BREEDING BEHAVIOR OF THE LAUGHING FALCON (*HERPETOTHERES CACHINNANS*) IN SOUTHWESTERN ECUADOR AND NORTHWESTERN PERU

Comportamiento de anidación del Halcón Reidor (*Herpetotheres cachinnans*) en el suroccidente de Ecuador y el noroccidente de Perú

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ABSTRACT

Though it has received more attention than many other tropical raptors, the Laughing Falcon (*Herpetotheres cachinnans*) remains a poorly known species. Here we provide data from two Laughing Falcon nests we studied in the Tumbesian region of northwest Peru and southwest Ecuador. We observed the nests for a total of 304 hr. The incubation period was approximately 40 d at one nest. The nestings were observed in one nest in March, in the other in August. During incubation, the female spent the majority (90.1%) of the day on the nest, leaving only to feed on prey delivered by the male. There were no pronounced incubation rhythms, but the female showed a tendency to take breaks between 08:00 and 09:00. The nestling was fed an average of 1.3 times per day, again on food brought entirely by the male. We observed 10 duets between members of pairs that lasted between 3.47 and 10.37 min. Site fidelity and nesting season appeared consistent among years in each nest, but differed between the two nests. The female spent 4.5% of her time while on the nest engaged in behaviors other than incubation, particularly nest maintenance.

Keywords: Ecuador, *Herpetotheres cachinnans*, Laughing Falcon, nesting, Peru.

RESUMEN

El Halcón Reidor (*Herpetotheres cachinnans*) ha recibido más atención que muchas otras rapaces tropicales, pero sigue siendo una especie poco conocida. Aquí presentamos datos sobre dos nidos de *H. cachinnans* que estudiamos en la región de Tumbes en el noroeste de Perú y el suroeste de Ecuador. Observamos los nidos durante un total de 304 hr. La incubación en un nido duró aproximadamente 40 d; un nido tenía pichones en marzo, el otro en agosto. Durante la incubación, la hembra pasó la mayor parte (90.1%) del día en el nido, y salió solamente para alimentarse de las presas traída por el macho. No observamos ritmos marcados en los períodos de incubación, pero había una tendencia a salir entre 08:00 y 09:00. El pichón fue alimentado un promedio de 1.3 veces por día, siempre de presas traídas por el macho. Observamos 10 dúos vocales que duraron entre 3.47 y 10.37 min. La fidelidad al sitio y la época de anidación parecío consistente entre años en cada nido, pero diferente entre los dos nidos. La hembra pasó 4.5% de su tiempo en el nido haciendo otros comportamientos aparte de la incubación, principalmente relacionados con el mantenimiento del nido.

Palabras clave: anidación, Ecuador, Halcón Reidor, *Herpetotheres cachinnans*, Perú.

INTRODUCTION

The Laughing Falcon (*Herpetotheres cachinnans*) is a widespread but only locally common diurnal raptor in the Neotropics (Ferguson-Lees & Christie 2001, Fig. 1). As it occurs at higher densities in edge and disturbed habitats than in closed forests (Parker 1991, Enamorado & Orrego 1992), and across a large geographic area, it might be presumed to have a secure future. Accordingly, it is considered a species of Least Concern (BirdLife International 2010). In some badly fragmented areas, however, such as western Ecuador (Dodson & Gentry 1991), the species is considered uncommon to rare, and perhaps declining (Ferguson-Lees & Christies 2001, Alava et al. 2002), and its specialized diet may limit its success in areas with large human populations (Wetmore 1965).

Figure 1. A distribution map of *Herpetotheres cachinnans*, with El Angolo, Peru and Jorupe, Ecuador, the two study sites, noted. The distribution data were taken from Ridgely et al. (2007) and modified slightly in ArcGIS 9.3 by extending the southern boundary of presence to include the El Angolo site.

The nest of the Laughing Falcon has been described from a variety of localities (Wolfe 1954, Mader 1981, Robbins & Wiedenfeld 1982, Parker 1990, Specht et al. 2008). Nests are generally placed in somewhat exposed situations, either in an isolated tree or above the height of the surrounding vegetation, and are often located in a naturally occurring cavity or depression, with little to no material added by the adults (Parker 1990). The incubation period is reported as 40-42 d in Di Giacomo (2005), but no details are provided, and all detailed studies have focused on the nestling period, which is 50-57 d (Skutch 1960, Robbins & Wiedenfeld 1982, Parker 1990, Parker 1991, Enamorado & Orrego 1992, Specht et al. 2008).

The Laughing Falcon feeds primarily on snakes throughout its range (Skutch 1960, Haverschmidt 1962, Parker 1990, Robinson 1994). This includes venomous species, such as coral snakes (*Micrurus* spp. Howell 1957, Skutch 1960, Wetmore 1965, Parker 1990, Enamorado & Orrego 1992, DuVal et al. 2006), at least four genera of pit vipers (*Crotalus*, *Porthidium*, *Bothrops*, *Agkistrodon* spp. (Parker 1990, Enamorado & Orrego 1992, Specht et al. 2008), and many non-venomous species.

While working in the Tumbesian region of southwest Ecuador and northwest Peru, we found two Laughing Falcon nests. The first, which we studied in Peru in 1992 and 1993, was observed only during the nestling period. The second, which we studied in Ecuador in 2006, was found early in the incubation period. Here we present data from these two nests to add to our understanding of the breeding biology of the Laughing Falcon.

METHODS

The first Laughing Falcon nest was located in the 65,000 ha El Angolo Game Reserve, in Piura, Peru (Fig. 1). The dry forest and thorn scrub in this area is dominated by species of Malvaceae (*Eriotheca ruizzi, E. discolor*) and Fabaceae (*Acacia macracantha, Prosopis pallida*; Ríos 1989). Annual mean temperature at the site is 17°C, and rainfall ranges from 200 to 500 mm (CDC-UNALM 1995). On 19 August 1992 we located a Laughing Falcon nest ("El Angolo" nest) that contained a single

feathered nestling. We observed this nest for 84 hr between this date and 25 August 1992. We returned on 16 August 1993 to find the nest again contained a single nestling, which we observed for 89 hr between this date and 26 August 1993. We conducted these observations with a spotting scope between 0:500 and 19:30 from two sites located 6 and 25 m from the nest tree. We were able to see partly into the nest cavity, and base our description of the nestling period on these observations.

The second Laughing Falcon nest was located in the Jorupe Reserve, Ecuador (Fig. 1). Vegetation and rainfall at Jorupe are similar to El Angolo (Miller et al. 2007). Two park guards located this nest ("Jorupe" nest, Fig. 2) and noted the approximate date on which the egg was laid (1 April 2006). On 8 April we placed a camera ~30 m away from the nest tree. From 9-22 April, whenever possible, we filmed the nest from 06:00 to 18:00 (131 hr total). Tapes were transcribed, digitized, and archived at the Cornell Lab of Ornithology. These observations were augmented by ~15 hr of opportunistic study of the pair in the vicinity of the nest, e.g. watching prey transfers away from the nest. All of our conclusions about the incubation period come from the Jorupe nest.

At both nests we documented sex-specific activity patterns and size, type, and rate of delivery of prey items. At the Jorupe nest we also noted nest maintenance behaviors, incubation rhythms, and quantified the average length of duets and the time until and length of syncopation. We defined the beginning of a duet as when the vocalizations between the female and male moved from quiet, occasional calls to regular, insistent calls back and forth between the pair. Syncopation was defined as a regular call and response, where one individual called and the other immediately responded,

Figure 2. The female Laughing Falcon from the Jorupe nest. The nest can be seen behind and above the epiphytic plants; the egg is visible in the background. Photo: Murray Cooper.

generating a rhythmic *wa-co wa-co*.

RESULTS

The El Angolo nest was located ~700 m above sea level (ASL) in a cavity in a 10 m tall, 56.2 cm diameter at breast height *Eriotheca ruizzi* tree situated on a slight slope and surrounded by other bombacaceous trees (8-12 m high), thorny shrubs (2-4 m high), and low herbs and cacti. The nest opening faced 220° SW and was 5 m above the ground. The cavity was 36 cm deep, 37 cm wide, 79 cm high, and filled to about 14 cm deep with organic debris, dry feces and prey remains.

The Jorupe nest (Fig. 2) was located in the lower hills of the reserve, at 650 m ASL, and placed ~15 m up in a large, isolated *Ceiba trichistandra* (Malvaceae, ~30 m tall) that emerged from a thorny understory into an open canopy of other *C. trichistandra* (Fig. 3). The nest was situated in a depression in the side of the trunk. Epiphytic plants grew out of the bottom of this depression, creating a platform on top of which the pair nested. A single egg was visible and was bronze-colored with large, chocolate blotches.

We were able to infer the approximate length of the incubation period. On 9 May 2006 the Jorupe female was observed incubating. On 12 May a young nestling was observed in the nest. We assumed incubation began on 2 April, the day after the egg was laid. The implied incubation period, assuming a hatch date of 11 May, was approximately 40 d.

Nesting of the two pairs that we observed appears to be fairly temporally consistent among years, though not between sites. The El Angolo nest contained a nestling in August in both study years (1992 and 1993) as did a nearby nest in 1989 (observed by the authors but not discussed here). These observations suggest hatching may occur in El Angolo in July or early August. This is well after that of the Jorupe nest (11 May). The park guards again observed the Jorupe female incubating on 1 March 2007.

Sexes of the Laughing Falcon cannot be distinguished by plumage, and are only slightly dimorphic in size (Ferguson-Lees & Christie 2001). None of our study birds were banded, but at both nests we visually identified a larger individual that we assumed to be the female. This larger individual did all the incubation (Jorupe) and nestling care (El Angolo).

For both nests the male was responsible for all observed hunting, providing food for both the female and the nestling. During incubation, the female spent the majority of her time in the nest (90.1% of 131 hr filmed). Her incubation rhythms during this time were irregular (Fig. 4), and the only obvious patterns that emerged were her propensity for off bouts between 08:00 and 09:00, and the long on bouts she endured; in one case she remained on the nest for 6 hr 57 min. During the

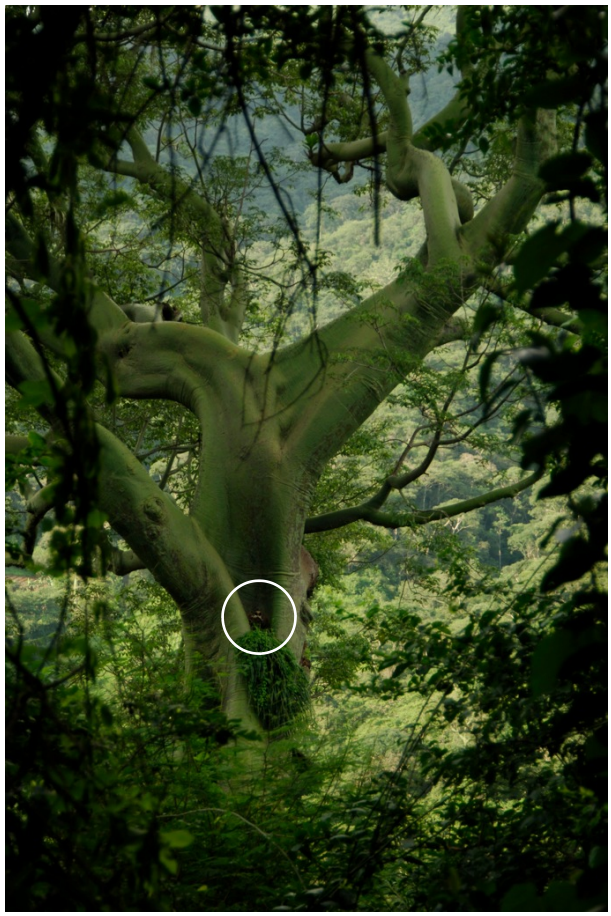

Figure 3. Nest location of *Herpetotheres cachinnans* in a natural hollow in a *Ceiba trichistandra* tree in dry forest of The Jorupe; the female is incubating (circle). Photo: Murray Cooper.

nestling period the female spent much of the observation time (96%) perched in 3-4 trees around the nest, though she occasionally entered the cavity if the nestling called repeatedly; the male spent most of the time out of the nest area and we were only able to observe him from our vantage point for 22 of 173 hr of observation (12.7%).

Though we never observed either nest long after dark, we did regularly start filming incubation before dawn and continue filming until after dusk. From this we infer that the female always spent the night on the nest during incubation. Similarly, from our direct observations in the vicinity of the nest tree in the late afternoon and evening, it appeared that the male roosted in the nest tree as well. He left in the early morning and generally returned mid-morning and again in the afternoon to deliver prey to the female. For both study pairs, prey was passed to females off the nest, in the canopy of the nest tree or of one adjacent to it.

When delivering prey to the incubating female, as the male neared the nest tree he called loudly, which alerted the female to his approach. She would then rise from her position on the egg, stretch, walk towards the rim of the platform, and fly into the crown of the nest tree. She also generally began to call during this time, occasionally while still perched on the nest rim. A series of calls followed, which occasionally developed into a full duet. After the prey was transferred, the female took it to a different perch to eat or, during the nestling period, flew to a tree in front of the nest and waited for 10-15 sec before entering the cavity to feed the nestling. When we first began to watch the El Angolo nest, the female placed small pieces of food in the beak of the 1-2 week-old nestling. After ~5 d of observation however, she let the young falcon feed by itself while she remained in the area. After feeding, the female at the Jorupe nest remained in the area for 5-35 min before resuming incubation. During these encounters she consumed the prey and generally preened and vocalized with the male. The male often remained in the tree for much longer, on one occasion at least two hours after the initial prey transfer.

We directly observed five snakes brought to the Jorupe nest. These ranged in size from approximately 50 to 120 cm. Small snakes were grasped behind the head and carried in the bill. Larger snakes were also held in this way but, in addition, the lower portion of the snake was clutched in the talons. On 2 May 2006, one of the park guards observed the male deliver a frog.

We observed 18 prey items delivered to the El Angolo nest. From this we estimate that across the nestling period, the nestling was fed an average of 1.3 prey items per day (18 items/173 total observation hr * 12.5 observation hr/d = 1.3 items/d, range 1-4). Most of the prey items carried to the nest were medium-sized colubrid and elapid snakes approximately 50 to 60 cm long, green iguanas approximately 15 to 30 cm long and, occasionally, small lizards of the family Teiidae. Dietary composition was not tabulated separately for nestlings and adults, but that of the nestlings was similar to that measured during 463 hr of direct adult observations at the same study site, where 69% of prey items were snakes, 23% were iguanas, 4% were small lizards, and 4% were unidentified (n

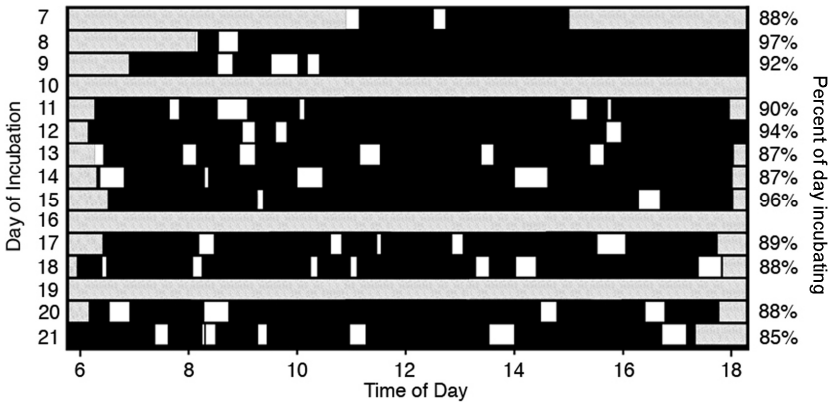

Figure 4. The incubation rhythms of the female Laughing Falcon at the Jorupe nest in southern Ecuador in 2006. Day of incubation is shown along the left margin, time of day along the bottom, and total percentage of that day's observation spent incubating along the right. Gray represents time not filmed, white represents an off bout, and black represents an on bout. The figure begins with day 7 of incubation and continues through day 21, as this encompasses our study period. The short incubation bout at 08:30 on day 21 was due to human disturbance in the area.

= 71, Valdez 1996).

Ten duets were recorded at the Jorupe nest. All occurred between 06:23 and 09:10 with one exception, at 16:46. We rarely observed the birds after 18:00 and could not determine if duets occurred in the evening as previously described (e.g. Enamorado & Orrego 1992). Duets ranged in duration from 3.47 to 10.37 min (mean 6.42 ± SD of 2.49). In eight out of ten duets the pair reached full syncopation. The time until syncopation ranged from 0.08 to 3.27 min (mean 1.70 ± SD of 1.52). The time the pair called in syncopation ranged from 1.93 to 6.65 min (mean 4.28 ± SD of 1.53).

The female was observed to give what may have been a whisper call. In these cases, though we could not hear her, we were able to observe that the female's bill opened in response to the male calling from nearby. Also, the pair occasionally continued vocalizing long after a duet had ended, in some cases up to 1.5 hr after the female had returned to the nest. The calls given by the female from the nest during these times were not always quiet; in fact, some were quite forceful, accompanied by head-bobbing, and given in direct response to queries from the male above. These louder calls were best classified as "chuckles," "koahs," and "wahs," *sensu* Parker (1997).

Though the Jorupe female spent the vast majority of the incubation period in the nest, on average, 4.5% of this time (SD = 1.8) was spent engaged in other activities such as standing (generally immediately after arriving, before departing, and in response to perceived threats), preening, picking at the nest and the surrounding vegetation, repositioning both herself and the egg, and calling quietly and head-bobbing. Both sharp and rapid probes (*sensu* Greeney 2004) were observed at the Jorupe nest. Rapid probing was rare, and we more regularly saw sharp probes, subdued picking, and kneading the nest with her talons, especially upon arrival.

DISCUSSION

The Laughing Falcon and the genus *Micrastur* are members of the Herpetotherinae, a subfamily that diverged early in the history of the Falconidae (Griffiths 2004). Our observed incubation period of ~40 d is similar to that reported by Parker (1997), who estimated it to be 45 d, and to the 40-42 day period reported by Di Giacomo (2005). Our value is also consistent with those reported for *Micrastur*: 46 d in *M. semitorquatus* (Thorstrom et al. 2000a), 33-35 d in *M. ruficollis* (Thorstrom et al. 2000b), and 38-39 d in *M. buckleyi* (UV unpubl. data), larger, smaller, and approximately equal-sized Neotropical forest raptors, respectively, as compared with the Laughing Falcon.

Like many other birds in southwest Ecuador (Marchant 1959, Best et al. 1996), the breeding of the Laughing Falcon may be tied to the rainy season. Generally, the Tumbesian region receives its greatest rainfall in March (Best & Kessler 1995), and from our limited data it seems that Laughing Falcons in the Jorupe area nest soon after this period of heavy rainfall. This pattern is likely linked with the emergence of large amounts of suitable prey to provision growing nestlings.

Our observations of snakes up to 120 cm increases the length of prey known to be taken by this falcon (Duval et al. 2006). That said, Parker (1990) did note that Laughing Falcons will attack *Boa constrictor* 72 cm in length, and the longest snakes we observed were thin *Leptodeira*-like colubrids.

We note that few duets failed to develop into a syncopated state, and hypothesize that this component of the duet may be especially important to these pairs. Further support for this idea comes from the regularity of hours at which these duets were given, and the likely importance of duetting to territorial defense in these specialist predators (Parker 1997, Hall 2004).

As shown in the incubation rhythms (Fig. 4), though the female's off bouts were generally not as predictable as the few other species for which comparable data exists (e.g. Greeney et al. 2008), she did exhibit a propensity for off bouts between 08:00-09:00. It was during these breaks when the pair often duetted, especially if they had not done so during an earlier prey transfer in the day. We suggest that the predictable incubation rhythms in small insectivores may be related to their need to regularly feed; the observed lack of predictability in

this study may thus be related to the large food items consumed by Laughing Falcons (Nagy 1987).

As noted by Greeney (2004), nest probing may help to remove ectoparasites from the nest. In support of this idea, the Jorupe female was often seen to consume small invertebrates after such probing bouts. Additionally, by depressing the nest material below the egg, when the female probed the nest the egg occasionally rolled, and this may have been an indirect method of accomplishing this.

Parker (1997) noted that successful nests generally contained nidicolous ant colonies. As we never climbed to the nests, we are unable to determine whether our study nests also held ant colonies. However, at both the Jorupe and El Angolo nests, regular streams of ants were observed walking along the trunk and traveling in and out of the cavity. Wolfe (1954) commented on the stinging ants present in his presumed nest tree. Such avian-hymenoptera associations are widespread (Quinn & Ueta 2008), and future studies of Laughing Falcons should examine this relationship.

ACKNOWLEDGEMENTS

We thank Rudy Gelis, Leonidas E. Cabrera F. and Giovanni Cabrera for help in the field. We also thank Francisco Sornoza and the Jocotoco Foundation for access to Jorupe, The Peregrine Fund Research Library, José Hidalgo for assistance with the map, Murray Cooper for the photo, and the Loiselle and Blake lab groups, Lloyd Kiff, Russell Thorstrom, Joan Morrison, and three anonymous reviewers for help with previous drafts of this manuscript. Partial funding was provided by the Population Biology Foundation, John V. and the late Ruth Ann Moore, Matt Kaplan, the Forestry Department of the Universidad Nacional Agraria la Molina and the Lende Simmons Fund. UV wishes to thank Antonio Tovar, Pedro G. Vásquez, Mercedes S. Foster, Martha J. Groom and Fiona Wilkinson. This is publication no. 192 of the Yanayacu Natural History Research Group.

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Recibido: 12 abril 2010
Aceptado: 28 diciembre 2010