Myiarchus* species nestling periods are as follows: *M. tuberculifer,* at least 13 days; *M. apicalis,* 16-17 days; *M. cinerascens,* 13-17 days; *M. crinitus,* 13-15 days; *M. tyrannulus,* 15 days (Fitzpatrick 2004). Other tyrannids nesting in the same habitat have also recently been found to have rather long nestling periods when compared to congeners (e.g., Greeney *et al.* 2004, Dobbs & Greeney 2006, Greeney 2007). Most of the species living at this elevation and latitude are understudied, however, and the reasons for this pattern remain unclear.

Although more data are needed, especially from other pairs, the recorded dates of activity suggest that the Pale-edged Flycatcher nests predominantly during the drier months (September-January; Valencia 1995). This is consistent with records for other insectivorous tyrannids at this site (e.g., Greeney *et al.* 2004, Dobbs & Greeney 2006, Greeney 2007, Dyrcz & Greeney 2010). One clutch, however, was initiated in March, suggesting that some breeding may occur year-round. We encourage others to publish further information on this species which, though generally uncommon in Ecuador, can be fairly common and conspicuous in other parts of its range (Ridgely & Tudor 1994, Ridgely & Greenfield 2001). Based on the rapid colonization of nest boxes by Pale-edged Flycatchers at our study site, anyone working in an area inhabited by this species could easily further our knowledge by placing out a few boxes within known territories.

Acknowledgments

We thank Jose Simbaña for his tireless dedication to field work, as well as the staff of Yanayacu Biological Station and Cabañas San Isidro for their ongoing support. The manuscript was greatly improved by the comments of H. Álvarez-López and L. Cruz-Bernate. The work of AD was supported by the Polish State Committee for Scientific Research. The studies of HFG are funded in part by Matt Kaplan and John V. Moore through the Population Biology Foundation, National Geographic Society grant #W38-08, Field Guides Inc., and the Maryland Ornithological Society. This study was aided by the PBNHS and is publication no. 217 of the Yanayacu Natural History Research Group.

Literature Cited

AR, A. & H. RAHN. 1980. Water in the avian egg: overall budget of incubation. American Zoologist 20:373-384.

BANCROFT. J. 1984. Further observations of Great-crested Flycatchers. Blue Jay 42:114-116.

BANCROFT, J. 1986. A further report on Great Crested Flycatchers. Blue Jay 44:114-116.

BELCHER, C. & G. D. SMOOKER. 1937. Birds of the colony of Trinidad and Tobago. Part VI. Ibis Ser. 14, 1: 504-550.

BENT, A. C. 1942. Life histories of North American flycatchers, larks, swallows, and their allies. U. S. National Museum Bulletin 179.

DOBBS, R. C. & H. F. GREENEY. 2006. Nesting and foraging ecology of the Rufous-breasted Flycatcher (*Leptopogon rufipectus*). Ornitología Neotropical 17:173-181.

DYRCZ, A. & H. F. GREENEY.2010. Breeding ecology of the Smoke-colored Pewee (*Contopus fumigatus*) in northeastern Ecuador. Ornitología Neotropical 21:489-495.

FFRENCH, R. 1991. A guide to the birds of Trinidad and Tobago, 2nd Edition, Cornell University Press, Ithaca, New York.

FITZPATRICK, J. W. 2004. Genus *Myiarchus*. Pp. 431-441 *in* del J. Hoyo, A. Elliott & D. A. Christie (eds). Handbook of the Birds of the World. Volume 9: Cotingas to pipits and wagtails. Lynx Edicions, Barcelona.

GREENEY, H. F. 2007. Observations on nesting biology and natural history of Slaty-backed Chat-Tyrant (*Ochthoeca cinnamomeiventris*) with a description of nestling growth and plumaje development. Boletín de la Sociedad Antioqueña de Ornitología 17:10-16.

GREENEY, H. F., N. KRABBE, M. LYSINGER & W. C. FUNK.2004. Observations on the breeding and vocalizations of the Fulvous-breasted Flatbill (*Rhynchocyclus fulvipectus*) in eastern Ecuador. Ornitología Neotropical 15:365-370.

HARRISON, H. H. 1975. A field guide to birds' nests (found east of the Mississippi River). Houghton Mifflin Co., Boston, Massachusetts.

HILTY, S. L. & W. L. BROWN. 1986. A guide to the birds of Colombia. Princeton University Press, Princeton, New Jersey.

KATTAN, G. H., H. ALVAREZ-LÓPEZ, N. GÓMEZ & L. CRUZ. 2000. Notes on the nesting biology of the Apical Flycatcher, a Colombian endemic. Journal of Field Ornithology 71:612-618.

KENDEIGH, S. C. 1952. Parental care and its evolution in birds. Illinois Biological Monographs 22:1-365.

LANYON, W. E. 1978. Revision of the *Myiarchus* flycatchers of South America. Bulletin of the American Museum of Natural History 161:429-627.

MOUSLEY, H. 1934. A study of the home life of the Northern Crested Flycatcher (*Myiarchus crinitus boreus*). Auk 51:207-216.

RIDGELY R. S. & P. J. GREENFIELD. 2001. The birds of Ecuador. Cornell University Press, Ithaca, New York.

RIDGELY, R. S. & G. TUDOR. 1994. The birds of South America, Volume 2. University of Texas Press, Austin, Texas.

SKUTCH, A. F. 1960. Life histories of Central American birds II. Pacific Coast Avifauna 34, Cooper Ornithological Club, Berkeley, California.

SKUTCH, A. F. 1985. Clutch size, nesting success and predation on nests of Neotropical birds, reviewed. Ornithological Monographs 36:575-594.

STRECKER, J. K. 1926. On the use by birds of snakes' sloughs as nesting material. Auk 43:501-507.

TAYLOR, W. K. & M. A. KERSHNER. 1991. Breeding biology of the Great Crested Flycatcher in central Florida. Journal of Field Ornithology 62:28-39.

TUBELIS, D. P. 1998. Biologia reprodutiva de duas espécies de *Myiarchus* (Tyrannidae) utilizando caixas de nidificação instaladas em uma mata secundária. Ararajuba 6:46-50.

VALENCIA, R. 1995. Composition and structure of an Andean forest fragment in eastern Ecuador. Pp. 239-249 *in*: S. Churchill, H. Balslev, E. Forero, & J. L. Luteyn (eds.). Biodiversity and conservation of Neotropical montane forests. New York Botanical Garden, New York, USA.

Recibido: 02 de marzo de 2010. *Aceptado:* 08 de agosto de 2011.