

THE WILSON BULLETIN

A QUARTERLY JOURNAL OF ORNITHOLOGY

Published by the Wilson Ornithological Society

VOL. 114, NO. 4

December 2002

PAGES 421–561

Wilson Bull., 114(4), 2002, pp. 421–445

A NEW SPECIES OF FOREST-FALCON (FALCONIDAE: *MICRASTUR*) FROM SOUTHEASTERN AMAZONIA AND THE ATLANTIC RAINFORESTS OF BRAZIL

ANDREW WHITTAKER¹

ABSTRACT.—I describe a new species of *Micrastur* (forest-falcon) from the rainforests of Brazil and adjacent northeastern Bolivia. Initial detection of the cryptic new taxon was enabled through hearing its distinctive voice, notably different from any of its congeners. Several specimens of the undescribed species subsequently were located in several museums; because the new species closely resembles *M. gilvicolis* (Lined Forest-Falcon), these specimens had remained unrecognized for more than a century. The new taxon not only has a vocal repertoire that differs from those of congeners, *M. gilvicolis*, *M. plumbeous* (Plumbeous Forest-Falcon), and *M. ruficollis* (Barred Forest-Falcon), but it also exhibits subtle yet consistent morphological distinctions that distinguish it from all other forest-falcons. This elusive raptor inhabits humid *terra firme* forest in southeastern Amazonia, and a disjunct population exists in the Atlantic rainforests of eastern Brazil (the latter known only from historic specimens) and merits great conservation concern. I summarize current information on the new species' distribution, offer insight into its natural history and conservation, and discuss its systematic relationships within the genus *Micrastur*. *Received 19 November 2001, accepted 30 September 2002.*

RESUMO.—Eu descrevo uma nova espécie de *Micrastur* (gavião florestal) da floresta tropical do Brasil e adjacente nordeste da Bolívia. O descobrimento inicial do novo cryptico táxon foi capacitada pela sua distinta voz, notavelmente diferente de qualquer um dos congêneres. Vários espécimes das espécies não descritas foram subsequentemente localizadas em vários museus; devido à nova espécie assemelhar-se do *M. gilvicolis* (falcão-mateiro), estas espécimes ficaram desconhecidas por mais de um século. O novo táxon não somente tem um repertório vocal que difere desses congêneres, *M. gilvicolis*, *M. plumbeous*, (falcão-chumbo) e *M. ruficollis* (falcão-caburé), mas isto ainda também sutilmente exibe uma distinção morfológica que o distingue de todos os outros *Micrastur*. Este gavião evasivo habita nas matas de *terra firme* úmida do sudeste da Amazônia, e com uma população disjunta existindo na mata Atlântica do leste do Brasil (o ultimo conhecimento somente através de espécimes históricas) e merece grande interesse de conservação. Eu sumariei informações atuais sobre a distribuição da nova espécie, e apresentei a introspecção dentro da história natural e conservação, e discuto o seu relacionamento sistemático dentro do gênero *Micrastur*.

At dawn on 28 October 1997, while in low-land *terra firme* forest at Caxiuanã, Pará, Bra-

zil, I tape recorded an unfamiliar bird vocalization that I suspected belonged to some species of forest-falcon (*Micrastur* spp.). I employed tape playback in an attempt to locate the bird. After about 10 min a forest-falcon responded vocally and then approached, land-

¹ Conjunto Acariquara, Alexio, Rua Samaumas 214, Manaus, 69085-410 Amazonas, Brazil; E-mail: andrew@birdingbraziltours.com

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FRONTISPIECE. *Micrastur mintoni* sp. nov., Cryptic Forest-Falcon, a new species of raptor from tropical rainforests of southeastern Amazonian Brazil, extreme eastern Bolivia, and the Atlantic rainforests of eastern Brazil. Adult female (holotype) is above subadult male. Figure is from a mixed media oil painting by P. J. Greenfield.

ing close by in the midstory. This unfamiliar-sounding bird looked almost exactly like *M. gilvicollis* (Lined Forest-Falcon), a species with which I had extensive field experience. I noted a few subtle but distinctive plumage differences from *M. gilvicollis*, and thus suspected that the bird I was observing represented a cryptic *Micrastur* species previously undescribed.

Upon subsequently examining specimens of *M. gilvicollis* at the Museu Paraense Emílio Goeldi (hereafter MPEG) in Belém, Brazil, I found the specimens could be sorted into two distinctly different plumage types. Twenty-three specimens matched the field characters of the bird I observed in Caxiuanã and 12 fitted *M. gilvicollis*. I, together with MPEG taxidermist D. Pimentel, returned to Caxiuanã to obtain specimens of this unrecognized species. We successfully obtained a series of tape recordings and a voucher specimen with voice and tissue samples for future analysis.

I analyzed all catalogued vocalizations of the smaller *Micrastur* species from the Macaulay Library of Natural Sounds (MLNS) at the Cornell Laboratory of Ornithology and the British Library of Natural Sound Archive. I also searched the holdings of the following major natural history collections: Academy of Natural Sciences of Philadelphia (ANSP), Louisiana State Univ. Museum of Natural Science (LSUMZ), Museu Nacional de Rio de Janeiro (MNRJ), Naturhistoriska Riksmuseet Stockholm (NRM), and Museu de Zoologia da Univ. de São Paulo (MZUSP). I identified seven recordings of the new forest-falcon attributed to the other *Micrastur* species and located an additional 22 specimens. I have concluded that these represent a new species of *Micrastur*, and I propose to name it:

Micrastur mintoni sp. nov.

Cryptic Forest-Falcon

Falcão Cryptico (Portuguese)

Holotype.—MPEG 54849; adult female from Estação Científica Ferreira Penna, Caxiuanã, Melgaço, Pará, Brazil (01° 44.176' S, 51° 21.162' W); at approximately 200 m; 2 August 1999 collected by Dionsío Corrêa Pimentel Neto and tape recorded by AW. Vocal recordings were archived (MLNS 107100–107103) and tissue samples were deposited at MPEG.

Diagnosis.—The most diagnostic feature separating this new cryptic *Micrastur* from all congeners is its voice (see below).

A small raptor (body mass 170–264 g) belonging to the family Falconidae; clearly assignable to the genus *Micrastur*, characterized by short rounded wings, long graduated tail, and a slight, almost owl-like facial ruff (Ridgely and Gwynne 1989). Similar in size and plumage to the monotypic *M. gilvicollis*, but differing in its proportionately shorter tail (a mean of 7.5% smaller) and a different wing:tail ratio (Table 1).

The most important diagnostic plumage character of *M. mintoni* is the tail pattern; adults have one broad white central tail band, and subadults have two broad white to buff tail bands. In contrast, adult and subadult *M. gilvicollis* show two distinctly narrower white tail bands, and immature *M. gilvicollis* have two or three white to buff narrow tail bands. In the field the second (basal) tail band of *M. gilvicollis* often is obscured from view by wing projection (pers. obs.). *M. mintoni* sometimes has an incipient additional second tail band completely covered by the upper tail coverts (13 of 22 MPEG specimens; absent in *M. gilvicollis*). A contrastingly darker forehead, crown, and nape is shown on 50% of *M. mintoni* (all subadult birds except one in the MPEG displayed this feature), whereas only 7% of *M. gilvicollis* showed a contrastingly darker hood. In *M. mintoni*, an eyebrow of bare bright orange skin extends above the whole eye (Fig. 1), whereas in *M. gilvicollis* it extends above only the anterior three-quarters of the eye. From the nares, the distance to the feathering on the forehead is less in *M. mintoni* (mean of 5.49 mm, range 3.49–6.56 mm, $n = 23$) than in *M. gilvicollis* (mean of 6.63 mm, range 5.18–9.15 mm, $n = 13$). The horizontal dark barring on the underparts is bolder on *M. mintoni*, in which the barring is better defined on the breast (especially in females), and extends down to the midbelly and lacks buff wash (Fig. 1). Posterior to the midbelly, in *M. mintoni* the dark barring is absent or greatly reduced (Fig. 1), the bars becoming narrower with wider pale interstices, whereas *M. gilvicollis* shows denser and finer dark barring with less white showing between the bars that typically extends farther down than *M. mintoni* (Fig. 2). Also, *M. gilvicollis* often has

TABLE 1. Morphology of four *Micrastur* forest-falcons; values are means (range, *n*). Wing chord is flattened. *M. gilvicollis* weights (*n* = 92) were from field captures ca 60 km north of Manaus, Amazonas, Brazil and were from unsexed birds.

Sex	Wing chord (mm)	Tail length (mm)	Wing : tail ratio	Body mass (g)
<i>M. mintoni</i> ^a				
Male	183 (175–200, 24)	135 (129–151, 24)	1.36 (1.28–1.46, 24)	200 (171–238, 8)
Female	186 (174–201, 16)	137 (129–145, 14)	1.35 (1.22–1.45, 14)	219 (170–264, 11)
<i>M. gilvicollis</i> ^a				
Male	178 (169–188, 10)	137 (131–150, 11)	1.29 (1.16–1.35, 10)	
Female	182 (177–188, 4)	140 (138–146, 4)	1.29 (1.28–1.32, 4)	209 (170–262, 96)
<i>M. plumbeous</i> ^b				
Male	175 (171–178, 4)	127 (123–134, 4)	1.34 (1.27–1.45, 4)	180 (172–188, 3)
Female	174 (168–182, 9)	130 (115–140, 9)	1.37 (1.30–1.45, 9)	191 (180–213, 4)
<i>M. ruficollis</i> ^a				
Male	170 (164–179, 9)	159 (151–167, 9)	1.06 (1.04–1.12, 9)	
Female	175 (162–190, 17)	164 (153–179, 17)	1.06 (1.00–1.16, 17)	

^a Data from MPEG, MZUSP, and MNRS.

^b Data from P. G. W. Salaman (pers. comm.).

an irregular wash or stain of buff on the upper breast (Fig. 2).

The other two small *Micrastur* species differ in plumage as follows. *M. plumbeous* has shorter wings and tail (Table 1); cere, lores, and orbital area are bright flaming red (not orange); irides dark brown in adults and whitish beige (not white) in immatures (P. G. W. Salaman pers. comm.); paler bluish gray upperparts; pale gray throat (not white) with the underparts otherwise entirely barred, with the barring typically darker and bolder. *M. ruficollis concentricus* differs in its shorter wings and longer tail and different wing : tail ratio (Table 1); three narrow tail bands in adults (subadult and immatures have four); cere, lores, and orbital area dull yellow-orange (not orange); irides brownish (not white); and underparts entirely barred except for throat. Nominate *M. ruficollis* displays the same features as those outlined for *M. r. concentricus* above, differing distinctly with a brown (not gray) mantle and a bold striking rufous nuchal collar in adults.

Description of holotype.—See frontispiece and Figures 1–3. Capitalized color nomenclature and corresponding numbers follow Smithe (1975).

Forehead, crown, and nape slightly darker than the back, wings and rump Blackish Neutral Gray (82). Sides of face and neck Dark Neutral Gray (83) with irregular faint traces

of fine white grizzling on lower neck caused by white bases to neck feathers.

Cere, lores, nares (both external and internal), and orbital area (including eyebrow) Spectrum Orange (17). Legs and toes nearest to Orange Yellow (18). Claws: basal third nearest to Buff (124) and distal two-thirds Blackish Neutral Gray (82). Upper mandible: basal 4 mm nearest Orange Yellow (18), remainder Jet Black (89). Lower mandible: basal three-quarters nearest Orange Yellow (18), remainder Blackish Neutral Gray (82). Base of bill, cere, and nares with tiny 6- to 9-mm black rictal bristles, some with basal third white under the mandible. Iris white with a slight grayish cast, eyelid Spectrum Orange (17) covered with fine short white feathers.

Chin white. Throat: upper two-thirds white and lower third with fine 0.5-mm Blackish Neutral Gray (82) horizontal barring across the feathers, which becomes gradually bolder, reaching 1.5 mm toward the lower throat. Breast: base color white, each feather finely barred with 5–6 narrow Blackish Neutral Gray (82) bars, forming continuous horizontal bars in a gentle u-shape across the breast, increasing slightly in width and gradually in boldness from the lower throat down to the upper breast, where they reach maximum of 2.5 mm wide; below this the number and width of bars begins to decrease gradually in size to 0.5



FIG. 1. Adult male *Micrastur mintoni*, demonstrating four diagnostic distinctions from the cryptically similar *M. gilvicollis*: (1) the bolder dark barring on the underparts extending down to the midbelly; (2) posterior to the mid-belly, barring is generally absent or greatly reduced; (3) irregular wash of buff on any of the underparts is lacking; and (4) the bare bright orange eyebrow skin extends above the whole eye. Photographed in *terra firme* forest mid-story by W. Carter, September 2002, Alta Floresta, Mato Grosso, Brazil.

mm, with no bars below about the middle of the breast. Flanks and lower belly white and unbarred, stained irregularly with Pale Horn (92), mostly toward the center of the lower belly.

Ventral area white. Tibia: very fine horizontal barring broadly spaced, Dark Neutral Gray (83) across the front of the thighs. Axillars and underwing coverts white, with only the exterior carpal coverts finely vermiculated

with dark Neutral Gray (83) bars. Tail slightly darker than Blackish Neutral Gray (82) but not as dark as Jet Black (89); darker, however than primary and secondary flight feathers. One broad white central tail band 11 mm wide, 55 mm from tail tip and 62 mm from base of the tail. All rectrices with a Pale Horn (92) terminal apical fringe of 1–2 mm. A second incipient white tail band 6 mm wide on the central rectrices hidden under the upper-tail coverts. Undertail Blackish Neutral Gray (82) with central white cross bar. Undertail coverts white.

Measurements of holotype.—Wing (unflattened chord) 193 mm, tail 131 mm, culmen from base (at skull) to cere 16 mm, tarsus 50 mm, hind claw 15.2 mm, total length 342 mm, skull 100% ossified, body mass 225 g, ovary 4×2 mm, oviduct 2 mm wide, largest ovum 2 mm. Plumage fresh and unabraded with outer three rectrices on both sides symmetrical in molt.

Description of subadult and immature plumage.—See frontispiece and Figures 3 and 5. Forehead, crown, and nape darker than back on all four subadult females (MPEG 36072, 37965, 52498, and MZUSP 43867). MPEG 36072 exhibited a distinct dark-capped effect due to greatest crown-mantle contrast, closest to Jet Black (89). MPEG 52498 was molting into adult plumage with the darker hood showing much contrasting Plumbeous (78) mixed among Blackish Neutral Gray (82). Six of the seven subadult males (MZUSP 11864, 43869, 42759, 14020, 28055, and MPEG 31428, showed contrast on the crown, mantle, and wings; variation from darkest Blackish Neutral Gray (82) to the palest, nearest Dark Neutral Gray (83).

Bill: two subadult females (MPEG 34933 and 36072) had culmen tipped 7 mm and 4 mm, respectively, Orange Yellow (18), contrasting to the rest of the bill, Jet Black (89). MPEG 37965 had a 4-mm tip to the culmen that was closest to Buff (124), with the rest of the culmen a Blackish Neutral Gray (82). Iris: five subadult specimens (MPEG 36072, 37966, 52498, and two not yet accessioned) were labelled as white and three (MPEG 37965 and two not yet accessioned) were labelled as brown.

Tail: ten subadult specimens (MZUSP 11864, 14020, 28035, 42759, 43867, 43869,

MPEG 36072, 37965, 52498, and MNRJ 1472) with Blackish Neutral Gray (82) tail crossed by two broad white tail bands and a well-defined 2- to 6-mm Buff (124) terminal apical fringe. On one subadult (MPEG 43867) the tail was too badly worn for it to be detected. The tail band position varied on all seven subadult specimens (MPEG 37965 and 52489, and MZUSP 43867, 11864, 42759, 14020, and 28035). Measurements (distance of the two bands from the tail tip) were taken on the central rectrix. Distances of first band (nearest point of the band to tail tip) were 48, 49, 54, 50, 53, 42, and 56 mm, respectively. Distances of second band were 92, 91, 112, 91, 106, 90 and 101 mm, respectively. Three subadult males (MPEG 37966, 31428 and 34933) were in advanced stages of body molt, nearing adult plumage and having already acquired the single broad white central tail band of adult plumage. MPEG 34933 had the lowest position of tail band compared to all 16 adult MPEG specimens, only 43 mm from the tail tip.

Possible juvenal male (MPEG 37966) was almost unmarked below (Fig. 5), its white underparts with a Buff (124) stain, with only eight 10-mm-long, 2- to 3-mm-wide horizontal bands, closest to Dark Brownish Olive (129) and restricted to the sides of the upper breast, with only faint traces of the bars in the center. Lower belly, thighs, and flanks were white with Buff (124) stain. The boldest underpart markings were on a subadult female (MPEG 52498) with 3- to 4-mm-wide Blackish Neutral Gray (82) horizontal barring down to the lower breast, with a distinct unbarred 25-mm white wedge in the center of the breast. Three other subadult birds (MPEG 37965, 34933, and 36072) showed substantial reductions in the amount of horizontal barring on the underparts. Subadult male MPEG 31428 showed underparts closest to Pale Horn (92) with fine Dark Brownish Olive (129); horizontal barring extended only one-third of the way down the breast with the lower two-thirds unbarred.

I describe the single presumed immature male (NRM 568416) from a photograph (G. Frisk unpubl. data) with the help of a detailed plumage description Gyldenstolpe (1945). This unique specimen showed a well-marked white spot or half crescent below the auricular

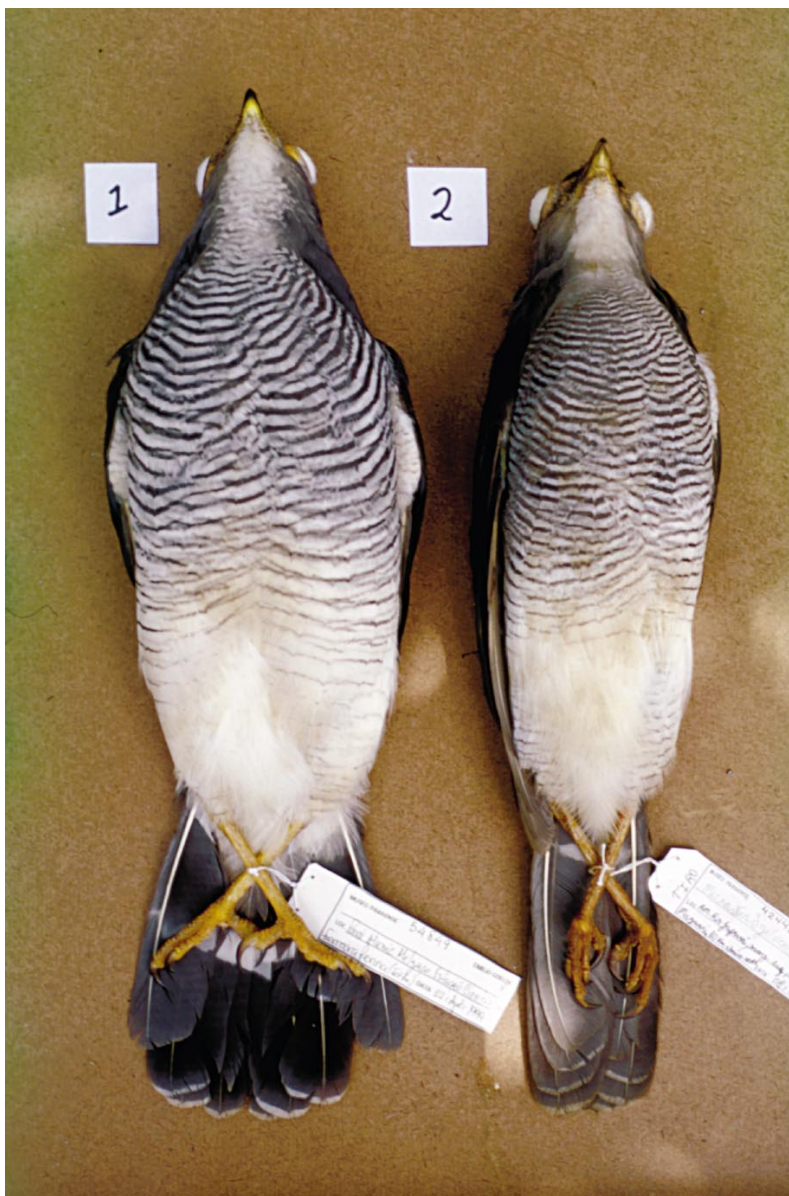


FIG. 2. Ventral barring on *Micrastur mintoni* and *M. gilvicollis*. (1) *M. mintoni* adult female holotype (MPEG 54849), Caxiuanã, Pará, Brazil. (2) *M. gilvicollis* adult male (MPEG 42442), Rio Japurá, Amazonas, Brazil. Photograph by A. Whittaker.

region. Further unique plumage characteristics were the extreme reduction of banding beneath, restricted to only a few narrow, faint, short, Blackish Neutral Grey (82) bars along the sides of the chest; rest of underparts, including throat, were white. The tail feathers had two broad (5 mm) white bands. The lower

tail band was below the center of the tail, whereas the upper band was just below the upper tail coverts, i.e., located higher up the tail than in any of the other *M. mintoni* specimens. Underwing coverts and axillars were white without any cross banding.

Sexual dimorphism and variation in para-



FIG. 3. Tail patterns of *Micrastur mintoni*, illustrating distinct tail barring. (1) Adult female holotype (MPEG 54849), Caxiuanã, Pará, Brazil. (2) Subadult female (MPEG 37965), Marabá, Pará, Brazil. Photograph by A. Whittaker.

types.—The type series of *M. mintoni* consists of 53 specimens: 37 adults (21 male, 16 female), 10 subadults (six male, four female), 1 probable immature male, and 5 unsexed specimens (2 adult, 3 subadult). Although there is great individual variation, sexual dimorphism in *M. mintoni* involves only the extent of ven-

tral barring (Fig. 5), with females generally more boldly barred below than males. Individual variation in mantle color exists but is subtle, the darkest individuals being slightly darker than Blackish Neutral Gray (82), the palest being nearest to Dark Neutral Gray (83).

The single broad central tail band varied from white to a Buff (124), but this variation may be the result of specimen preparation, chemical staining, or the age of older skins. The central tail band varied in width from 5–12 mm and was white to Buff (124). The apical fringe varied from 2–6 mm, and was generally bolder in subadult birds and absent on two adult males and an unsexed adult (possibly due to abrasion); however it also was absent on all specimens with fresh tails (MPEG 28090, 38406 and 34064). Two subadult females (MPEG 34933 and 37966) had an additional second 2-mm subterminal tail band of Buff (124), with the typical 2-mm apical fringe more Gray (83) than Blackish Neutral Gray (82). The incipient second upper tail band was specifically searched for on 23 MPEG skins of the new taxon, and was found present in seven males, five females, and one unsexed specimen.

Iris color was labelled white on 11 adults (MPEG 39331, 39332, 41601, 54849, and LSUMZ 131911 and 136811, MNRJ 6184, and four not yet accessioned) and five subadults (MPEG 36072, 37966, 52498, and two not yet accessioned). These 16 specimens and 20 additional field observations confirm that the normal eye color of *M. mintoni* is white (Fig. 1). However, three subadult specimens, indicating brown irides, strongly suggests that some subadult and immature birds probably have darker irides, similar to the ontogenetic sequence of iris color in other *Micrastur* species (pers. obs.). I conclude that the brown iris of the adult female (MPEG 34933) probably was not a true color due to bloodstaining as this specimen was shot.

Underwing pattern varied from white to Buff (124), with no vermiculation on six adult males (MPEG 32382, 33499, 48490, 39332, 41601, and 37207) and two subadult males (MPEG 31428 and 37966), to having vermiculation restricted to the carpal coverts on five adult males (MPEG 17970, 24263, 28090, 39331, and 38406) and three adult females (MPEG 54849, 48489, and 47661). Adult male MPEG 11591 had extensive dusky bars on the carpal coverts, axillars, and remainder of the underwing. Five subadult females (MPEG 27965, 34933, 36072, 52498, and 11288) showed creamy buff underwings with no vermiculation.

The Atlantic rainforest specimens from eastern Brazil (MNRJ 30548 and MZUSP 11864 and 14020) differed from Amazonian birds as follows. An adult female (MNRJ 30548) had an irregular Buff (124) wash on the breast, whereas the two males, both subadult, were more extensively and heavily barred below. Given the small sample size, it is impossible to determine if this represents individual variation or if this isolated population deserves subspecific status. I suggest that this population's geographic (and thus likely genetic) isolation from Amazonian birds makes it likely that a separate subspecies is involved. More material from this geographical area will need to be located and examined to determine whether this is the case.

Specimens examined.—The material from three institutions (MPEG, MNRJ, and MZUSP) was measured by the author. Flattened wing chord and tail length were measured to the nearest 1 mm with a wing rule with a perpendicular stop at zero. Bill and tarsus measurements were made to the nearest 0.1 mm with dial callipers. Six additional specimens were located outside Brazil (ANSP, LSUMZ and NRM) and are not included in measurement analysis. I compared *M. mintoni* to at least 15 specimens of the other members of the genus *Micrastur*, with the exception of *M. plumbeous* (P. G. W. Salaman unpubl. data).

M. mintoni: (53) BRAZIL: (50). Pará 33: 18 males, 11 females, 4 unsexed birds, Belém area (MPEG 11288, 11591, 28090, 47661, 17970; Km 86 BR 010; MUZSP 42759); Benfca municipal Benevides (MPEG 2426); Bacabá, Capitão Poço (MPEG 31428); Ourém, Rio Guamá (MPEG 32382); Paque Nacional de Tapajós (MPEG 34064); Santa Jacundá, Left bank of the Rio Tocantins (MPEG 36072); Carajás, Serra dos Carajás (MPEG 37207); Marabá, Rio Sororo, CVRD Reserve (MPEG 37965, 37966); Breves, Ilha do Marajó (MPEG 41601); Santana do Araguaia (MPEG 48489–48490); Estação Científica Ferreira Penna, Caxiuanã, Melgacão (MPEG 52498, 54849, and six not yet accessioned); one of unknown sex from Altamira (MPEG); Rio Gurupi, Camiranga (MNRJ 1472); Rio Curuá, Iripi (MNRJ 6184); Caxiriéatuba (MUZSP 22915); Rio Pracupi, Portel (MUZSP 2071); Capim, BR 14 km 96,

MUZSP 43867–43869). Amazonas: two, a male and female, Lago Batista (MUZSP 18032, MNRJ 21669). Rondônia: two males, Cachoeira Nazaré, west bank of Rio Japaraná (MPEG 39331–39332). Mato Grosso: four, two males, Rio Peixoto de Azevedo (MPEG 33499); Rio Teles Pires (MNRJ 30550); two females not yet accessioned from Rio Juruená (MUZSP). Maranhão: three, two females, one male, Turiça, Bom Jesus da Mata (MPEG 34932–34933); Acailandia, Rio Itingá (MPEG 38406). Bahia: two males, Itabuna (MUZSP 11864); Rio Jucurucú, Cachoeira Grande (MZUSP 14020). Espírito Santo: one female, Linhares (MNRJ 30584).

Specimens confirmed by photographs: BRAZIL: (4). Pará: three, a male and female from Aveiro, Rio Tapajós (NRM 568416–56817; G. Frisk pers. comm.), a female from Rio Guama (ANSP 80812), and one of unknown sex and locality in Brazil (ANSP 241; N. H. Rice pers. comm.). BOLIVIA: (2). A male and female, Depto. Santa Cruz (LSUMZ 136811–136812).

M. gilvicolis: BRAZIL: (17). Amapá: eight, five males, three females (MPEG 19797, 20904, 24196, 29079, 16457, 20905, 29071; MNHRJ 29162). Amazonas: six males (MUZSP 28035, MPEG 42441–42442, 46913, 50523, 52946). Pará: three, one male and two females (MPEG 34506, 46913, MNHRJ 6183).

M. ruficollis concentricus: BRAZIL: (21). Pará: nine (MPEG 1500, 3819, 6610, 29686, 35816, 35819, 41601, 46914, 47660). Amapá: three (MPEG 20906, 24834, 47662). Acre: three (MPEG 48031, 48032, 52016). Maranhão: one (MPEG 41946). Mato Grosso: one (MPEG 51274). Rondônia: four (MPEG 39333 and one not yet accessioned, MUZSP 30503, 34945).

Tape recordings examined.—All recordings are by the author unless otherwise stated. I compared all of the three similar (small sized) *Micrastur* species, including the five races of *M. ruficollis*, nominate *ruficollis*, *M. r. concentricus*, *M. r. guerilla*, *M. r. zonothorax*, and *M. r. interstes*, to the *M. mintoni* recordings.

M. mintoni: (42 recordings). BRAZIL: (35). Pará: 17, Melgaço 14; Belém (P. Schwartz, MLNS 59166); Serra dos Carajás (J. F. Pacheco, 1); Amazonia National Park, 1. Mato

Grosso: 13, Alta Floresta, 4, (K. J. Zimmer and T. A. Parker, 1; K. J. Zimmer, 1; C. A. Marantz, 1); Rio Cristalino 1, (C. A. Marantz, MLNS 88528–88530, 1 uncatalogued). Rondônia: 4, Serra do Pacaás Novas, 1; Guajará-Mirim, 2; Cachoeira Nazare (T. S. Schulenberg, MLNS 43364). Amazonas: Borba, 1. BOLIVIA: (7). Depto. Santa Cruz.

M. gilvicolis: (76 recordings). BRAZIL: (33). Amazonas: 29, 18, (T. A. Parker, MLNS 80425; C. A. Marantz, MLNS 88303–88306; P. Schwartz, MLNS 59167–59170, 59172; M. Cohn-haft, 1). Amapá: 3. Acre: 1. PERU: (16). Loreto: 6, 4, (M. B. Robbins, MLNS 37400; J. V. Moore, 1). Madre de Dios: 10, 1, (T. A. Parker, MLNS 24113, 24269, 24279, 29437, 29573, 29439, 29710; P. Donahue, MLNS 55837; A. B. Van den Berg, MLNS 28968). GUYANA: (6). Essequibo: (M. B. Robbins, MLNS 85812, 85757). Rupununi: (D. W. Finch, MLNS 89863, 89877; T. A. Parker, MLNS 70021, 73048). VENEZUELA: (14). Bolivar: (P. Schwartz, MLNS 59153, 59163, 59164). Río Grande: 10 (P. Schwartz, MLNS 59154–59162, 59165). Amazonas: (K. J. Zimmer 1). ECUADOR: (5). Prov. Napo: (K. J. Zimmer, 2; R. A. Rowlett, MLNS 84458; J. V. Moore, 2). BOLIVIA: (2). Depto. Beni: (A. B. Hennessey, MLNS 88004). Depto. La Paz: (T. A. Parker, MLNS 52325).

M. ruficollis: (179 recordings). BRAZIL: (49). Rondônia: 5, 3, (T. S. Schulenberg, MLNS 43374, 43774). Amazonas: 3 (P. Schwartz, MLNS 59136, 59149); Acre, 1. Rio de Janeiro: 6, 4, (T. A. Parker, MLNS 22136, 32049). Bahia: 1. Paraná: 3. Rio Grande do Sul: 15, 4, (P. Schwartz, MLNS 18852, 59132–59134; G. A. Bencke, MLNS 88095, 90113; W. Belton, MLNS 18848, 19855, 25421; F. Silva, MLNS 25444, 25447). Mato Grosso: 4, 3, (C. A. Marantz, MLNS 88377). Minas Gerais: 3. Pará: 2, 1, (S. M. Fonseca, 1). São Paulo: 2 (P. Schwartz, MLNS 59130–59131). Espírito Santo: 2. VENEZUELA: (63). Aragua 31: (P. Schwartz, MLNS 59085–59087, 59090–59091, 59098–59103, 59106, 59110, 59119–59123, 59127–59129, 59137–59142, 59144–59145, 59148, 59151). Tachira: 6 (P. Schwartz, MLNS 59088–59089, 59124–59126, 59143). Bolivar: 20 (P. Schwartz, MLNS 59092–59097, 59104–59105, 59107–59109, 59111–59118; L. Macaulay, MLNS 60936). Merida: 5 (D. Macdonald, MLNS



FIG. 4. Tail patterns of male and female *Micrastur gilvicollis*. (1) Adult male (MPEG 52946), Manaus, Amazonas, Brazil. (2) Adult male (MPEG 42442), Rio Japurá, Amazonas, Brazil. (3) Adult female (MPEG 16547), Rio Iratapura, Amapá, Brazil. (4) Adult female (MPEG 46913), Porteira, Pará, Brazil. Photograph by A. Whittaker.

44252, 44255; P. Schwartz, MLNS 59146–59147; D. Fisher, MLNS 55728). Amazonas: 1 (P. Coopmans, MLNS 68139). PERU: (18). Loreto: 2, 1, (M. B. Robbins, MLNS 37399). Madre de Dios: 12 (T. A. Parker, MLNS 11498, 23808, 23816, 29700, 29581, 29809; C. A. Marantz, MLNS 76005–76006, 76136, 76375; P. Donahue, MLNS 55838; J. W. Fitzpatrick, MLNS 43128). Cuzco: 2 (A. Begazo, MLNS 85071, 85334). Pasco: 1 (T. S. Schulenberg, MLNS 35875). Amazonas: 1 (T. A. Parker, MLNS 17571). ECUADOR: (15). Esmeraldas: 4 (M. B. Robbins, MLNS 48928, 48942, 48971; T. A. Parker, MLNS 80233). Pichincha: 3 (P. Coopmans, MLNS 58021, 58041; M. B. Robbins, MLNS 49103). Chical: 1 (M. B. Robbins, MLNS 49199). Mindo: 1 (L. Macaulay, MLNS 63454). Sucambo: 1 (M. B. Robbins, MLNS 74698). Morona: 3 (T. S. Schulenberg, MLNS 36037, 39953; M. B. Robbins, MLNS 41272); El Oro, 1 (M. B.

Robbins, MLNS 43465). Manabi: 1 (T. A. Parker, MLNS 71852). COLOMBIA: (2). Santa Marta: 2 (P. Coopmans, MLNS 68062, 68059). BOLIVIA: (12). La Paz: 5 (T. A. Parker, MLNS 13808, 13843, 13886; G. Cox, MLNS 90860; A. B. Hennessey, MLNS 87617). Beni: 2 (A. B. Hennessey, MLNS 87821, 88036). Pando: 1 (T. A. Parker, MLNS 38386). Santa Cruz: 3 (T. A. Parker, MLNS 51934, 52455; G. Cox, MLNS 90189). Tambo: 1 (R. A. Rowlett, MLNS 85600). GUYANA: (1). Rupununi: 1 (T. A. Parker, MLNS 70052). PARAGUAY: (1). Canideyú: 1 (À. Madrono, MLNS 91959). ARGENTINA: (1). Salta. PANAMA: (2). Darien: 2 (T. A. Parker, MLNS 25819, 25859). COSTA RICA: (13). Limón: 4 (C. A. Marantz, MLNS 76648–76651). Puntarenas: 7 (D. Ross, MLNS 53905, 55082, 55240, 55186; B. [?? MI?] Spencer, MLNS 31408, 31412; C. A. Marantz, MLNS 76107). Guanacaste: 1 (T. A. Parker,



FIG. 5. Age variation in ventral barring of *Micrastur mintoni*. (1) Adult female holotype (MPEG 54849), Caxiuanã, Pará, Brazil. (2) Adult female (MPEG 34933), Turiacu, Maranhao, Brazil. (3) Subadult female (MPEG 37965), Maraba, Pará, Brazil. (4) Possible juvenal male (MPEG 37966), Maraba, Pará, Brazil. Photograph by A. Whittaker.

MLNS 32334). Las Cruces: 1 (T. A. Parker, MLNS 39304). GUATAMALA: (1). (J. C. Roché, MLNS 59150). BELIZE: (5). Toledo, 5 (T. A. Parker, MLNS 71051, 71076, 71841, 71844, 71848). MEXICO: (1). Chipas: 1 (C. O. B. Hanks, MLNS 95071).

Etymology.—I take great pleasure in naming this species in honor of my good friend Clive D. T. Minton in recognition of his major contribution to our understanding of shorebird biology and their conservation worldwide. Clive was a major influence in teaching me ornithology during my childhood and later became my bird-banding trainer and mentor. His never-ending enthusiasm for the study of birds and their conservation was contagious and has inspired many. The English and Portuguese names call attention to the forest-falcons cryptic plumage, which caused this new species to be overlooked for nearly a century, despite being represented in leading museum collections worldwide.

REMARKS

Systematics.—Since the formation of the genus *Micrastur* (Gray 1841), the systematics of the smaller forms, particularly those inhabiting the Amazon Basin, has been the subject of considerable controversy. Hellmayr (1910) was the first to suggest that there were in fact two small species in the *M. ruficollis* complex, concluding that *M. gilvicollis* was a valid species. He later changed his mind (Hellmayr 1929). After re-examining specimens, Hellmayr and Conover (1949) reverted to treating *M. gilvicollis* as a valid species. Meyer de Schauensee was equally indecisive, first (1966) recognizing *M. gilvicollis* as a valid species, but later (1970) retracting this and considering it conspecific with *M. ruficollis*. Pinto (1935, 1947, 1964), Phelps and Phelps (1958), and Haverschmidt (1968) also treated *M. gilvicollis* as a species separate from *M. ruficollis*. Schwartz (1972) finally presented

conclusive vocal and biometric evidence demonstrating that *M. gilvicollis* was indeed a valid species, sympatric with *M. ruficollis* across much of its range.

Historically, several ornithologists had puzzled over the complex plumage variation in small *Micrastur* forest-falcons, particularly from Brazil. Gyldenstolpe (1945), in reviewing the Olalla collection from the Rio Juruá, Amazonas, Brazil, compared two *M. gilvicollis*, a male (NRM 568421) and a female (NRM 568422), with five other supposed *M. gilvicollis* specimens: a male and female from Aveiro, Pará (NRM 568416–568417), and Casa Nova, Pará (NRM 568418–568419), and one female from Lagoa Baptista, Amazonas (NRM 568420). Gyldenstolpe was especially puzzled by NRM 568416, noting its remarkable plumage and its exceptionally small size, particularly its short (134 mm) tail. Gyldenstolpe concluded a correct understanding could be reached only by examination of a very large series from all parts of their range. I conclude after studying photographs and measurements of the NRM specimens (G. Frisk pers. comm.) that this puzzling small male *Micrastur* (NRM 568416) is a *M. mintoni* in immature plumage. I also confirm that (NRM 568417) is an adult *M. mintoni*. Gyldenstolpe surely was further confused by this series because *M. gilvicollis* (NRM 568422) is a *M. ruficollis concentricus*.

Neumann (1933) was the first to claim that certain short-tailed individuals from Brazil (Bahia and Pará) with a single tail band were conspecific with *M. plumbeous* of western Ecuador. Hellmayr, in a personal note to Gyldenstolpe, also discussed the possibility of the Pará birds being *M. plumbeous* (G. Frisk pers. comm.). Intent on solving the problem, Hellmayr and Conover (1949) re-examined specimens from the Vienna and Berlin museums, comparing them with the puzzling Aveiros skins (NRM 568416–568417) at the British Museum of Natural History collection, concluding that they occupy an intermediate position between *M. gilvicollis* and *M. plumbeous*. They also noted the existence of other Pará specimens with two tail bands, contradicting the notion that all Pará birds have but a single tail band. This was an oversight, because Pará state extends both north and south of the Amazon; *M. gilvicollis* occurs north of

the Amazon in Pará and only *M. mintoni* occurs south of the Amazon. *M. gilvicollis* occurs in Brazil on the south bank of the Amazon only west of the Rio Madeira in Amazonas, Acre, and extreme western Rondônia.

More recently, the taxonomic status of the short-tailed Pará birds was noted by Amadon (1964), who stated concerning *M. gilvicollis*, “the tail is shorter than any of the other small *Micrastur* (except *M. plumbeous*); and in some cases, especially in Brazilian Amazon, as on the Rio Madeira and Rio Tocantins, the basal of the two tail bars is lacking or is concealed by the upper tail coverts.” Nearly a decade later Schwartz (1972) noted that the addition of material from Brazilian museums increased the overlap in his wing : tail ratios of *M. gilvicollis*. In fact, he had included several specimens that now have been demonstrated to represent *M. mintoni*.

M. plumbeous is found only in the foothill forests of southwestern Colombia and northwestern Ecuador (Ridgely and Greenfield 2001), having an entirely disjunct distribution from that of *M. gilvicollis*. *M. plumbeous* has been found to be sympatric and even syntopic with *M. r. interestes* in both Colombia (P. G. W. Salaman pers. comm.) and Ecuador (R. S. Ridgely pers. comm.). The taxonomic history of *M. plumbeous* is almost as convoluted as that of *M. mintoni*, both having been confused with *M. gilvicollis*. Meyer de Schauensee (1966) suggested that *M. plumbeous* would best be considered a separate species if *M. gilvicollis* were recognized as distinct from *M. ruficollis*, as suggested by Amadon (1964). However subsequent to Schwartz’s (1972) recognition of *M. gilvicollis* as a distinct species, most authors did recognize *M. plumbeous* as a valid species (e.g., Hilty and Brown 1986). Recent work in Colombia has demonstrated unequivocally that *M. plumbeous* is indeed a valid species (P. G. W. Salaman pers. comm.).

Early taxonomists thus had noted several perplexing plumage and morphological features on certain small *Micrastur* specimens, features that included a single broad tail band, shorter tail, and variation in breast markings. However, due to ongoing confusion with the taxonomy of *M. ruficollis* (with which *M. gilvicollis* was still widely regarded as conspecific) and to a lesser degree with *M. plum-*

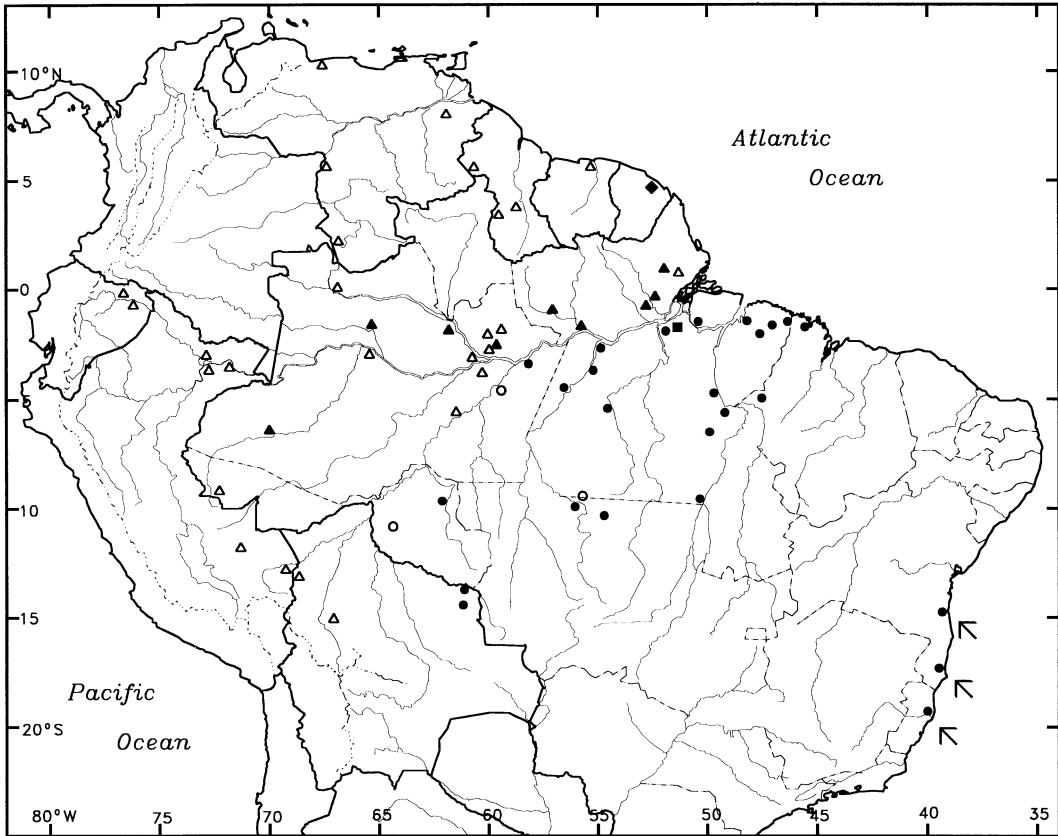


FIG. 6. Distributions of *Micrastur mintoni* sp. nov. and *M. gilvicollis*. All localities are confirmed by specimens or tape recordings examined by the author. (solid square) Type locality of *M. mintoni*, Caxiuanã; (open circles) locality documented by voucher tape recording; (solid circles) locality documented by either a voucher specimen or by both a voucher specimen and tape recording. (solid diamond) Type locality of *M. gilvicollis*, Cayenne, designated by Hellmayr (1910); (open triangles) locality documented by voucher tape recording; (solid triangles) locality documented by either a voucher specimen or by both a voucher specimen and tape recording. Map by M. L. Isler.

beous, no one suspected that an entirely new species was actually involved. They all lacked an important piece of the puzzle that modern field workers have: first hand field experience with these birds and especially their vocalizations. It was the markedly different voice of this new *Micrastur*, combined with my extensive field experience with the vocal repertoires of *M. gilvicollis* and *M. ruficollis* across most of their respective ranges, that initially enabled me to single out this new, cryptic species.

Distribution.—*M. mintoni* is known from southeastern Amazonia, with its range south of the Amazon River and east of the Rio Madeira extending into the Brazilian states of

Amazonas, Pará, and Maranhão south into Mato Grosso and southwest into Rondônia, extending just into adjacent northeastern Bolivia in northern Depto. Santa Cruz. A second range-restricted population is known from eastern Brazil, from southern Bahia into northern Espírito Santo north of the Rio Doce (Fig. 6). *M. mintoni* is found in Amazonian lowlands up to about 600 m, as in Carajas, Pará, Brazil.

Habitat.—Specimens, tape recordings, and observations of *M. mintoni* all are from humid tropical rainforest. Recent observations indicate that the principal habitat for *M. mintoni* is *terra firme* forest. This forest type is characterized by a high diversity in tree species,

tall canopy with height of about 30–35 m with occasional emergents, and a dense understory with many palms, vines, and epiphytic plant species. The *terra firme* forest in Noel Kempff Mercado National Park, Bolivia, differs from the forests farther east in having lower tree diversity and being almost devoid of epiphytes (this presumably due to lower annual precipitation and greater temperature variation). *M. mintoni* also frequents seasonally flooded forests with two Brazilian sight records, one from Pará and the other from Rondônia, and a specimen from Bolivia. Both Brazilian records were of single birds in low stature (15–20 m) seasonally flooded *igapo* forest (black water flooded forest). In Depto. Santa Cruz, Bolivia, LSUMZ 136812 was collected in *varzea* (white water flooded forest) with much bamboo in the understory.

Vocalizations.—Territorial displays of many Neotropical forest raptors involve soaring above the forest proclaiming their territorial presence by vocalizing, often combined with a flight display. *Micrastur* spp., on the other hand, never soar (Thorstrom et al. 2000a); vocal activity within the forest is their only means of long range communication to conspecifics. Thus, voice probably is important in species recognition in this genus. All *Micrastur* species have evolved a distinctive species specific repertoire, which includes three main vocal types, which I describe as follows. (1) The “territorial advertising song” is the most commonly heard vocalization in all *Micrastur* species and therefore the most well known. (2) The “excited cackling call” is the second most commonly heard vocalization, regularly heard in response to tape playback. This vocalization is quite similar among species, especially between *M. gilvicollis* and *M. r. concentricus*. (3) The “quacking song” is heard mostly from one of a pair during a duet (rarely heard in the field); however, sometimes one bird or one of a pair responds using this voice to tape playback. The complex vocal repertoire found within each species of *Micrastur* has led to great confusion in voice identification (Whittaker 2001), which has resulted in many errors in identification of *Micrastur* specimens to species level.

Peak vocal activity for *M. mintoni*, as for all other *Micrastur* species (Thorstrom 1993, Klein and Bierregaard 1988, Whittaker 2001),

is 20–30 min prior to dawn. A less important peak occurs just before dusk; the species is seldom heard at other times of the day. Long range communication in diurnal birds typically is concentrated in the early morning (Hawwood and Fabrik 1979). *Micrastur* species are among the first birds to be heard in the morning in any Neotropical forest because their series of low frequency notes is ideal for traveling long distances through these dense forests at this time, when background noises are at a minimum. Vocal activity may be weather dependent, with reduced vocal activity associated with overcast conditions (pers. obs.). Seasonal variation in vocal activity has not been quantified; I have noted seasonal changes in *M. gilvicollis*, i.e., periods of intensified vocal activity at the onset of the rainy season (presumed to be their early breeding season).

I include herein a description of all known vocalizations of *M. mintoni*, as well as spectrograms of the other three small *Micrastur* species. The territorial advertising song (Figs. 7A, 8A–8D, 9A, 10A–10B) is the most commonly heard vocalization of *M. mintoni*. This song consists of single low-pitched notes repeated at about 1 note per second, “UK, UK, UK, UK, . . .,” with each note “swallowed.” The repetitions may continue for an extended period, with a short gap of 3–5 s between song bouts. The number of “UK” notes varies individually, in some bouts as many as 273 notes and lasting about 2.5 min. Typical bouts include 120–150 notes and last from 1–1.5 min. Short song bouts, however, may include as few as 18 notes. This song is most frequently heard from a single bird vocalizing during pre-dawn. The initial song bout usually starts at a low volume, increasing gradually, until the typical volume is achieved. At a distance this song could be confused with those of certain frogs. Occasionally I have heard the territorial advertising song as an antiphonal duet (Fig. 7F), during which the pair remains widely separated. During such duets, I have noted slight differences in pitch in the “UK” notes; the slightly higher-pitched bird presumably is the smaller male (Fig. 10A; see female in Fig. 10B).

The excited cackling call (Fig. 7B) is a series of short, fast, cackled “CA” notes that speed up and sound like a bouncing object going downscale, “CA, CA, CA, CA-CA-

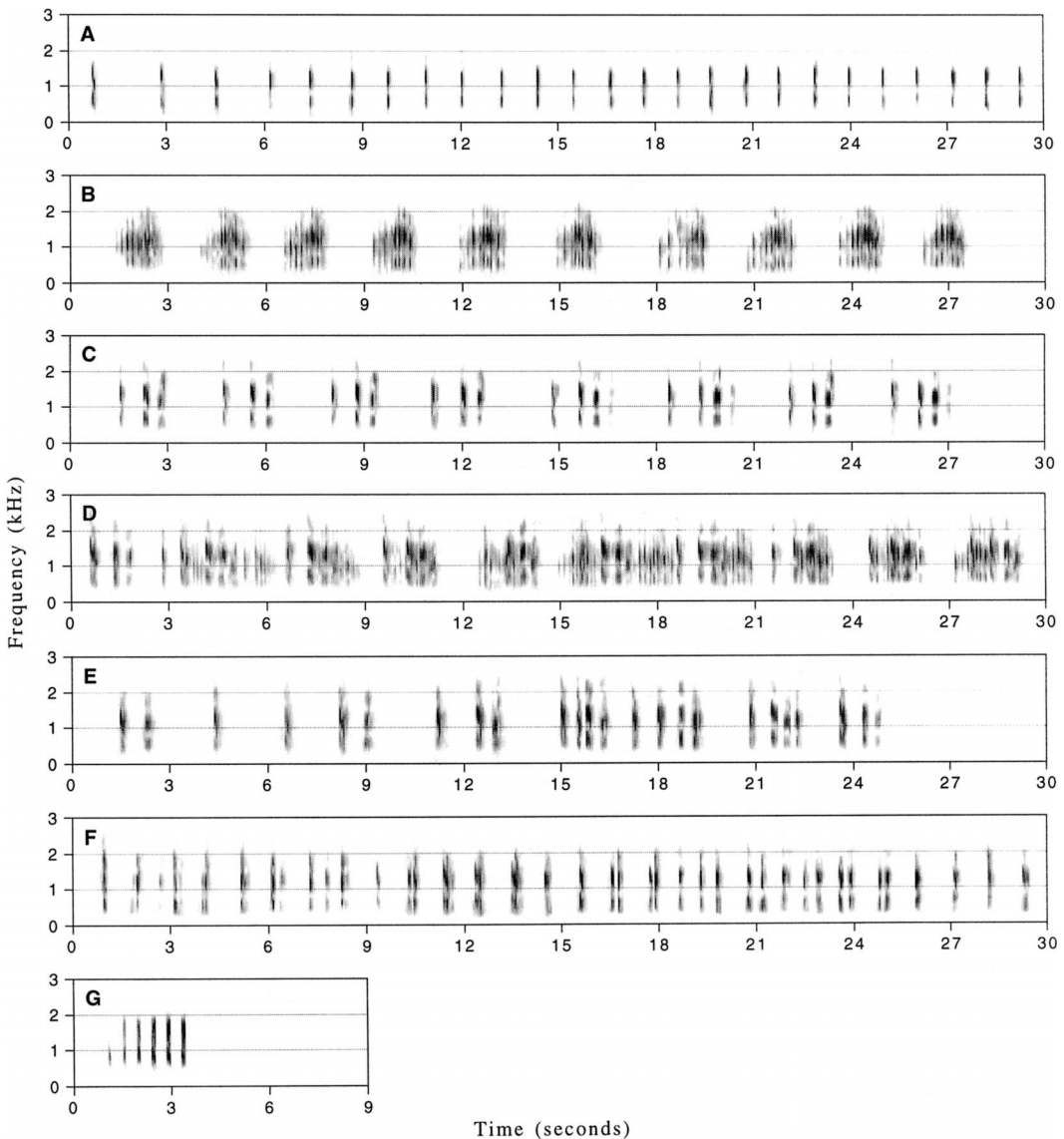


FIG. 7. Vocalizations of *Micrastur mintoni*. Recordings are by the author except as noted. (A) Territorial advertising song, Caxiuanã, Pará, Brazil, 29 October 1997, MLNS 10704. (B) Excited cackling call from the holotype (MPEG 54489), Caxiuanã, Pará, Brazil, 2 August 1999, MLNS 107102. (C) Quacking song, Alta Floresta, Mato Grosso, Brazil, 10 September 1999, MLNS 107107. (D) Duet, in which one bird begins with quacking song and mate responds with excited cackling calls; Caxiuanã, Pará, Brazil, 2 August 1999, MLNS 107102. (E) Territorial duet, including the holotype (MPEG 54849), showing both birds using quacking song, but with a different number of notes; Caxiuanã, Pará, Brazil, 2 August 1999, MLNS 107102. (F) Antiphonal duet of pair singing territorial advertising song; Alta Floresta, Mato Grosso, Brazil, 24 August 1991 (to be archived at MLNS); recorded by Kevin Zimmer. (G) Unusual response to tape playback of a territorial advertising song, Rio Cristalino, Alta Floresta, Mato Grosso, Brazil, 19 October 1997, MLNS 88529; recorded by C. A. Marantz. Spectrograms by P. R. Isler.

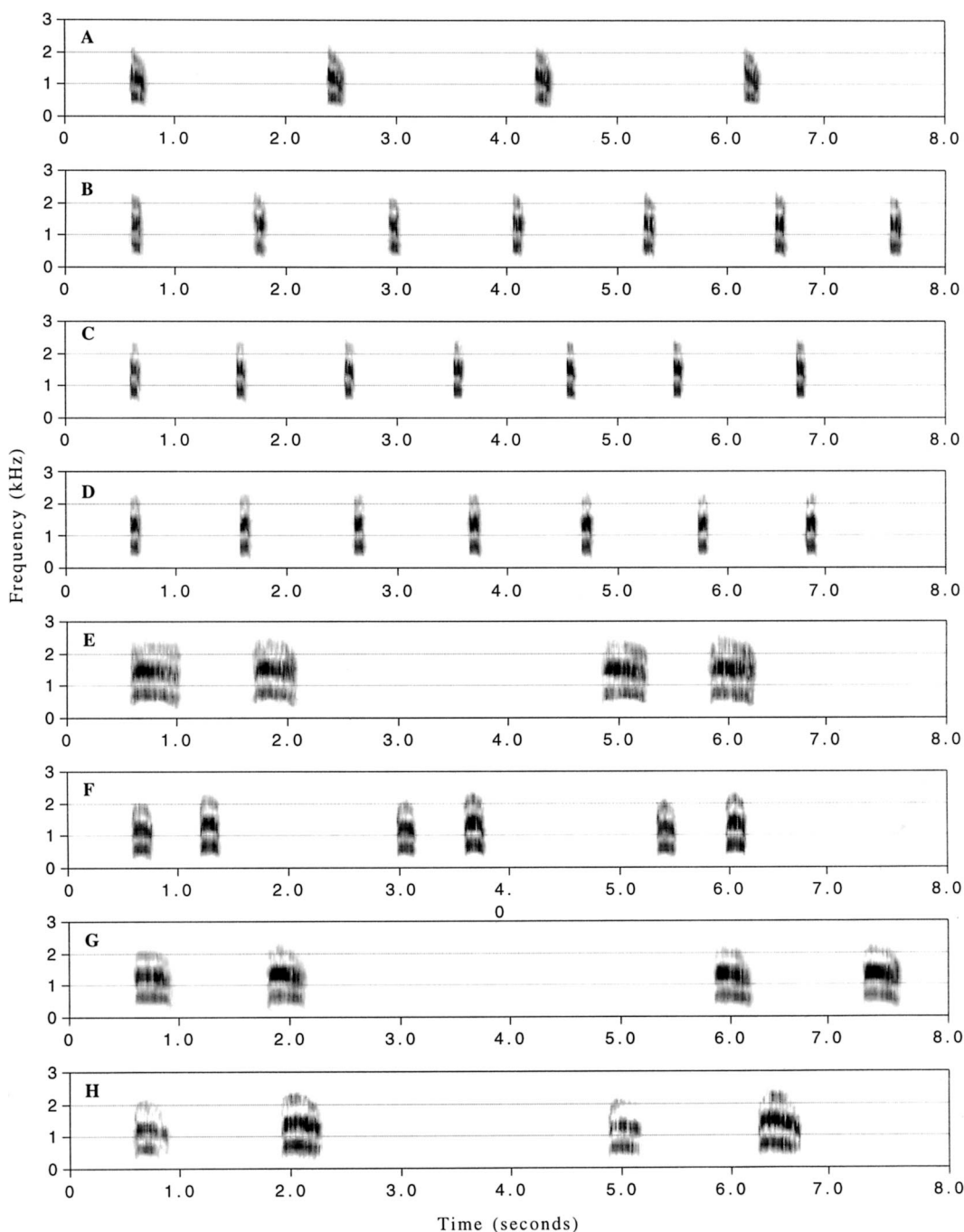


FIG. 8. Territorial advertising songs of *Micrastur mintoni* and *M. gilvicollis* from geographically widespread localities. Recordings are by the author except as noted. (A–D) *M. mintoni*. (A) One of the pair of the holotype (MPEG 54849), Caxiuanã, Pará, Brazil, 2 August 1999, MLNS 107102. (B) Alta Foresta, Mato Grosso, Brazil, 11 September 1999, MLNS 107105. (C) Parque Nacional da Amazônia, Pará, Brazil, 7 June 2000, MLNS 17106. (D) Parque Nacional Noel Kempff Mercado, Depto. Santa Cruz, Bolivia, 17 July 2000, MLNS 17108. (E–H) *M. gilvicollis*. (E) Maipaima Creek Rupununi, Guyana, 5 February 1993, MLNS 70021; recorded by T. A. Parker. (F) Aceer, Dept. Loreto, Peru, 19 April 1999, MLNS 10721. (G) Tambopata, Dept. Madre de Dios, Peru, 17 June 1982, MLNS 29439; recorded by T. A. Parker. (H) Careiro do Castanho, Amazonas, Brazil, 3 December 2000, MLNS 107109. Spectrograms by P. R. Isler.

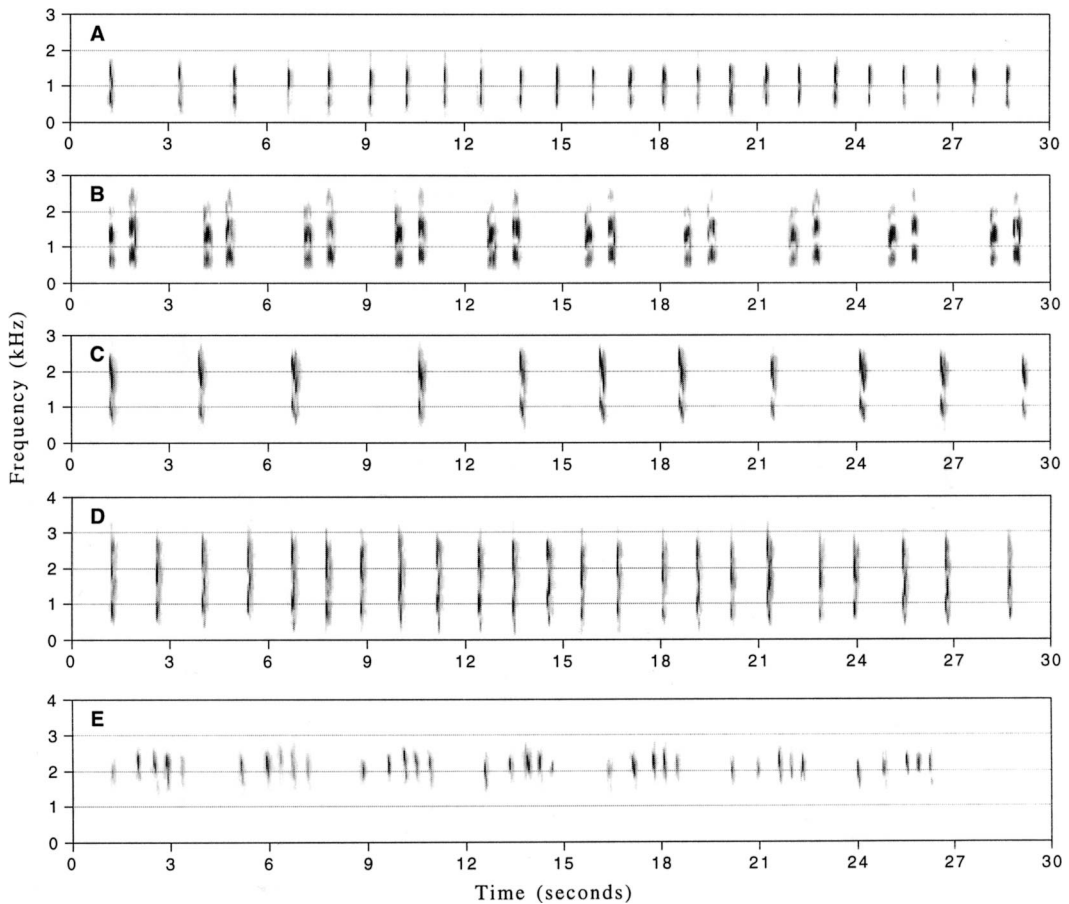


FIG. 9. Territorial advertising songs of all small *Micrastur* species. Recordings by the author except as noted. (A) *M. mintoni*, Caxiuanã, Pará, Brazil, 29 October 1997, MLNS 107104. (B) *M. gilvicollis*, Balbina, Amazonas, Brazil, 19 December 1999, MLNS 107111. (C) *M. r. concentricus*, Rio Cristalino, Mato Grosso, Brazil, 14 September 1998, MLNS 107112. (D) *M. r. ruficollis*, Parque Nacional do Itatiaia, Rio de Janeiro, Brazil, 23 October 1999, MLNS 107113. (E) *M. plumbeous*, Narino, Colombia; recorded by P. G. W. Salaman. Spectrograms by P. R. Isler.

CA'CA'CA'....” These calls are repeated every 1–2 s, and calling bouts last from 45 to >60 s. The first four notes are emitted rapidly, and the following notes given even faster, with the last few notes decreasing slightly in speed. One variation to this pattern was a bird adding six deep “UR” notes before resuming a typical excited cackling call.

The quacking song (Fig. 7C) consists of a series of three loud, lamenting notes, “UUK, QUI, QUA” that lasts about 1.5 s and gradually progresses to a four-note “UUK, QUI, QUA-QUA,” which lasts about 2 s. These series of notes are repeated every 1.5–2 s during 1.0- to 1.5-min song bouts. Toward the end of

long song bouts a bird sometimes reverts back to three notes. Agitated birds responding to tape playback may add an initial 1–2 more emphatic “UUK” notes to the sequence, giving 5–6 notes (Fig. 7E). Once I recorded an unusual two-note “QUI, QU” call repeated 18 times during 30 s before the bird reverted to the typical quacking song.

The territorial duet of a pair (mostly heard in response to tape playback) begins when the first bird to approach utters the excited cackling call, often beginning by calling very quietly before gaining in volume. The mate then joins in with a territorial advertising song, often from a distance, although later it usually

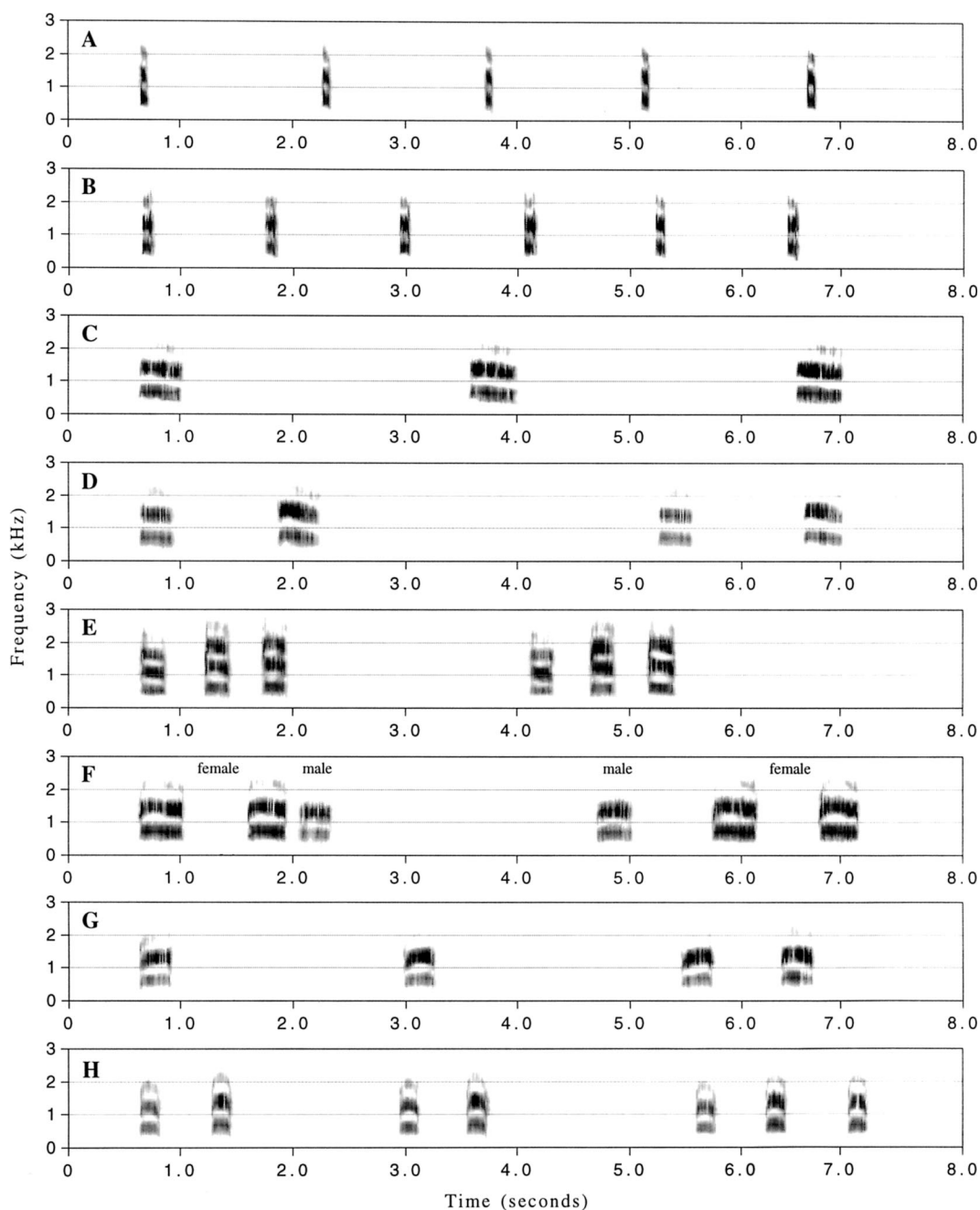


FIG. 10. Territorial advertising songs of *Micrastur mintoni*, showing sexual variation, and *M. gilvicollis*, showing variation in the number of notes. All recordings are by the author. (A–B) *M. mintoni*. (A) Territorial advertising song of a presumed male, Alta Floresta, Mato Grosso, Brazil, 11 September 1999, MLNS 107114. (B) Territorial advertising song of a presumed female, Alta Floresta, Mato Grosso, Brazil, 11 September 1999, MLNS 107115. (C–H) *M. gilvicollis*. (C) One-note song, São Gabriel do Cachoiera, Amazonas, Brazil, 11 August 1999, MLNS 107116. (D) Two-note song, São Gabriel do Cachoeira, Amazonas, Brazil, 11 August 1999, MLNS 107117. (E) Three-note song, Uara, Rio Solimoes, Amazonas, Brazil, 8 September 1992, MLNS 107118. (F) One- and two-note song duet, Balbina, Amazonas, Brazil, 19 December 99, MLNS 107119. (G) One-note changing to two-note song, Balbina, Amazonas, Brazil, 19 December 1999, MLNS 17120. (H) Two-note changing to three-note song, Aceer, Lorento, Peru, 19 April 1999, MLNS 107121. Spectrograms by P. R. Isler.

approaches. Then one member of the pair switches to a typical quacking song and its mate then follows with the excited cackling call, the two alternating forming a rhythmic duet (Fig. 7D).

An unusual series of quiet, guttural, frog-like croaks (MLNS 88529, 88530; Fig. 7G) in response to tape playback of a territorial advertising song was recorded by C. A. Marantz. Another unusual voice in response to tape playback (not shown by sonogram) was a short series of 3–5 “hoo” calls between the excited cackling calls; this sounded very similar to a call of *Tigrisoma lineatum* (Rufescent Tiger-Heron).

There is no known tape recording of the disjunct population of *M. mintoni* from the Atlantic rainforests of eastern Brazil. During an intensive two-day search using tape playback during peak vocal activity (pre-dawn and predusk) in Espírito Santo in April 2000, I surveyed about 15 km of trail in humid lowland Atlantic rainforest at Linhares CVRD reserve and failed to encounter the species.

For comparison with *M. mintoni*, I present *M. gilvicollis* territorial advertising song (the most commonly heard voice), consisting of a loud, lamenting, two-note bark (Figs. 8E–8H, 9B, 10D). This two-note song is repeated regularly at intervals of generally 3–5 s for several minutes. Two variants of the main two-note pattern are heard regularly. (1) The song can be initiated as repeated single note every 2–4 s during early pre-dawn (Fig. 10C), later changing into the typical two-note song (Fig. 10G). (2) The two-note song can progress to a three-note song towards the end of song bouts (Fig. 10H).

A comparison of 42 different *M. mintoni* recordings with 76 *M. gilvicollis* (from a wide geographical distribution) confirmed that *M. mintoni* showed a consistent diagnostic difference in all its vocal types from *M. gilvicollis*. Furthermore, no geographical variation in voice was apparent in either of these two species (Fig. 8). The sonograms of the other congeners, *M. r. concentricus* (Fig. 9C), *M. r. ruficollis* (Fig. 9D), and *M. plumbeous* (Fig. 9E), also demonstrate their strong vocal differences from *M. mintoni*. However, I did find a consistent strong vocal difference between nominate *M. r. ruficollis* and *M. r. concentricus*

(Fig. 9C, 9D) and suggest that this complex warrants further taxonomic research.

Because voice is taxonomically informative, I conclude that *M. mintoni* is a valid species because of subtle but consistently distinctive morphology, diagnostic voice (see Fig. 11), and parapatric distribution from the cryptically similar *M. gilvicollis*.

Systematics.—Comparison of vocal similarities in sibling species has been used effectively to demonstrate species limits (Isler et al. 1997, Krabbe and Schulenberg 1997). The territorial advertising song of *M. plumbeous* is a repeated series of five notes (Fig. 9E) that sounds very similar to the quacking song of *M. mintoni* (Fig. 8E); further vocal comparison was not possible due to the very small vocal sample of *M. plumbeous*. However, this vocal similarity, combined with several shared plumage characters (shorter tail, distinctive single broad central tail bar of adults), leads me to predict that the closest species to *M. mintoni* may be the geographically distant *M. plumbeous*.

Behavior and ecology.—*M. mintoni* is an inconspicuous and elusive forest dependent raptor. Consequently, almost nothing is known of its natural history. Although the species is a year round resident of Neotropical rainforest, the structure of the forests and the bird's secretive and shy nature makes field observations of this *Micrastur* extremely difficult. Birds rarely were observed by chance. I did observe a bird perched on a bare branch 30 m high in the canopy of *terra firme* forest at Arequimes, Rondônia, Brazil, on 28 January 1995 at 15:00. I presumed it was drying out in the afternoon sun because it had rained hard since dawn, stopping only about 30 min earlier.

On another occasion at 12:50 on 8 July 2002 at Guajara-Mirim, Rondônia, Brazil, in secondary growth bordering virgin *terra firme*, I observed *M. mintoni* attending an army-ant (*Eciton* sp.) swarm. An area of the understory bordering the trail had been recently cleared by farmers; here an adult bird flushed from the floor, landing 2 m high on a horizontal branch above the swarm. The ant swarm was attended by *Rhegmatorhina hoffmannsi* (White-breasted Antbird), *Dendrocicla merula* (White-chinned Woodcreeper), *D. fuliginosa* (Plain-brown Woodcreeper), and

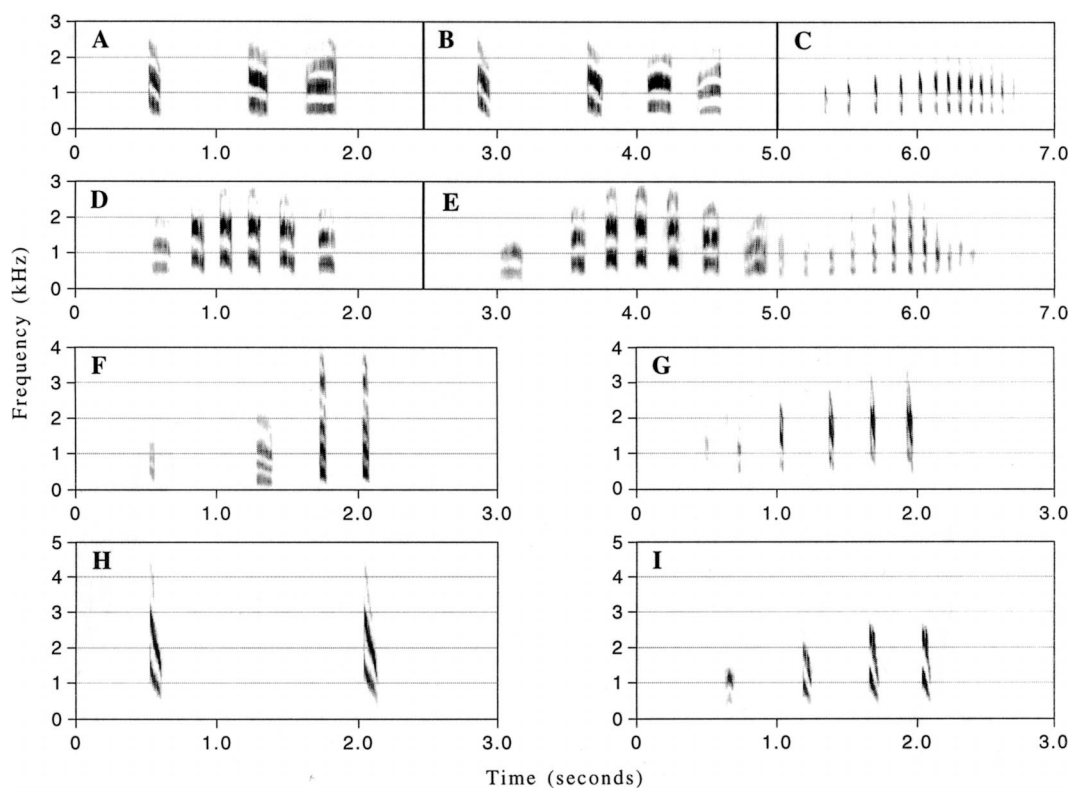


FIG. 11. Comparison of the calls of all small *Micrastur* species. Recordings by author except as noted. (A–C) *M. mintoni*. (A) Three-note quacking song, Alta Floresta, Mato Grosso, Brazil, 10 September 1999, MLNS 107107. (B) Four-note quacking song, Alta Floresta, Mato Grosso, Brazil, 10 September 1999, MLNS 107107. (C) Excited vibrating cackling call from holotype (MPEG 54849), Caxiuanã, Pará, Brazil, 2 August 1999, MLNS 107100. (D–F) *M. gilvicollis*. (D) Excited cackling call, Balbina, Amazonas, Brazil, 19 December 1999, MLNS 107124. (E) Excited cackling call and vibrating cackling call, Balbina, Amazonas, Brazil, 19 December 1999, MLNS 107125. (F) Excited cackling call in response to extended playback, Balbina, Amazonas, Brazil, 19 December 1999, MLNS 07126. (G) *M. plumbeous*. Excited cackling call, Narino, Colombia; recording by P. G. W. Salaman. (H) *M. ruficollis concentricus*. Excited cackling call, Reserva Ducke, Amazonas, Brazil, 6 November 1995, MLNS 10727. (I) *M. r. ruficollis*. Excited cackling call, Parque Nacional de Itatiaia, Rio de Janeiro, Brazil, 23 October 1999, MLNS 107128. Spectrograms by P. R. Isler.

Cnemotriccus fuscatus (Fuscous Flycatcher); none exhibited an apparent response to the raptor's presence. The *Micrastur* still-hunted from its perch above the swarm, occasionally bobbing its head while intently looking down at the forest floor. After about 5 min it flew down diagonally about 15 m, landing on a dead stump 30 cm above the ground. Almost immediately it dropped to the floor and ran quickly out of sight, presumably pursuing a prey item. Ant swarm attendance also is documented for four other *Micrastur* species, including *M. ruficollis*, *M. gilvicollis*, *M. semitorquatus* (Collared Forest-Falcon), and *M. buckleyi* (Buckley's Forest-Falcon), which

were observed feeding on fleeing arthropods and lizards (Willis et al. 1983, Mays 1985, Whittaker 2001).

On 13 September 2000, 10:30, at Rio Cristalino, Alta Floresta, Mato Grosso, Brazil, N. Zeide watched a bird as it flew to a perch 15 m high in the mid story of *terra firme* forest and from there tore at an unidentified prey item held in its talons. A minute later another bird landed within 5 m of the first bird. Moments later they both flew away together, and what sounded like a food-begging call was heard from that direction.

Most observations of *M. mintoni* were obtained by tracking down vocalizing birds; tape

playback of their voice (especially during pre-dawn) greatly increases the chances of encounters. A combination of a ventriloquil quality of their calls and the dense habitat makes it difficult to locate even vocalizing birds. Upon closer approach, birds frequently stop singing, remain silent, then flush from their concealed perch and silently fly away, most often unseen by the observer. Typically in response to playback, a pair of territorial birds will approach, at first silently, usually unseen by the observer, and minutes later start calling. Continued tape playback generally induces one of the pair to approach more closely, often with a direct fast flight through the midstory, with a characteristic *Accipiter*-like flight pattern (a few quick, deep wing beats followed by a short glide). Vocalizing *M. mintoni* perched mostly on large horizontal boughs, often close to a tree trunk, typically 10–20 m high in the midstory. Occasionally, I have found vocal birds lower (3–5 m) in the understory. At dawn and dusk however, they often go higher into the canopy and subcanopy to vocalize.

During singing bouts, *M. mintoni* moves its body, wings, and tail slightly in synchrony with each note. The head also is gently jerked about 10–15° upward from the horizontal as each note is emitted. Individuals do not necessarily remain on the same song perch during song bouts, often moving to new perches in response to vocal neighboring birds or tape playback. On arrival at a perch in response to playback, a bird often would lean forward, craning its head and neck, peering around to locate the intruder. Birds also run agilely for short distances along boughs to a better vantage point or to turn through 180° on a perch in search of the vocal intruder. On one occasion, upon my approach a singing bird hopped to a higher perch where it repeatedly quivered its tail. I also noted this behavior in *M. gilvicollis* in response to tape playback of its voice. Both *M. r. ruficollis* and *M. gilvicollis* may produce audible wing clapping. *M. gilvicollis* on initial take off, and *M. r. ruficollis* during horizontal flight, each produced loud wing claps at a volume similar to some *Columba* spp. during wing-flapping flight displays (pers. obs.).

Until recently little was known about the behavior of any *Micrastur* species because

they are so difficult to locate. However, recent intensive fieldwork in Guatemala by Thorstrom (1993) and Thorstrom et al. (2000a, 2000b) has added greatly to our knowledge. Recent information on the behavior of the other small *Micrastur* may provide some inference about *M. mintoni* behavior. Thorstrom (1993) and Robinson (1994) found that *M. ruficollis* hunts by surprise attacks from low, concealed perches. Robinson (1994) watched a *M. ruficollis* that was perched inconspicuously 2 m above the ground, still-hunting along the edge of a forested clearing, catch two lizards 15–20 cm long. Robinson (1994) also observed the same behavior in *M. gilvicollis*, still-hunting in low understory <10 m high. In Brazil I observed an *M. gilvicollis* still-hunting, perched 2.5 m high in shaded forest understory, searching the forest floor. Klein and Bierregaard (1988) observed four radio-marked *M. gilvicollis* for a total of 67 days north of Manaus, Brazil, and concluded that they perched during the day from 6–8 m high on vines or understory plants. These data are contrary to the hypothesis of Willis et al. (1983) that *M. gilvicollis* was primarily a canopy species. Klein and Bierregaard (1988) found that *M. gilvicollis* typically remained in one area without moving more than 50 m during 1–3 days. Recent field work on the poorly known *M. plumbeous* (P. G. W. Salaman pers. comm.) found that it has two main foraging methods: (1) foraging actively on the ground, running after prey with tail held high, and using their long legs to grasp prey with their feet; and (2) still-hunting from low (usually <2 m high) perches, searching the leaf litter for movement and sound, and then pouncing on prey.

Until recently the diet of the small *Micrastur* species was thought to be birds (Hilty and Brown 1986, Ridgely and Gwynne 1989). However, raptors that prey primarily on very maneuverable prey such as birds tend to be highly sexually dimorphic (Thorstrom et al. 2000a) and also have relatively long toes (Bierregaard 1978). These adaptations are found in the larger *M. semitorquatus*, in which females are 48% larger (Thorstrom et al. 2000a). This is not the case in *M. mintoni*, which exhibits none of these morphological adaptations. I suspect that *M. mintoni* will prove to be a generalist, eating a variety of reptiles and small

invertebrates. The specialized narrow, curved, stiff feathers forming the small ear ruff may be used to improve auditory detection of prey. This feature, combined with their large eyes, perhaps enhances hunting ability using a sit-and-wait strategy from a low perch in the poorly lit understory. Stomach contents of two male *M. mintoni* (MPEG 39332 and MNRJ 1472) each contained a single large unidentified arthropod, and the latter also contained a lizard. These data support the generalist hypothesis.

Research on *M. ruficollis* in Guatemala (Thorstrom et al. 2000a) revealed that of 405 identified prey items, reptiles were predominant (61.5%), followed by birds (22.0%), insects (8.2%), mammals (mostly small rodents; 5.9%), amphibians (2.5%), and snakes (1.1%). Fruit eating behavior was recorded for *M. ruficollis* on two occasions (Thorstrom 1996). No detailed studies have been made on the diet of *M. gilvicollis*; however, stomach contents from MPEG included a grasshopper, a coleopteran, a small lizard, a 2-cm land snail, and a large unidentified arthropod. Robinson (1994) reported cockroach, hylid tree frog, and insect remains in the stomach. Schwartz (1972) reported bird nestlings, arachnids, insects, and lizards as food items in Venezuela. During mist-netting studies in Manaus, *M. gilvicollis* regularly was captured following small passerines into the nets; however, this presumably was opportunistic feeding behavior (pers. obs.). The main food of *M. plumbeous* is lizards (P. G. W. Salaman pers. comm.).

Population and sympatry.—I found *M. mintoni* to be fairly common but easily overlooked, although it occurs at a rather high density, similar to its sibling species *M. gilvicollis* and *M. plumbeous*. I located 3–4 pairs using tape playback experiments during pre-dawn in Depto. Santa Cruz, Bolivia, along a 1,000-m transect in *terra firme* forest. Research in *terra firme* forest in Brazil and Peru (Klein and Bierregaard 1988, Robinson 1994) on *M. gilvicollis* produced estimates of territory sizes for a pair from 20–67 ha and 40–50 ha. Similarly, mean territory size of four radio-marked pairs of *M. plumbeous* in Colombia was 35–40 ha (P. G. W. Salaman pers. comm.). Robinson (1994) stated “generalists searching for small vertebrates and insects from concealed perch-

es tend to be the most abundant diurnal raptors. These raptors exploit lower trophic levels, where more food is likely to be available.”

Several species of *Micrastur* typically are found sympatrically in *terra firme* forest. *M. mintoni* at Caxiuanã was sympatric with *M. ruficollis concentricus*, *M. semitorquatus* and *M. mirandollei* (Slaty-backed Forest-Falcon). I have recorded as many as five species of *Micrastur* occurring sympatrically in *terra firme* in Acre, Brazil (Whittaker 2001). *M. mintoni* was strongly associated with undisturbed *terra firme* forest with dense understory, whereas *M. r. concentricus* seemed to prefer disturbed forest types, both natural secondary growth and man made, including bamboo and more open seasonally drier forest on rocky outcrops.

Breeding and molt.—Direct observation of breeding by *M. mintoni* have not been recorded. Recent information on *M. ruficollis* and *M. semitorquatus* confirmed cavity nesting, and only the females are known to incubate (Mader 1979, Thorstrom et al. 2000a, Thorstrom 2000b). Nest cavities for these two species were located mostly in natural cavities in live trees; however, nesting also occurred in cavities excavated by other animals, and there is one report of *M. ruficollis* nesting in a hole in a cliff (Baker et al. 2000). An adult female *M. mintoni* (MPEG 36072) collected on 4 June showed heavily abraded tips of all rectrices, suggesting that the tail was damaged in a nesting cavity. These data suggest that *M. mintoni* also might be a cavity nester and that the female (MPEG 36072) may well have been in breeding or post breeding condition. Excessive rectrix wear also has been interpreted as indicating cavity breeding in *M. gilvicollis* (Bierregaard 1994). In Guatemala, *M. ruficollis guerrilla*, similar in size to *M. mintoni*, laid two or three eggs; courtship through postjuvenile dispersal lasted 20 weeks, coinciding with the wettest time of the year. I expect that *M. mintoni* also schedules its breeding during the wet season (December to May) when availability of invertebrates and reptiles are highest.

Molt during April to August has been confirmed in *M. mintoni*. An adult female (MPEG 34932) collected on 22 July was molting both primaries and rectrices. Similar tail molt was

recorded from several specimens (MPEG 28090, 48490, 54849) on 22 April, 30 July, and 2 August.

Conservation.—Deforestation is occurring within the range of *M. mintoni* at an alarming rate in southeastern Amazonian Brazil, particularly in the states of Pará, Mato Grosso, and Rondônia. The following national parks, reserves, and indigenous reserves are found within the species' range. Bolivia: Depto. Santa Cruz: Parque Nacional Noel Kempff Mercado. Brazil: Pará: Floresta Nacional de Caxiuanã, Reserva Floresta Gorotiré, Reserva Floresta Mundurucânia, Floresta Nacional do Tapajós; Amazonas: Parque Nacional de Amazônia; Rondônia: Reserva Biológica do Jaru, Parque Nacional de Pacaás Novos, Reserva Biológica do Guaporé; Mato Grosso: Parque Indígena do Xingu. At Caxiuanã, the type locality, the Museu Paraense Emílio Goeldi has established the Estação Científica Ferreira Penna. This reserve is bordered by the Floresta Nacional de Caxiuanã; together they form an important area of preservation of 330,000 ha of primarily *terra firme* rainforest that protects not only this new species but also many other threatened species, such as *Guaruba guarouba* (Golden Parakeet) and other fauna and flora of the Pará center of endemism. I see no apparent threat in the near future to the Amazonian population of *M. mintoni*. However, deforestation is continuously destroying vast tracts of pristine habitat, especially in the Brazilian states of Pará, Mato Grosso, and Rondônia. Many Brazilian parks and reserves are well marked on maps but lack management or protection.

The status of the disjunct population in eastern Brazil is critical, if not already extinct. The Atlantic rainforests have suffered some of the most extensive deforestation of any Neotropical rainforest, with only 5–10% of their original area remaining. The single protected area here is in Bahia, the Parque Nacional de Monte Pascoal. Continued hunting by the indigenous people, and poor management of the reserve, makes the situation precarious. The last record for this population was a bird collected in Rio Jucuruçu, Cachoeira Grande, Bahia, on 20 March 1933, by O. M. O. Pinto. Surveys need to be conducted in eastern Brazil as soon as possible to assess the species' status.

DISCUSSION

During the past decade there have been several remarkable ornithological discoveries of new taxa involving overlooked cryptic species (e.g., Schulenberg and Parker 1997, Whitney et al. 2000, Zimmer et al. 2001). Without exception, the discovery of these new species was first made in the field by voice identification. Subsequent searching of museum collections for the new cryptic species always resulted in confirmation that specimens already were present, but had been previously overlooked or were incorrectly identified. This dramatic discovery of yet another new cryptic species should encourage more critical attention to the possibility of more cryptic species yet undiscovered. A much closer revision of existing material in museum collections of Neotropical birds, and particularly those in the less visited South American museums, is strongly encouraged. A better understanding of our cryptic biodiversity would allow for a more accurate cataloging of global biodiversity and would help in the future conservation of many as yet unknown species.

Greater understanding of Neotropical vocalizations during the past two decades has helped to revolutionize Neotropical ornithology. It is an important tool for taxonomic reevaluation of species limits in many Neotropical groups (Isler et al. 1998), and has led to exciting discoveries of new taxa (e.g., Pierpont and Fitzpatrick 1983; Willis 1992; Bierregaard et al. 1997; Zimmer 1997; Zimmer and Whittaker 2000a, 2000b). This recent focus on the importance of vocal behaviors as taxonomic characters has been especially focused on suboscines species. I predict that vocalizations will prove equally important as taxonomic characters in some nonpasserines, in which vocalizations are innate.

ACKNOWLEDGMENTS

I am indebted to P. G. W. Salaman for his constant help during the preparation of this paper, for sharing his unpublished data on *M. plumbeous*, and for examining *Micrastur* skins in the BNHM. I especially thank K. J. Zimmer, my good friend and field partner, from whom I have learned so much and who has added many valuable ideas to this manuscript. I thank M. L. Isler and P. R. Isler for preparing the maps and spectrograms. I thank P. Greenfield for the skillfully painted frontispiece. I thank D. C. P. Neto for his help during our collecting expedition and his fine preparation of

the type specimen. I am thankful to R. S. Ridgely and S. L. Hilty, who inspired my love of the Neotropics and provided many helpful comments on this manuscript. I also thank J. V. Remsen and two anonymous reviewers for their many helpful comments on improving early drafts of the manuscript. I thank V. Emanuel of Victor Emanuel Nature Tours for traveling opportunities that made much of this research possible. I am grateful to G. Frisk, T. S. Schulenberg, C. Witt, R. O. Bierregaard, Jr., J. F. Pacheco, and R. Thorstrom for helping to locate important references and skins. I thank G. Budney and A. Priori at the MLNS and R. Ranft at the British Library National Sound Archive for allowing access to their collections of *Micrastur* recordings and for copying many tapes for this investigation. I thank all who allowed me to use their tape recordings. The following kindly allowed access to specimens: F. C. Novaes, D. C. Oren, M. Luiza, and M. F. da Lima (MPEG); J. Nascnoviki (MNRJ); M. de Vivo and L. F. Silveira (MZUSP); R. S. Ridgely and N. H. Rice (ANSP); J. V. Remsen and C. Witt (LSUMZ). Finally, to my wife Nadime and my three children Steven, Luana, and Suzana, I offer my gratitude for understanding my absence during time spent on this project. I dedicate this paper to the late Ted Parker for the inspiration he gave to Neotropical ornithologists and birders.

LITERATURE CITED

- AMADON, D. 1964. Taxonomic notes on birds of prey. *Am. Mus. Novit.* 2166:1–26.
- BAKER, A. J., O. A. A. BARRERA, D. F. WHITACRE, AND C. M. WHITE. 2000. First record of a Barred Forest-Falcon (*Micrastur ruficollis*) nesting in a cliff pothole. *Ornitol. Neotrop.* 11:81–82.
- BIERREGAARD, R. O., JR. 1978. Morphological analysis of community structure in birds of prey. Ph.D. diss., Univ. of Pennsylvania, Philadelphia.
- BIERREGAARD, R. O., JR. 1994. Neotropical Falconiformes. Pp. 253–255 in *Handbook of the birds of the world*, vol. 2: New World vultures to guineafowl. Lynx Edicions, Barcelona, Spain.
- BIERREGAARD, R. O., JR., M. COHN-HAFT, AND D. F. STOTZ. 1997. Cryptic biodiversity: an overlooked species and new subspecies of antbird (Aves: Formicariidae) with a revision of *Cercomacra tyrannina* in northeastern South America. *Ornithol. Monogr.* 48:111–128.
- GRAY, G. R. 1841. List of genera of birds of prey 6. British Museum of Natural History, London, United Kingdom.
- GYLDENSTOLPE, N. 1945. Pp. 9–35 in *The bird fauna of Rio Juruá in western Brazil*. Kungl. Sv. Vet. Akademiens Handlingar. Band 22:9–35.
- HANWOOD, K. AND A. FABRIK. 1979. A quantitative analysis of the dawn chorus: temporal selection for communicatory optimization. *Am. Nat.* 114:260–274.
- HAVERSCHMIDT, F. 1968. *Birds of Surinam*. Oliver and Boyd, Edinburgh, United Kingdom.
- HELLMAYR, C. E. 1910. The birds of the Rio Madeira. *Novit. Zool.* 17:257–428.
- HELLMAYR, C. E. 1929. A contribution to the ornithology of northeastern Brazil. *Field. Mus. Nat. Hist. Publ. Zool. Ser.* 12, no. 18 (Publ. 255).
- HELLMAYR, C. E. AND B. CONOVER. 1949. Pp. 249–259 in *Catalogue of birds of the Americas*, part 1, no. 4. *Field. Mus. Nat. Hist. Zool. Ser.* 13:249–259.
- HILTY, S. L. AND W. L. BROWN. 1986. *A guide to the birds of Colombia*. Princeton Univ. Press, Princeton, New Jersey.
- ISLER, M. L., P. R. ISLER, AND B. M. WHITNEY. 1997. Biogeography and systematics of the *Thamnophilus punctatus* (Thamnophilidae) complex. *Ornithol. Monogr.* 48:335–381.
- ISLER, M. L., P. R. ISLER, AND B. M. WHITNEY. 1998. Use of vocalizations to establish species limits in Antbirds (Passeriformes: Thamnophilidae). *Auk* 115:577–590.
- KLEIN, B. C. AND R. O. BIERREGAARD. 1988. Movement and calling behavior of the Lined Forest-Falcon (*Micrastur gilvicolis*) in the Brazilian Amazon. *Condor* 90:497–499.
- KRABBE, N. AND T. S. SCHULENBERG. 1997. Species limits and natural history of *Scytalopus tapaculos* (Rhinocryptidae), with descriptions of Ecuadorian taxa, including three new species. *Ornithol. Monogr.* 48:47–88.
- MADER, W. J. 1979. First nest description for the genus *Micrastur* (forest-falcons). *Condor* 81:320.
- MAYS, N. M. 1985. Ants and foraging behavior of the Collared Forest-Falcon (*Micrastur semitorquatus*). *Wilson Bull.* 97:231–232.
- MEYER DE SCHAUENSEE, R. 1966. The species of birds of South America and their distributions. Livingston, Narberth, Pennsylvania.
- MEYER DE SCHAUENSEE, R. 1970. *A guide to the birds of South America*. Livingston, Wynnewood, Pennsylvania.
- NEUMANN, V. O. 1933. Ueber einige Brasilianische Vogel. *Orni. Gesellschaft.* 1:181–191.
- PHELPS, W. H. AND W. H. PHELPS, JR. 1958. Lista de las aves de Venezuela con su distribución, 1: passeriformes. *Bol. Soc. Venezolana Cienc. Nat.* 19:1–90.
- PIERPONT, N. AND F. W. FITZPATRICK. 1983. Specific status and behavior of *Cymbilaimus sanctaemariae*, the Bamboo Antshrike, from southwestern Amazonia. *Auk* 100:645–652.
- PINTO, O. 1935. Aves da Bahia. *Revista. Mus. Paulista* 19:1–326.
- PINTO, O. 1947. Contribuição à ornitologia do Baixo Amazonas: arquivos de zoologia do Estado de São Paulo. *Vartigo* 6:322–328.
- PINTO, O. 1964. *Ornitologia Brasileira*, vol. 1: *Reidae a Cuculidae*. Dept. Zool. Secret. Agric., São Paulo, Brazil.
- RIDGELY, R. S. AND P. GREENFIELD. 2001. *The birds of Ecuador: status, distribution and taxonomy*. Cornell Univ. Press, Ithaca, New York.
- RIDGELY, R. S. AND J. A. GWYNNE, JR. 1989. *A guide*

- to the birds of Panama with Costa Rica, Nicaragua, and Honduras. Princeton Univ. Press, Princeton, New Jersey.
- ROBINSON, S. K. 1994. Habit selection and foraging ecology of raptors in Amazonian Peru. *Biotropica* 26:443–458.
- SCHULENBERG, T. S. AND T. A. PARKER, III. 1997. A new species of Tyrant-Flycatcher (Tyrannidae: *Tolmomyias*) from the western Amazon basin. *Ornithol. Monogr.* 48:723–731.
- SCHWARTZ, P. 1972. *Micrastur gilvicollis*, a valid species sympatric with *M. ruficollis* in Amazonia. *Condor* 74:399–415.
- SMITHE, F. B. 1975. *Naturalists color guide*. American Museum of Natural History, New York.
- THORSTROM, R. 1993. Breeding ecology of two species of forest-falcon (*Micrastur*) in northeastern Guatemala. M.Sc. thesis, Boise State Univ., Idaho.
- THORSTROM, R. 1996. Fruit-eating behavior of a Barred Forest-Falcon. *J. Raptor Res.* 30:44.
- THORSTROM, R., D. RAMOS, AND D. J. M. CASTILLO. 2000b. Breeding biology and behavior of the Collared Forest-Falcon (*Micrastur semitorquatus*) in Guatemala. *Ornithol. Neotrop.* 11:1–12.
- THORSTROM, R., J. D. RAMOS, AND C. M. MORALES. 2000a. Breeding biology of Barred Forest-Falcons (*Micrastur ruficollis*) in northern Guatemala. *Auk* 117:781–786.
- WHITNEY, B. M., J. F. PACHECO, D. R. C. BUZZETTI, AND R. PARRINI. 2000. Systematic revision and biogeography of the *Herpsilochmus pileatus* complex, with description of a new species from northeastern Brazil. *Auk* 117:869–891.
- WHITTAKER, A. 2001. Notes on the poorly-known Buckley's Forest-Falcon (*Micrastur buckleyi*) including voice, range and first Brazilian records. *Bull. Br. Ornithol. Club* 121:198–207.
- WILLIS, E. O. 1992. Three *Chamaeza* ant thrushes in eastern Brazil (Formicariidae). *Condor* 94:110–116.
- WILLIS, E. O., D. WECHSLER, AND F. G. STILES. 1983. Forest-falcons, hawks, and a pygmy-owl as ant followers. *Rev. Bras. Biol.* 43:23–28.
- ZIMMER, K. J. 1997. Species limits in *Cranioleuca vulpina*. *Ornithol. Monogr.* 48:849–864.
- ZIMMER, K. J. AND A. WHITTAKER. 2000a. Species limits in Pale-tipped Tyrannulets (*Inezia*: Tyrannidae). *Wilson Bull.* 112:51–66.
- ZIMMER, K. J. AND A. WHITTAKER. 2000b. The Rufous Cachalote (Furnariidae: *Pseudoseisura*) is two species. *Condor* 102:409–422.
- ZIMMER, K. J., A. WHITTAKER, AND D. C. OREN. 2001. A cryptic new species of flycatcher (Tyrannidae: *Suiriri*) from the *cerrado* region of central South America. *Auk* 118:57–78.