

## PRELIMINARY GROUND AND AERIAL SURVEYS FOR ORANGE-BREASTED FALCONS IN CENTRAL AMERICA

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**ABSTRACT.**—Ground and aerial surveys for Orange-breasted Falcons (*Falco deiroleucus*) were conducted during March–June 1999 in Honduras, and March–May 2000 in El Salvador, Honduras, Nicaragua, Costa Rica, and Panama, all within the likely range of this species. Sixty-six cliffs were checked by ground surveys. No Orange-breasted Falcon was found in Central America. We examined 55 cliffs by fixed-wing aircraft during 24 hr of flying. No Orange-breasted Falcon was seen in El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. In Honduras and Panama, we checked 262 limestone cliffs by helicopter during 47 hr of flying and one Orange-breasted Falcon was seen in a limestone canyon in the Darién Province of Panama, and one sighting of two birds, possibly Orange-breasted Falcons, 11 km south in the same region. The apparent absence of cliff-nesting Orange-breasted Falcons in seemingly suitable habitat in much of Central America is inexplicable and warrants further surveys but indicates that the population in Guatemala and Belize is geographically and genetically isolated from the South American birds.

**KEY WORDS:** *Falco deiroleucus*; *Orange-breasted Falcon*; *Central America*; *survey*; *cliffs*.

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Estudios preliminares terrestres y aéreos para los Halcones de Pecho Naranja en Centro América

**RESUMEN.**—Estudios terrestres y aéreos para el halcón de pecho naranja (*Falco deiroleucus*) fueron conducidos durante marzo–junio de 1999 en Honduras, y marzo–mayo 2000 en El Salvador, Honduras, Nicaragua, Costa Rica, y Panamá, todos dentro del rango probable de la especie. Sesenta y seis cornisas fueron revisadas en los estudios terrestres. No se encontró ningún halcón de pecho naranja en Centro América. Examinamos 55 precipicios con aeronaves de ala fija durante 24 horas de vuelo. Ningún halcón de pecho naranja fue visto en El Salvador, Honduras, Nicaragua, Costa Rica, y Panamá. En Honduras y Panamá, revisamos 262 cornisas de piedra caliza en helicóptero durante 47 horas de vuelo y un halcón de pecho naranja fue visto en una cañón de piedra caliza en la provincia del Darien en Panamá, y un avistamiento de dos aves, posiblemente halcones de pecho naranja, 11 km al sur en la misma región. La aparente ausencia de halcones de pecho naranja anidando en cornisas en un hábitat hipotéticamente adecuado en la mayoría de Centro América es inexplicable y requiere mayores estudios para indicar que la población en Guatemala y Belice esta aislada geográfica y genéticamente de las aves de Sur América.

[Traducción de César Márquez]

The Orange-breasted Falcon (*Falco deiroleucus*) is a little known and, perhaps, rare falcon (Baker 1998). Although distributed in Central and South America, the species is local (del Hoyo et al. 1994), sparsely distributed and difficult to detect (Cade 1982), and probably threatened by habitat alteration (Jenny 1989, Baker 1998, Baker et al. 2000). The historical distribution of Orange-breasted Falcons in Central America is summarized in Baker et al. (2000). Apart from 19 nest sites documented recently in Guatemala and Belize (Jenny 1989,

Baker 1998, Baker et al. 2000) most reliable records for Central America are more than 20 years old, and none of them involve breeding. Possibly, the species has been extirpated from parts of its former breeding range (Cade 1982). This species may warrant special status due to the isolation of the known population in Central America from larger populations in South America (Collar and Andrew 1988, Baker et al. 1992, Collar et al. 1994, Baker 1998, Baker et al. 2000).

Substantial areas of seemingly suitable habitat for Orange-breasted Falcons exist in Belize, Guatemala, Honduras, Nicaragua, Costa Rica, and Panama among limestone mountains, yet recent ob-

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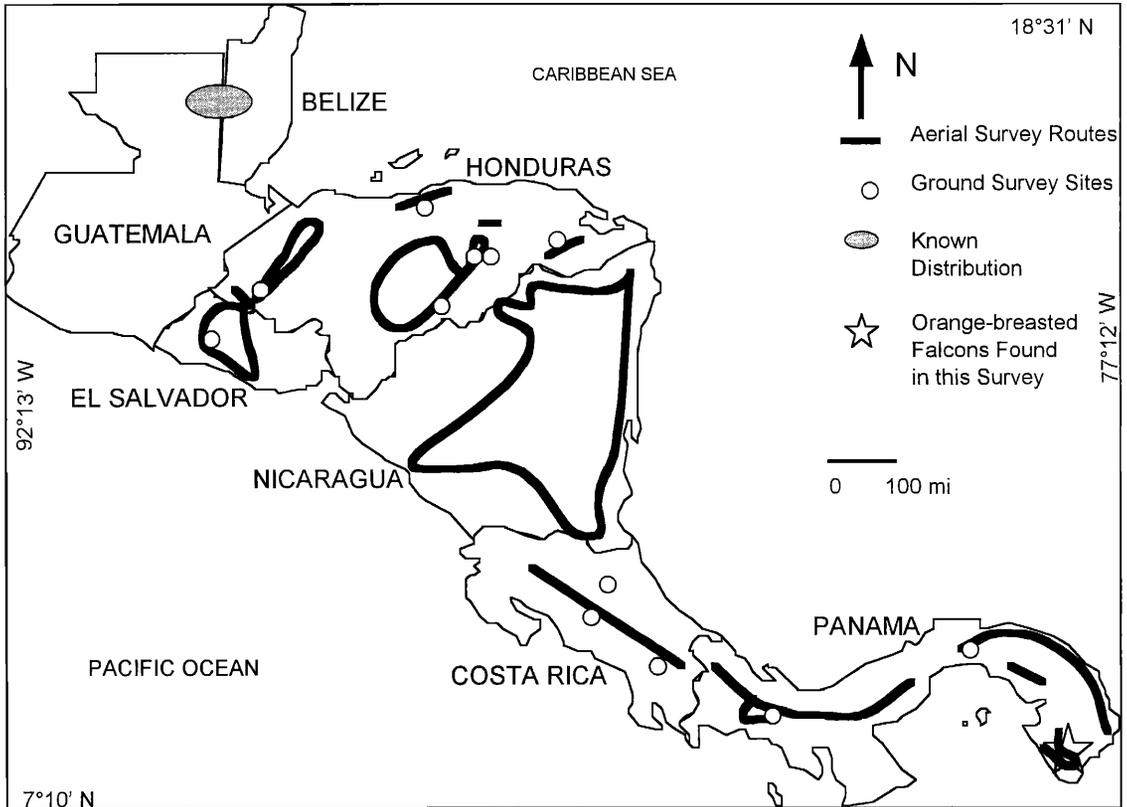


Figure 1. Ground and aerial surveys for Orange-breasted Falcons in Central America from April 1999–May 2000.

servations of this species are almost nonexistent throughout this region. We conducted ground and aerial surveys for Orange-breasted Falcons from El Salvador to Panama to improve knowledge of its present breeding range in Central America.

#### STUDY AREA AND METHODS

The breeding season for Orange-breasted Falcons in Guatemala and Belize begins with courtship in January and February. Eggs are laid in late March and early April, and young fledge mainly in June and July at the beginning of the wet season (Baker 1998). Nesting pairs are particularly aggressive toward congeners and other raptors during the courtship period and the post-fledging dependence period in June and July. We chose March–June for the aerial surveys to take advantage of the conspicuousness of breeding pairs tending their nest and young. Ground surveys were conducted from March–May in 1999–2000. Because most of the Pacific slope from El Salvador through Costa Rica is deforested, significantly drier, and has yielded few, if any, Orange-breasted Falcon records historically, we concentrated our survey effort on the Atlantic slope (Fig. 1).

**Honduras.** Ground surveys were conducted in April–

May 1999 within a 15-km radius of the Tawahka Indian village of Krausirpe ( $15^{\circ}02'N$ ,  $84^{\circ}52'W$ ) in the Sierra del Warunta (Anderson 1999). The small area of ground coverage was limited by walking distance and the lack of a trail system in this region.

Ground surveys were conducted by D. Anderson accompanied by 2–3 Tawahka guides to locally-known, limestone cliffs (Fig. 1). We searched for falcons using  $7 \times 42$  binoculars and a 16–24 zoom spotting scope from 0700–1230 H and 1530–1730 H. Eighteen cliffs and one large limestone mountain were searched during 17 days. Cliff surveys consisted of looking for whitewash on cliff faces, falcons perched on cliffs and on trees atop cliffs, flying birds, prey remains at the bases of cliffs, and listening for vocalizing falcons.

Aerial surveys were conducted by R. Watson and R. Thorstrom in a larger area of the Sierra del Warunta and adjacent Montañas de Colón (ca.  $14^{\circ}50'–15^{\circ}05'N$ ,  $84^{\circ}45'–85^{\circ}05'W$ ) (Fig. 1). Three survey flights totaling 8.83 hr were made on 25–26 June 1999 in a Robinson 44 helicopter equipped with a Global Positioning System (GPS) navigational system. Survey routes were chosen at first by visiting the same cliffs surveyed from the ground by D. Anderson, as located by GPS and marked on 1:50,000 maps of the region. These cliffs were visited dur-

Table 1. Summary by country of suitable cliffs surveyed for Orange-breasted Falcons (*Falco deiroleucus*) from the ground, by fixed-wing aircraft and helicopters in 1999–2000.

COUNTRY	NUMBER OF SUITABLE CLIFFS SURVEYED FROM THE GROUND	NUMBER OF SUITABLE CLIFFS OBSERVED DURING FIXED-WING AIRCRAFT SURVEYS (hr)	NUMBER OF SUITABLE CLIFFS OBSERVED DURING HELICOPTER SURVEYS (hr)
El Salvador	12	15 (3)	0
Honduras	41	25 (5.75)	62 (8.5)
Nicaragua	0	0 (4)	0
Costa Rica	9	15 (6)	0
Panama	4	0 (5)	200 (38.5)
Total	66	55 (23.75)	262 (47)

ing the first part of the first flight, after which survey routes were chosen by sight, keying on potentially suitable nesting habitat (e.g., exposed cliffs with forest below) and major topographic features such as valleys and rivers. Our survey route was tracked by GPS and mapped between flights to ensure the entire mountain range was surveyed.

Surveys were conducted by flying the helicopter within 20–50 m of the cliff face, at about its highest point so two observers could look down on the cliff face and look into ledges and potholes. We were also able to see the top of the cliff and potential perches, such as snags and overhanging trees. Some cliffs were too tall for an adequate view of the entire cliff, so a second, third or even more passes were made at lower elevations in such cases. The helicopter flew slowly past the cliff face while observers scanned the face and all potential perch sites. The helicopter made a second pass or hovered in front of cliffs that needed more time to survey thoroughly. The helicopter provided ample time in front of cliffs, and maneuverability to complete visual surveys in narrow valleys and canyons.

**El Salvador to Costa Rica.** Fixed-wing aerial surveys to locate cliffs were conducted by A. Baker and S. Ayers from March–May 2000 (Fig. 1). Areas of potential habitat for aerial surveys were identified from topographic maps where relief might indicate cliffs. We communicated with individuals (both locally and abroad) known to have experience and information in and about the region. In addition, surveys were limited to below 2000 masl (meters above sea level) because this species is not known to occur above ca. 1000 masl. Surveys were conducted from a variety of small single-engine planes and, in one case, a twin-engine, fixed-wing plane chartered locally in each country. All flights were conducted at between 200–500 m above the ground at speeds of between 160–250 kmph, suitable altitudes and speeds for surveying the area for cliffs. When cliffs were spotted we circled for a closer look, recorded the locality with a GPS receiver, and noted cliff size, surrounding habitat, and accessibility from the ground.

Ground surveys were conducted by A. Baker and S. Ayers after cliffs were located from the air and consisted of spending several hours on the ground in view of and within hearing distance of any falcons on the cliff. Cliffs

were selected for ground survey based on accessibility and quality in terms of cliff size, height of cliff above surrounding forest, and extent of surrounding forest.

**Panama.** Between 12–26 April 2000, R. Thorstrom searched from a Robinson 44 helicopter for Orange-breasted Falcons on cliffs, rocks, and escarpments, using 10 × 42 binoculars and a Garmin 12 XL GPS receiver. We visited five major areas in Panama: Pacific side of the Darién region, the Majé range in central-eastern Panama, the Chagrés area of the Atlantic Colón region, Bocas del Toro, Veraguas, Coclé in the Atlantic western region, and the central range at Volcano Barú on the Chiriquí (Pacific side) (Fig. 1).

A. Baker and S. Ayers spent 9.25 hr in a helicopter on 22–23 May revisiting the three sites where R. Thorstrom had recorded an Orange-breasted Falcon on 26 April and other unidentified falcon activity. Fixed-wing aircraft flights were made by A. Baker and S. Ayers to survey Chagrés National Park and surrounding areas and all of San Blas from Nujagandi to the Colombia border on both sides of the coastal range totaling 5 hr (3 flights including 1 uncompleted flight due to weather). Ground surveys were made to Madden Dam by R. Thorstrom, and three cliffs were checked near Fortuna Reservoir north of David by A. Baker and S. Ayers (Fig. 1).

## RESULTS

**Honduras.** Eighteen cliffs and one large limestone mountain (Cerro Wampú) were searched from the ground during 17 days between 12 April–8 May 1999 (Table 1), dates corresponding to the incubation/nestling period in Guatemala and Belize (Baker 1998). One additional cliff was searched earlier on 15 March. Cliff size ( $N = 18$ ) ranged from 30–250 m tall ( $\bar{x} = 102$  m) and 35–500 m wide ( $\bar{x} = 153$  m). Cliff surfaces were broken by crevices, ledges, caves, and epiphytic bromeliads, providing many potential nest surfaces as well as abundant shade. Cliffs were oriented predominantly northward, with eight cliffs facing north, five northwest, one northeast, and four east.

We checked an additional 22 cliffs by ground survey in El Boquerón National Park, El Chile National Park, Sierra de Agalta National Park, Rio Cangrejil, and Celaque National Park.

Sixty-two distinct cliff faces were surveyed by helicopter in the Sierra del Warunta and Montañas de Colón ranges, as well as one isolated mountain in the Río Plátano Biosphere Reserve (en route to the main survey site) called Cerro Chachahuate (Table 1). We observed four Bat Falcons (*Falco ruficularis*), but no Orange-breasted Falcons.

**El Salvador to Costa Rica.** We detected 55 apparently-suitable cliff faces during 23.75 hr of fixed-wing aerial surveys (Table 1). Of these, we surveyed 41 cliffs from the ground (Table 1). Cliffs that were not surveyed from the ground were unreachable on foot due to their remote nature, extreme topography, and flooded rivers. All cliffs were of igneous origin and ranged from 50–700 m high and 50–1000 m wide (mode = ca. 100 m high  $\times$  200 m wide). Although all of these cliffs were located in forested areas, the surrounding forest was patchy, and the patches were mostly small. No suitable cliffs were found in Nicaragua where we conducted fixed-wing surveys (Table 1). No Orange-breasted Falcons were found in El Salvador, Honduras, Nicaragua, or Costa Rica. We are confident both that no Orange-breasted Falcons occurred on cliffs in the areas that we surveyed and that we surveyed thoroughly almost all suitable cliffs in these countries.

**Panama.** During 38.5 hr of helicopter survey, we visited over 200 cliffs, rock slopes, and escarpments (Table 1). No suitable cliffs were found in the Chagrés National Park or San Blas province of Panama where we conducted fixed-wing surveys (Table 1). In the Darién province, we observed one Orange-breasted Falcon on 26 April at 1304 H (07°44'N, 078°05'W) when a large dark-backed, heavy-winged falcon flew five times around the helicopter inside a box-like canyon at 610 masl (Fig. 1). This falcon had slightly larger and thicker wings with slower wing beat than a typical female Bat Falcon. On 13 April at 1030 H, two large dark-backed falcons were flushed off a cliff face by the helicopter (07°39'N, 078°05'W) and descended and disappeared into a ravine, allowing a 2 s observation of the darting falcons. We believe these two disappearing falcons were Orange-breasted Falcons. This site was at 770 m elevation, and the cliff contained one slightly overhung large pothole with a potential scrape and whitewash. We returned to the same site on 26

April at 1100 H but failed to detect the falcons at the site or on the cliff extension to the north (07°40'N, 078°05'W).

In the Coclé province, on 22 April 2000 at 1700 H an unidentified falcon nest was located (08°41'N, 080°40'W). This nest site was a pothole with two cavities at the base of an overhung rock. It contained two nestlings with dark rufous on the sides of neck, blue ceres, and no down on the head. On the first helicopter pass by this site a small dark-backed falcon was flushed from the face and disappeared. On the second pass a larger dark-silhouetted falcon flew above the helicopter and disappeared. On 23 April, we visited this site at 1300 H and found no young present in the pothole. One silhouetted heavy-billed falcon was observed flying from the helicopter. At 1500 H, we returned to this site after investigating other cliffs in the area; here we located a Bat Falcon on a nest with two eggs on the opposite side of the cliff face formerly containing the unidentified nestlings and at a distance of ca. 200–300 m.

During a follow-up helicopter survey in Panama we confirmed the presence of an adult female Orange-breasted Falcon at one site in the Darién. At another Darién cliff, we flushed either a female Bat Falcon or male Orange-breasted Falcon from a ridge-top perch. At the Coclé site, we observed either a female Bat or male Orange-breasted Falcon flying away from the helicopter. During 38.5 hr of helicopter time, we recorded eight observations of Bat Falcons perched in trees or evading the helicopter near cliffs and two nests; one in the Majé mountains and the other in the Coclé region.

#### DISCUSSION

Orange-breasted Falcons formerly occurred in a broad range from southern Mexico south through Central America and into South America, where the species was found east of the Andes as far south as northern Argentina (del Hoyo et al. 1994). Records of the species, however, are sparse throughout its range. The most concentrated records, including the only breeding records from Central America, come from Guatemala and Belize (Baker 1998). Baker (1998) studied 13 breeding pairs in Belize and six pairs in Guatemala from 1991–97, of which the closest neighboring pairs were 1.7 km apart. If our survey in Central America was in similarly suitable habitat, we estimate there would be sufficient cliffs, spaced far enough apart, to support numerous breeding pairs. In Nicaragua, no

cliffs were found in forested habitat and in El Salvador, no cliffs were associated with primary forests. The fact that we found no Orange-breasted Falcons in El Salvador, Honduras, Nicaragua, or Costa Rica suggests that either the habitat is not suitable, they are not using cliffs as nest sites, or we overlooked this species' presence. The only Orange-breasted Falcons detected during these surveys were in the Darién province of Panama. This area contains the northernmost foothills of the Andes of South America. The presence of these falcons in the Darién suggests that these birds are at the northern limit of the South American population.

Panama appears to have many cliffs in the Coclé and Darién regions surrounded by intact primary forest, perhaps as many as the Belize and Petén, Guatemala region. It seems very likely that Panama contains a breeding population of Orange-breasted Falcons. The presence of this species in Belize, Guatemala, and the Darién province of Panama, where an abundance of cliffs in conjunction with large tracts of forest remains, lends support to this hypothesis.

One pair of palm-nesting Orange-breasted Falcons was recorded in Petén, Guatemala (Baker 1998) and equally suitable palm trees and other canopy emergent trees potentially suitable as nesting sites occur throughout Central America. Due to the rarity of this behavior we suspect that it may result from the size of the population in the Guatemala and Belize region relative to a limited number of suitable nesting cliffs, leading to the occasional use of trees for nesting sites.

The seeming absence of cliff-nesting Orange-breasted Falcons from El Salvador, Nicaragua, and Costa Rica is not surprising because of the low museum records of the species from the region. A very low abundance of suitable cliffs in Costa Rica and El Salvador, and no cliffs in Nicaragua compounded by extensive deforestation and dry areas, especially in El Salvador and most of Honduras, is a likely explanation. The lack of nesting Orange-breasted Falcons in parts of Honduras is surprising, because there are many limestone cliffs with an extensive tract of primary forest. Detection of four Bat Falcons during 8.5 hr of helicopter surveys provides evidence that our observation methods should have revealed the Orange-breasted Falcons if they were present.

We offer the following speculative explanations for the apparent absence of Orange-breasted Fal-

cons from most of Central America, with the understanding that they might influence further study. Populations of this falcon may have been negatively affected in the period before DDT was banned in the United States (prior to 1972) as a result of feeding on contaminated migratory and resident birds, but this is not consistent with the presence of the Belize/Guatemala population. DDT and other organochlorines were used for years in developing countries after being banned in the U.S., particularly for pest control on cotton crops. Cotton was grown extensively along the Pacific seaboard of Central America from southern Mexico through Guatemala, El Salvador, Honduras, Nicaragua, and into Costa Rica, expanding rapidly in the 1950s and 1960s, and reaching peak production in 1978 (Murray 1994). Because pesticide contamination has never been associated with a decline of Orange-breasted Falcons and DDT has been used primarily on the Pacific coastal side, however, we suggest it is unlikely that this was the main cause for extirpating this species from most of Central America.

Alternatively, the lack of detection of nesting falcons may be a result of our focusing only on cliffs in areas where Orange-breasted Falcons may be nesting in trees. However, while Orange-breasted Falcons are sometimes difficult to locate when nesting in trees, when nesting they are usually near their nests and quite vocal making detection a bit easier. In 7 yr, staff of The Peregrine Fund's Maya Project located 1 tree nest in Guatemala and Belize (Baker 1998). In Ecuador, searches by boat, air, and truck during five months resulted in observations of 15 Orange-breasted Falcons and four nests in emergent trees (Cade 1982). Furthermore, Orange-breasted Falcons may have been more difficult to detect from the ground in Central America if April and May correspond to the incubation period, as in Guatemala (Baker 1998), which could have contributed to our lack of detections.

Orange-breasted Falcons are regarded as threatened in Central America because of their small population size and the probability that breeding populations in Guatemala and Belize are genetically isolated from the South American population (Collar and Andrew 1988, Collar et al. 1994, Baker 1998). The lack of detection of Orange-breasted Falcons in apparently all suitable habitat in Honduras and Costa Rica is an important observation that should stimulate further study. If the species is sensitive to habitat alteration, as suggested by

some authors (Jenny and Cade 1986, Jenny 1989, Baker 1998), it could be a useful indicator of native-plant community alteration in the remaining lowland tropical rain forests of Central America. We recommend additional studies to understand nest site selection in areas where this bird may nest in emergent trees as in Ecuador and possibly Brazil (Whittaker 1996) or in palms as in Guatemala. Results would be useful in implementing surveys for tree-nesting Orange-breasted Falcons in the Sierra del Warunta range of Honduras, La Mosquitia region of Honduras and Nicaragua, and the Coclé, Bocas del Toro, Veraguas, and Chagrés regions of Panama.

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