

# Observations on the Biology of the Orange-breasted Falcon *Falco deiroleucus*

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## INTRODUCTION

The Orange-breasted Falcon (*Falco deiroleucus*) is a neotropical falcon, similar morphologically in many ways to the well-known Peregrine Falcon (*Falco peregrinus*). Very little is known about the living bird, its food habits or its breeding biology. The purpose of this paper is to summarise our findings on these aspects obtained during nine field trips between 1979 and 1983 in Guatemala and Ecuador.

## RESULTS

We have observed 35 different Orange-breasted Falcons during the course of nine field trips between 1979 and 1983. Sixteen were adult pairs defending a territory, 14 were juveniles associated with an adult pair, and five were isolated individuals. Terrain and climatic conditions made observations difficult, but the species is audibly and visually very conspicuous. In the field it was often very difficult to differentiate between Orange-breasted Falcons and the similar, but more abundant, Bat Falcon.

Without exception, all eight pairs of Orange-breasted Falcons were located on ridges or knolls overlooking vast expanses of uncut climax tropical canopy. In Ecuador, we found their nests under epiphytic growth in the crotches of large emergent trees. The substrate in these large crotches resembled moist, spongy soil. In Guatemala, we found the falcons nesting in cavities in limestone cliffs and inside the hollow roof-comb of an ancient Maya temple.

In 1980 we selected one pair of falcons in the tropical wet forest of eastern Ecuador and one pair in the dry tropical forest of northern Guatemala because extensive study of these sites was feasible. Detailed written observations were collected for 130 hours at the nest site in Ecuador and a total of 109 hours were collected at the site in Guatemala. Owing to human limitations imposed by the climate of these areas and our desire to locate additional pairs, these periods of observation were not continuous. The length of uninterrupted observation varied from one to seven days. Observations were recorded during courtship, incubation, rearing and fledging at both of these sites.

**Vocalization.** The Orange-breasted Falcon is very vocal throughout the breeding season. We noted three distinct calls associated with different types of behaviour. The most frequent vocalisation was the "defensive" call;

this is very different from the defensive call of the Peregrine Falcon (Ratcliffe, 1980). It is much more rapid, higher in pitch, and more like that of a Cooper's Hawk (*Accipiter cooperii*). A second vocalization similar to the "defensive" call, but slower and with less accent, is the "begging" call. We describe the third vocalization as a "pair recognition" call; this is a soft, single-syllable piping note repeated slowly several times. These three vocalizations appear unlike those of any other falcon with the exception of the Bat Falcon, which exhibits similar vocalizations, but more rapid and at a slightly higher pitch.

Nest Defence. In both Guatemala and Ecuador, loud defensive calling was observed at the nest sites. During courtship, incubation and the early brooding period, this was generally performed by the adult male. During courtship and once the young were about two weeks old, the female also demonstrated considerable defensive calling. The young from about four weeks of age and throughout fledging also exhibited a great deal of defensive vocalization. In Guatemala, defensive pursuits accompanied by much defensive vocalization were precipitated by the approach of such species as the Black Vulture (*Coragyps atratus*), Mealy Parrot (*Amazona farinosa*), Red-lored Parrot (*Amazona autumnalis*) and Keel-billed Toucan (*Ramphastos sulfuratus*) to the nest site. In Ecuador the same behaviour was observed with Bat Falcons, Greater Yellow-headed Vultures (*Cathartes melambrotus*), Crested Oropendola (*Psarocolius decumanus*), Yellow-headed Parrots (*Amazona ochrocephala*) and Swallowtailed Kites (*Elanoides forficatus*). Often the female would initiate an aggressive pursuit, but the male appeared more ardent in his attacks. On five different occasions we observed the male actually bind to the back of the following species: Keel-billed Toucan, Black Vulture, Plain Chachalaca (*Ortalis vetula*), Barn Owl (*Tyto alba*), and Crested Oropendola.

The young Orange-breasted Falcons also became extremely defensive of the nest site, and within two weeks after fledging actively engaged in chasing the previously mentioned species.

Breeding Biology. Copulation prior to incubation occurred two or three times daily. Typically, the male would begin a series of pair-recognition calls, often from the future nest site. The female would respond with a similar call; the male would then fly to the female and copulate in much the same manner as a Peregrine (Cade, 1982). Copulation was always observed in a tree and was frequently initiated by a food transfer. Once incubation began, copulation was no longer observed. During late incubation the female spent most of the day in the nest. Typically, the male would bring a food item to the vicinity of the nest and call to the female, using the "pair recognition" call. The male was never observed entering the nest with food and if, after several attempts, the female did not take the food, the male would cache it in one of the several epiphyte clumps in a nearby tree. Caching of food items appeared to be quite common in both adult and fledged juveniles. Incubation and the feeding of young were carried out principally by the female; however, we once observed the adult male relieving the female during late incubation. We have been able to observe two clutches of eggs; one contained three eggs and the other four. These were both in northern Guatemala and resulted in two young each. Both sets were positioned in shallow scrapes in fine gravel and were located at the back of a large cavity. There was no evidence of any nesting material. The eggs were an unblotched, even cinnamon brown colour, much like those of the Prairie Falcon (*Falco mexicanus*) and one measured 51.5 mm by 39.0 mm. From our observations, we estimated the period of incubation to be approximately 30 days.

We have observed eight nests with young, or recently fledged young, in Guatemala and Ecuador. Of these nests, six had two young and two had a single young. It is interesting to note that all the nests with more than one young contained one male and one female. They fledged approximately 40 days after hatching. Unlike other species of the genus Falco, the post-fledging period was not characterized by loud begging behaviour by the young.

Generally, only the female fed the young. When the male returned to the nest site with prey and the female was not present, he would cache the prey rather than feed the young. Only after the young had left the nest would the male transfer food directly to them.

Food transfers between the adults were stereotyped. Using the "defence" call, the male would appear at the nest site with prey. The female would respond with the "begging" call. The actual transfer occurred on a specific limb of a tree near the nest site or in the air. In either case the male would transfer the prey from his foot to his beak, whereupon the female would take the prey from his beak with her foot. Occasionally, in the non-aerial transfers, the female would take the prey from the male's beak with her beak. We never observed a transfer directly from foot to foot. The male terminated the food transfer with the "pair recognition" call.

Hunting Behaviour. Predatory behaviour was difficult to observe owing to the high canopy. The beginnings of 93 predatory attempts were observed, but the outcome was rarely determined. The most common types observed were direct chases, originating from a tall tree, at passing birds. These were much like that of a Merlin (Falco columbarius) and were either a climbing pursuit, followed by a short, close-wing dive, or simply a very fast direct chase.

In Guatemala, we observed an adult male Orange-breasted Falcon leave his hunting perch in a long climbing chase to a height of approximately 300 m above the canopy. At the limit of our binoculars, he began a short stoop, followed by a climb of 50 m, whereupon he caught a small bird which was later identified as a Grey-breasted Martin (Progne chalybea).

In Ecuador, we were able to observe two different techniques utilized when hunting White-collared Swifts (Streptoprocne zonaris). When small flocks of swifts, flying approximately 100 m above the canopy, approached one of the hunting falcons, the latter, rather than embark on a direct chase, would elect to intercept the flock at a distant point, where it gained the element of surprise. At first it appeared that the falcon was pursuing an unrelated prey item, until the flight ended in a short, climbing chase which placed it in the midst of the same flock of swifts.

Commonly, large columns of swifts, numbering in the thousands, would congregate above knolls and ridges. On one occasion we observed the male falcon leave his hunting perch and begin to soar up in the distance. From this distant soar, he folded up into a near-vertical stoop, levelling off at a considerable speed towards the column of swifts. Once below his intended target, he shot up into the column in an attempt to capture one of them.

On two occasions in Guatemala, we observed the adult male stooping at small flocks of passing birds from a height in excess of 400 m, in much the same manner as that commonly utilized by the Peregrine.

The wing beat of the Orange-breasted Falcon is more rapid than that of the Peregrine, and gives the impression of being faster in both level and

climbing flight. When the bird is chasing prey the beat appears swift-like and is quite different from that of the Peregrine. The movement of the wings continues at least 45 degrees above and at least 45 degrees below the horizontal. The Orange-breasted Falcon was observed easily overtaking such capable fliers as the Mourning Dove (*Zenaida macroura*) and White-collared Swift, but its relative speed compared to others of the genus *Falco* is yet to be determined.

Two of the most striking morphological characteristics of this species are the long and thick toes and well-developed mandibles. These structures are proportionately much larger than in any other member of the genus *Falco*, especially in the female. The need to grasp prey firmly until reaching a convenient perch is perhaps of significance to this species, which appears to hunt almost exclusively above a dense forest canopy. The powerful mandibles and heavy toes could also be an adaptation for holding and dispatching biting prey such as bats and psittacines, both of which appear to form a large part of its diet.

Prey. In Guatemala, we observed a total of 33 prey items brought to the nest by the male. We did not observe the female with any prey items that were not brought to her by the male. It is entirely possible, however, that the female captured bats during the evening when we were unable to observe her. In Ecuador, we observed a total of 51 prey items brought to the nest. Forty were provided by the male (78.4%) and 11 by the female. Although the female in Ecuador did much more hunting than the female in Guatemala, we observed little difference in the size or type of prey brought to the nest. The largest observed species successfully captured by a female was a Scaled Pigeon (*Columba speciosa*); we also observed an adult male successfully catch and carry an experimentally released Rock Dove (*Columba livia*) of almost identical size.

Virtually all prey items brought to the nest were headless and well plucked. This made positive identification impossible except on a few occasions when prey were brought to the nest in a more complete condition.

In Ecuador, the most commonly observed prey item was the White-collared Swift, with four being positively identified. In Guatemala, five Olive-throated Parakeets (*Aratinga astec*) were positively identified, making this species the most commonly observed prey item. Castings and prey remains were collected beneath favourite perches and carefully gleaned from debris in the nest sites, and it was from these that most of the prey species were identified (Table 1). The size of prey ranged from 14.3 gr to 265 gr.

In both Ecuador and Guatemala, the Orange-breasted Falcon became increasingly active towards dusk. We observed both male and female chasing bats well past sunset, and frequently heard food transfer vocalization well before sunrise. On two occasions we observed the adult male retrieve a bat that had been cached in an epiphytic clump. In the process of watching the male transfer the bat to the female, we were able to see that the patagial membrane of the bat had been torn away, leaving only the bare bone. Although this crepuscular, if not nocturnal, predatory behaviour is difficult to observe, it is our impression that bats may provide an important part of the diet of this species.

In 1979, two eggshell fragments collected from a recently fledged nest in northern Guatemala were analyzed for pesticide residues through membrane lipid extraction. These contained 180 ppm DDE and 50 ppm Heptachlor epoxide on a lipid weight basis. These levels for DDE are lower than those

recently observed in Peregrine Falcons from California (Peakall, pers. comm.), but this amount corresponds to about 10% thinner than normal eggshells in Peregrines (Cade et al. 1971). We cannot discount significant eggshell thinning in Orange-breasted Falcons, although the pairs we saw appeared to be reproducing well.

#### DISCUSSION

The Orange-breasted Falcon is, in many ways, similar to the cosmopolitan Peregrine Falcon, replacing it as a breeding bird in the Neotropics, where it is adapted to hunt above the forest canopy.

From our observations, it appears to require a vast expanse of unbroken forest canopy. Owing to the destruction of the neotropical forest, most of the historic locations, taken from museum specimens, no longer provide suitable habitat. With one exception, regions where specimens had been collected in the past are to day without forest and without Orange-breasted Falcons. There may be comparatively little time left for biological investigation of this species, which has potential as an environmental indicator of tropical forest ecosystems. Further study is needed, in the fields of both ecology and captive propagation, to assure the survival of this falcon.

We should like to thank William Burnham, the late R. Mario Dary, David H. Ellis, Fernando Ortiz, Richard O. Bierregaard, D. B. Peakall and Tom Lovejoy for their support and assistance in this project. Special thanks also to Ms. Roxy Layborne of the National Museum of Natural History for invaluable help in identifying prey. For extensive assistance in the field, we would like to thank William C. Sullivan, Michael D. Arnold and Barbara Jenny, without whose expertise and hard work many of these data could not have been collected.

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TABLE 1  
Observed Prey Species for Falco deiroleucus

<u>Species</u>	<u>Average Weight</u>	<u>Number Observed</u>
<u>GUATEMALA</u>		
Scaled Pigeon <u>Columba speciosa</u>	265 g	1
Ruddy Ground Dove <u>Columba talpacoti</u>	32 g	1
Grey-headed Dove <u>Leptotila plumbeiceps</u>	168.7 g	1
Mourning Dove <u>Zenaida macroura</u>	131 g	1
Masked Tityra <u>Tityra semifasciata</u>	79 g	1
Black-crowned Tityra <u>Tityra inquisitor</u>	53.4 g	1
Violaceous Trogon <u>Trogon violaceus</u>	62.6 g	2
Red-legged Honeycreeper <u>Cyanerpes cyaneus carneipes</u>	30.5 g	1
Swainson's Thrush <u>Catharus ustulatus</u>	24.6 g	1
Olive-throated Conure <u>Aratinga nana astec</u>	93 g	5
White-collared Swift <u>Streptoprocne zonaris</u>	110 g	1
Grey-breasted Martin <u>Progne chalybea</u>	35 g	1
Pectoral Sandpiper <u>Calidris melanotus</u>	60 g	1
Killdeer <u>Charadrius vociferus</u>	85 g	1
Lesser Yellowlegs <u>Tringa flavipes</u>	85.5 g	1
Lesser Swallow-tailed Swift <u>Panyptila cayennensis</u>	9.1 g	1
Rough-winged Swallow <u>Stelgidopteryx ruficollis</u>	14.3 g	1
Brown-headed Parrot <u>Pionopsitta haematotis</u>	26 g	1
Botteri's Sparrow <u>Aimophila botterii</u>	22.1 g	1
Rose-throated Becard <u>Pachyramphus aglaiae</u>	31.2 g	1
Rose-breasted Grosbeak <u>Pheucticus ludovicianus</u>	46 g	1
Woodpecker <u>Melanerpes</u> sp.		1
Bat ( <u>Chiroptera</u> )		1
<u>ECUADOR</u>		
Speckled Spinetail <u>Cranioleva gutturata</u>	20 g	1
Black-crowned Tityra <u>Tityra inquisitor</u>	40.5 g	1
Cobald-winged Parakeet <u>Brotogeris cyanoptera</u>	61 g	1
Rufous/Pale-vented Pigeon <u>Columba cayennensis</u>	209 g	1
Yellow-rumped Cacique <u>Cacicus cela</u>	81 g	1
Magpie Tanager <u>Cissopis leveriana</u>	77.1 g	1
Silver-breasted Tanager <u>Ramphocelus carbo</u>	30.1 g	1
White-collared Swift <u>Streptoprocne zonaris</u>	110 g	4
Bat ( <u>Chiroptera</u> )		1