

## A new species of *Hemitriccus* tody-tyrant from the state of Acre, Brazil

Kevin J. Zimmer<sup>1</sup>, Andrew Whittaker<sup>2</sup>, Carla Haisler Sardelli<sup>3</sup>, Edson Guilherme<sup>4</sup>, and Alexandre Aleixo<sup>2</sup>

On 6 September 2009, while conducting field surveys of birds just east of the town of Assis Brasil (242m), in the Brazilian state of Acre, KJZ and AW discovered a tody-tyrant, apparently of the genus *Hemitriccus*<sup>5</sup>, that did not conform vocally or morphologically to any species in their collective field experience. Realizing that we were likely dealing with an undescribed taxon, we attempted to obtain as many audio recordings, photographs, and data as possible over the course of the following four days. Almost from the beginning of our investigation, the one unresolved question in our minds revolved around the possibility that the Acre *Hemitriccus* could be referable to a previously unknown population of the Yungas Tody-Tyrant (*H. spodiops*), a species considered endemic to middle elevation (800–2450 m), humid forest-edge in Bolivia and the upper Río Inambari drainage in Peru (Cohn-Haft 1996, Schulenberg *et al.* 2007), and the only known species of *Hemitriccus* or *Lophotriccus* with which we had no field experience. AW, AA and EG returned to Assis Brasil between 28 February and 1 March 2010, when the first specimen and more recordings were obtained. Later, on 13 and 14 June 2012, AA and EG returned to the same site, collecting and recording the vocalizations of two additional specimens. Subsequent DNA-based phylogenetic analysis, combined with quantitative vocal analysis and morphological comparisons of our collected specimens from Acre with those of *H. spodiops*, revealing significant differences in several characters, have convinced us that this population of tody-tyrants from the vicinity of Assis Brasil represents a previously unknown species best placed in the subgenus *Snethlagea* of the Tyrannid genus *Hemitriccus*. We propose to name it:

### *Hemitriccus cohnhafti*

Acre Tody-Tyrant



**Holotype.**—MPEG 74531, skin, adult male; skull 100% ossified; no bursa of Fabricius; left testis 4 × 2 mm; trace fat; 9 g; no molt; carcass preserved in 70% ethyl alcohol under field number AB 001. Collected (shot) and tape-recorded in the sub-canopy of disturbed transitional forest (ca. 500 m away from the Acre River) by AA on 13 June 2012 at Estrada da Pedreira (10°56'34.5"S; 69°28'04.5"W), ca. 10 km E. of Assis Brasil, Acre, Brazil; prepared by Elton Pinho under field number AB 001. Pectoral muscle tissue preserved in approximately 96% alcohol; field number AB 001. Hologenotype (Chakrabarty 2010) sequences of the mitochondrial gene cytochrome *b* (1026 bp) deposited in GenBank (accession number KC874905). Recordings of vocalizations archived at the Macaulay Library of Natural Sounds under accession number 169986 (available at <http://macaulaylibrary.org/>). Digital pictures of the recently collected individual, before preparation, deposited at UFAC and MPEG.

**Diagnosis: Morphology.**—A small Tyrant Flycatcher, on general morphology and plumage characters obviously being a species of “tody-tyrant.” Assigned to the subgenus *Snethlagea* of *Hemitriccus* on the basis of its bill morphology and nostril shape (Fitzpatrick 1976, Cohn-Haft 1996), and further sepa-

rated from species of the genus *Lophotriccus* by the absence of a noticeable crest formed by elongated crown and nape feathers. Distinguished from all congeners except *H. minor* and *H. spodiops* by its large, round and exposed nostrils, and by the arched culmen. Further distinguished from all known populations of *H. minor* by the distinctive buff-colored feathering of the loreal and supraloral region, and the more distinctive wing-bars. Most similar in overall appearance to *H. spodiops*, with which it shares the plumage characters of having greenish upperparts, dark streaks on the crown, buff in the face and noticeable dark streaking on the otherwise pale throat. *H. spodiops* differs from *H. cohnhafti* in having noticeably longer crown feathers, imparting a more crested appearance; in having the ground-color of the crown feathers contrastingly brownish compared to the somewhat brighter green mantle (versus ground-color of the crown being essentially concolor with the darker and duller olive back in *H. cohnhafti*); and in having indistinct wingbars, lacking any obvious pale panel in the folded wing, and having the secondaries edged yellowish-green. By contrast, *H. cohnhafti* has two distinct, somewhat bronzy wing bars, and a pale panel, formed by bronzy edges to the secondaries, apparent in the folded wing. *H. spodiops* also has

<sup>1</sup> Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, CA 90007, USA. (kjzimmer@charter.net)

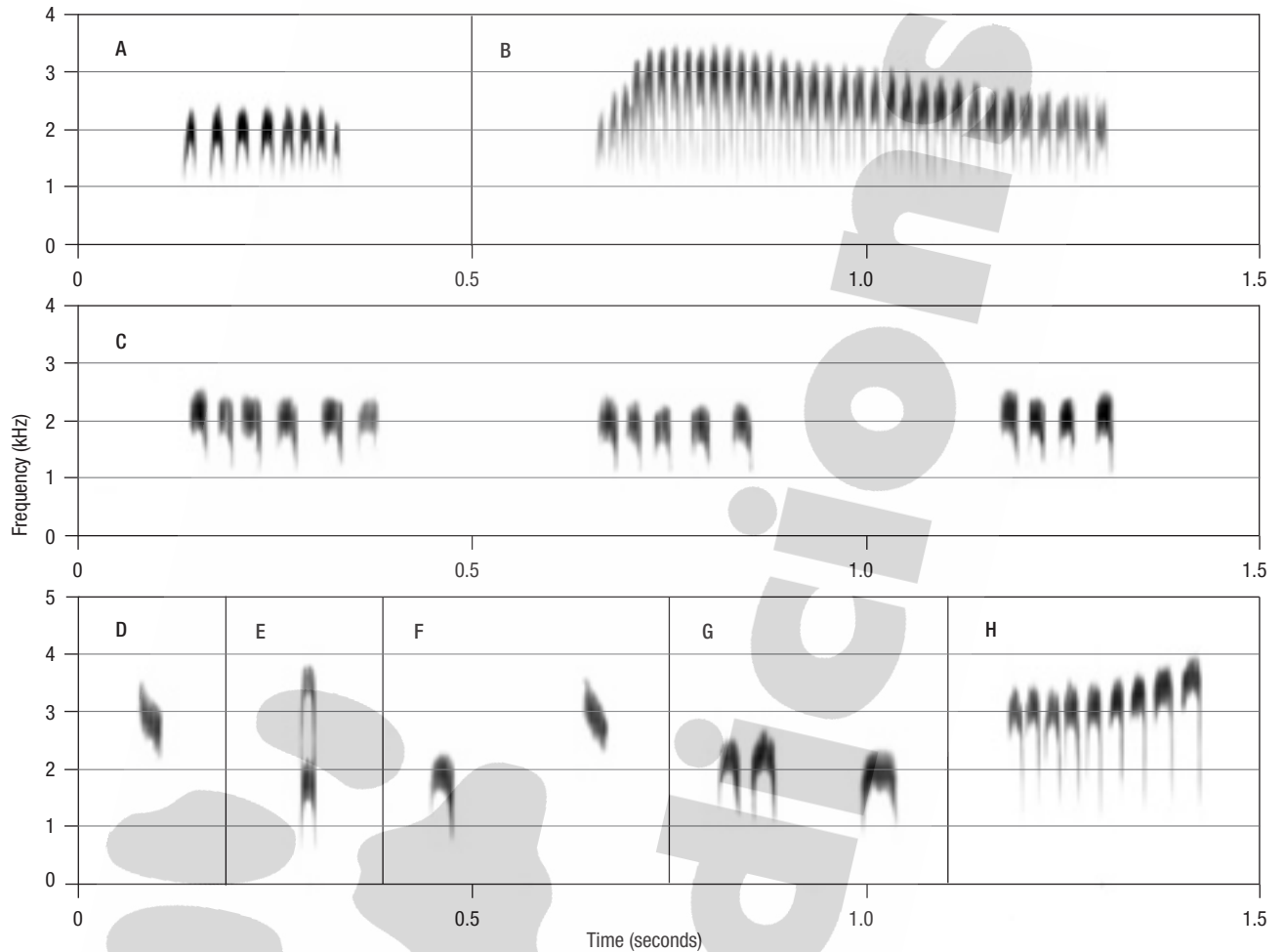
<sup>2</sup> Coordenação de Zoologia, Museu Paraense Emílio Goeldi, Caixa Postal 399, CEP 66040-170, Belém, Pará, Brazil

<sup>3</sup> Laboratório de Biologia Molecular, Museu Paraense Emílio Goeldi, Belém, Pará, Brazil

<sup>4</sup> Universidade Federal do Acre, Museu Universitário, Laboratório de Ornitologia. Campus Universitário – BR 364, Km 04, Distrito industrial, Rio Branco – Acre, Brazil

<sup>5</sup> Genus *Hemitriccus* 9: 321.

**Figure 1.**  
 Representative spectrograms of vocalizations of *Hemitriccus cohnhafti* and *H. spodiops*.  
 (A) *H. cohnhafti*, song: K. J. Zimmer, type locality, Acre, Brazil (ML 169983).  
 (B) *H. spodiops*, song: P. A. Hosner, El Beni, Bolivia (ML 132736). (C) *H. cohnhafti*, song burst: K. J. Zimmer, type locality, Acre, Brazil (ML 169985). (D) *H. cohnhafti*, isolated “keek” call: K. J. Zimmer, type locality, Acre, Brazil (ML 169985). (E) *H. cohnhafti*, isolated “kup” call: K. J. Zimmer, type locality, Acre, Brazil (ML 169985). (F) *H. cohnhafti*, “kup keek” call: K. J. Zimmer, type locality, Acre, Brazil (ML 169985). (G) *H. spodiops*, “treee-trunk” call: R. A. Rowlett, Cochabamba, Bolivia (ML 85617). (H) *H. spodiops*, “kreep” call: A. B. Hennessey, La Paz, Bolivia (ML 101632).

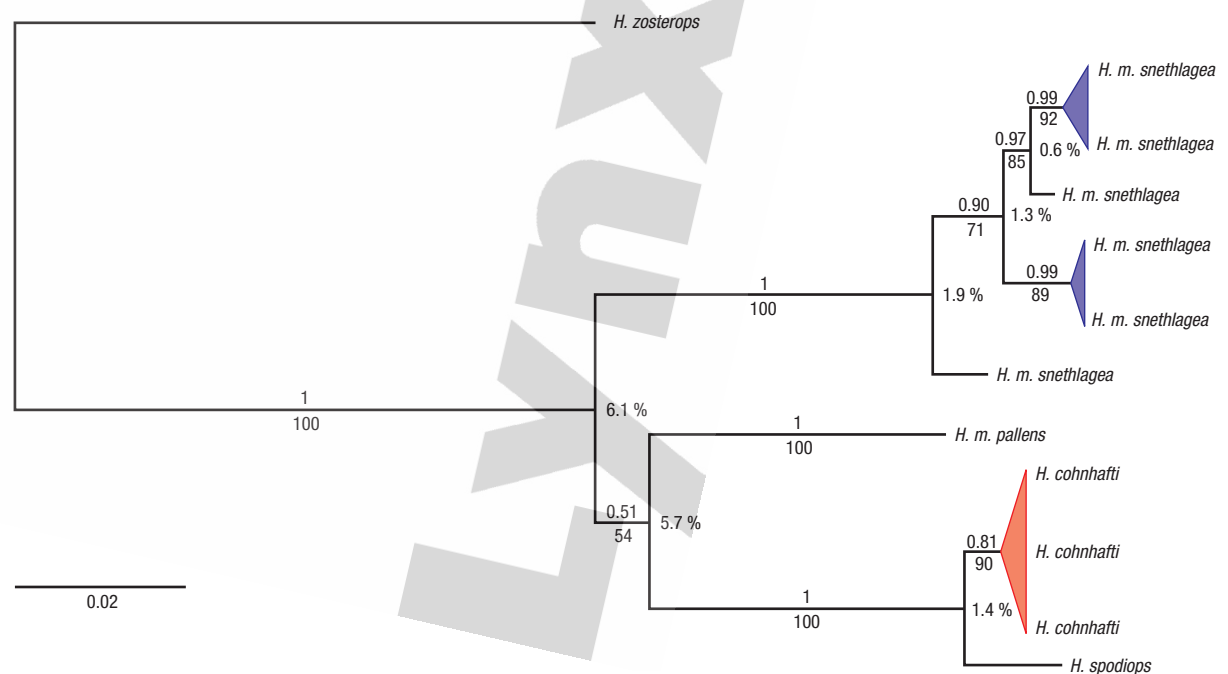


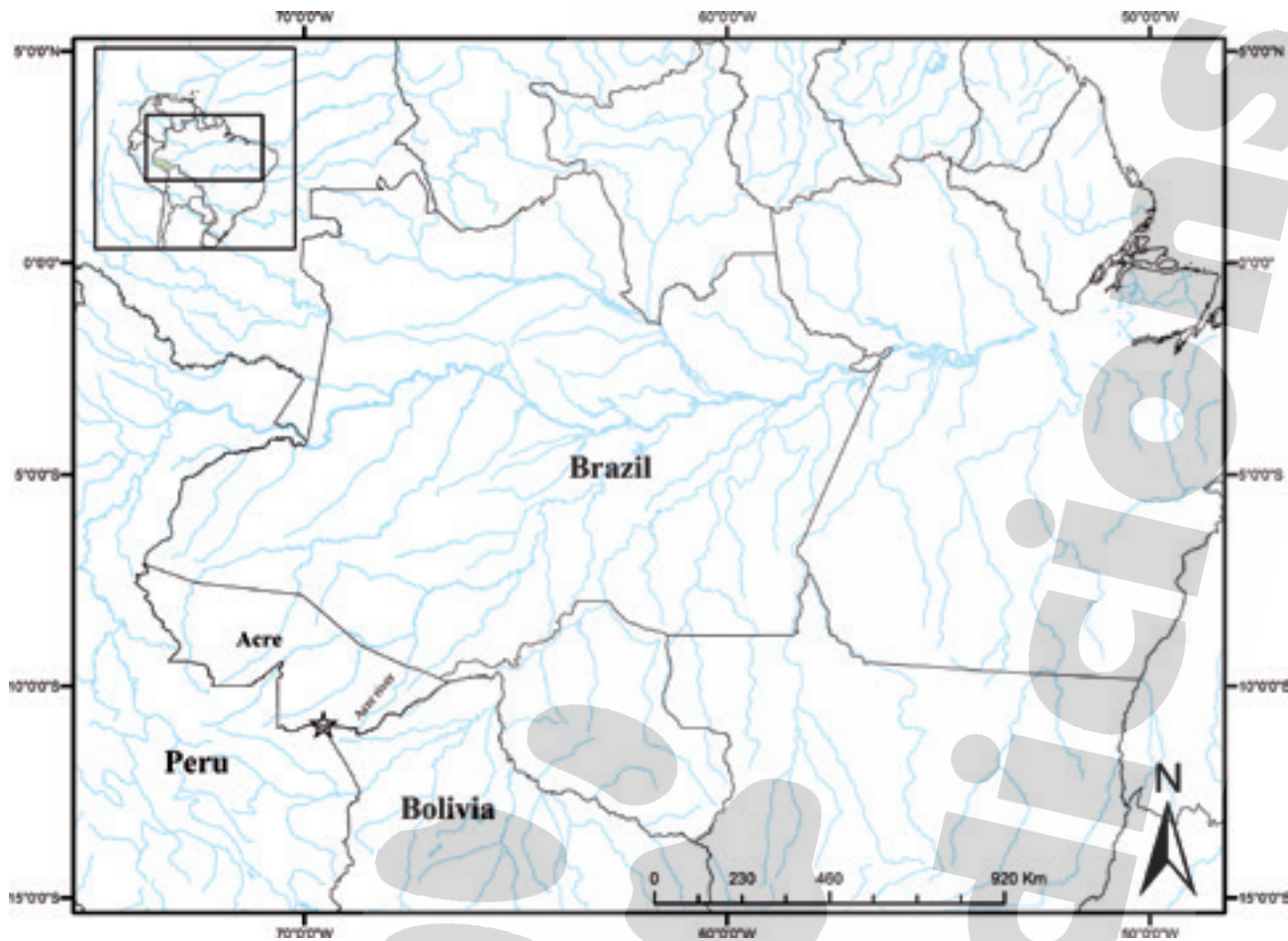
a diffuse brownish tinge to the entire face (most apparent in the auriculars), with a contrasting, narrow, buffy eyering. In *H. cohnhafti*, the buffy coloration is more confined to the loreal and supraloral regions, and contrasts more obviously with the rest of the face. Iris color varies from cream to dark beige to hazel or brownish-orange in both species. **Voice.**— The song differs diagnostically (Isler *et al.* 1998) in duration, number of notes and peak frequency from that of its sister taxon *H. spodiops* (Fig. 1). Vocal analysis revealed four other diagnostic characters of peak frequency pattern distinguishing the songs of the new species from those of *H. spodiops*, and multiple calls

that appear to be unique to one species or the other. **Genetic divergence.**— Separated from its sister-taxon *H. spodiops* by approximately 1.4% sequence divergence in the mitochondrial gene cytochrome *b* (Fig. 2).

**Distribution.**— Known only from the type locality on the Brazil – Bolivia border in the southeastern part of the state of Acre (Fig. 3). The type locality is only 500 m from the Acre River, which marks the border between Brazil and Bolivia in this part of the state. Since the Acre River is only about 100 m wide nearby the type locality, it seems unlikely that it represents a barrier

**Figure 2.**  
 Phylogenetic relationships within the *Snethlagea* subgenus of the genus *Hemitriccus* (*H. minor* spp., *H. spodiops*, and *H. cohnhafti*) recovered by Bayesian analyses based on *cyt b* sequences. Numbers refer to posterior probabilities values and genetic distances (% of average uncorrected p sequence divergence) between sister groups associated with the labeled nodes.





**Figure 3.** Type locality of *Hemitriccus cohnhafti* (star), ca. 10 km east of the municipality of Assis Brasil in southeastern Acre, near the borders of Bolivia (Pando), Brazil, and Peru (Madre de Dios).

to the dispersal of *H. cohnhafti* over time, so the new species almost certainly also occurs in the neighboring Department of Pando in Bolivia. Similarly, the type locality is only about 10 km from the Brazil – Peru border, so we expect that the new species will eventually be found in the Department of Madre de Dios in Peru as well.

**Description of holotype.**— See color illustration. Alphanumeric color designations determined through direct comparison with Smithe (1975). Head and nape greenish olive (color # 49), with crown covered with dark streaks. Face washed tawny (color # 38), particularly in the ear coverts, lores, and around the eyes. Mantle through uppertail coverts uniform parrot green (color # 260). Throat and breast, including some posterior extension to sides, olive green (color # 46), with distinct creamy yellowish streaks. Upper belly and sides concolor with breast. Mid-lower belly through undertail coverts sulphur yellow (color # 57). Primaries and secondaries blackish, with outer vanes edged with yellow (wider in the secondaries), inner vanes narrowly edged whitish. Alula, greater, and lesser wing coverts black but conspicuously edged yellowish-tawny, resulting in two distinct wing bars and a contrasting wing panel, formed by bronzy edges to the secondaries, visible in the folded wing. Underwing coverts sulphur-yellow. Tail worn, with rectrices blackish with dark-greenish inner vanes. **Soft parts in life:** Iris cream; maxilla black; mandible blackish, with a creamy base; tarsi and feet gray. **Measurements of holotype:** Wing length: 50 mm; tail length: 44.1 mm; tarsus length: 14.35 mm; bill length from anterior edge of nares: 7.35 mm; bill width at anterior edge of nares: 4.83 mm; bill depth at anterior edge of nares: 3.78 mm.

**Etymology.**— It is with great pleasure that we name this new species in honor of our friend and colleague, Mario Cohn-Haft, in recognition of his numerous and ongoing contributions to our understanding of the complexities of the marvelous avifauna of Amazonian Brazil. It is particularly fitting given that so much of Mario's research has focused on the biogeography of the Amazon Basin and its influences on the phylogenetic history of and species-limits within the tody-tyrants, particularly those of the genus *Hemitriccus*. That Mario was the one who clarified the validity of, and the characters that define the subgenus *Snethlagea*, to which the new species belongs, makes this recognition all the more appropriate.

The English and Portuguese names reference the Brazilian state where *H. cohnhafti* was discovered, and in which all records, to date, have been made.

#### REMARKS

**Type series.**— Paratypes of *H. cohnhafti* are the following two specimens, both topotypes: MPEG 70053: skin, adult female, ovary  $3 \times 2$  mm with ova minute; carcass preserved in 70% ethyl alcohol under field number ASS 001; collected (shot) on 28 February 2010 by AA in the understory of swampy transitional disturbed forest, and prepared by José Nilton da Silva Santa Brígida; tissue sample deposited at MPEG and mitochondrial cytochrome *b* sequence deposited in GenBank (KC874903). Voice tape-recorded by AW. MPEG 74532: skin, adult male, left testis  $3 \times 2$  mm, not in molt, skull 100% ossified; no bursa; trace fat; carcass preserved in 70% ethyl alcohol under field number AB 002; collected (shot) on 14 June 2012 by AA in the understory of transitional disturbed forest dominated by *Guadua* bamboo, and prepared by Elton Pinho; tissue sample deposited at MPEG and mitochondrial cytochrome *b* sequence deposited in GenBank (KC874904). Recordings of vocalizations archived at the Macaulay Library of Natural Sounds under accession number 169987 (available at <http://macaulaylibrary.org/>). **Variation in the type series:** The type series includes two adult male (MPEG 74531 and 74532) and one adult female specimens (MPEG 70053). The lone female specimen has shorter wings, tail, and tarsi, and appears darker overall than the males, particularly the buffy loreal and supralorel regions. Whether this plumage variation has a sexual or seasonal basis is uncertain, given that only one female specimen is available and that female and male specimens were collected only in late February (rainy season) and mid June (dry season), respectively. Also, the lone female specimen has a distinct dark beige iris contrasting with the pale hazel to creamy color irides of the males. The same range of color variation is present in the specimens of *H. spodiops* examined (see Table 1 in the SI file for a list of specimens examined), with males and females

having beige and creamy color irides alike, hence indicating no sexual dimorphism for this character.

**Ecology and behavior.**— To date, we have found *Hemitriccus cohnhafti* only in second-growth and forest-edge vegetation not far from the rio Acre, a habitat perhaps best described as *capoeira*, a Brazilian term for regenerating scrub (Johns 1991). The forest is clearly second-growth, but is also growing on obviously nutrient-poor, sandy soils. These soils support a stunted, woody vegetation (canopy height of 5–12 m with retained scattered emergent trees) composed of mostly slender-trunked saplings and herbaceous vine-tangled growth. Low-lying areas are poorly drained, with dense patches of aroid plants of the genus *Arum* comprising much of the ground cover. Most of the trees and shrubs in this habitat appeared to be Leguminous, and there are scattered thickets of bamboo, mostly *Guadua* sp. Within this habitat, *Hemitriccus cohnhafti* forages, like many other members of the genus (Fitzpatrick *et al.* 2004), primarily in the understory, and mostly at 0–4 m above the ground (Fig. 4). It appears to take a variety of arthropod prey, which are mostly gleaned from the undersides of live foliage at the apex of upward-directed sallies of less than 1 m. It does not appear to associate with mixed-species flocks of other insectivores, although KJZ and AW did record one instance of a pair that temporarily joined other species in mobbing our audio playback of pygmy-owl (*Glaucidium brasilianum*) calls. At the type locality, the new species was conspicuously absent from taller upland *terra-firme* forest, which was occupied only by the related species *Hemitriccus flammulatus* and *Lophotriccus eulophotes*. Similarly, KJZ and AW did not find *H. cohnhafti* during their brief surveys of nearby seasonally flooded forest bordering the rio Acre.

**Vocalizations.**— Most species of *Hemitriccus* and *Lophotriccus* have various vocalizations consisting of high-pitched “tick” notes (Cohn-Haft 1996; pers.obs.). In some species, these notes are incorporated into songs, the individual notes of which are delivered in such rapid succession as to form a short trill, which may or may not be preceded by one or more introductory notes (Cohn-Haft 1996; pers.obs.). Such trilled songs are particularly characteristic of members of the subgenus *Snethlagea* (currently recognized as consisting of *H. minor* and *H. spodiops*), and of the genus *Lophotriccus* (Cohn-Haft 1996; pers.obs.).

The song of *H. cohnhafti* is a typical trill, usually delivered without introductory notes, and at regular but widely spaced intervals within a given song bout. These songs ( $n = 6$  individuals) differed significantly (following Isler *et al.* 1998, 2007) from those of *H. spodiops* ( $n = 16$  individuals) in being of shorter duration (mean of 0.22 sec for *cohnhafti* versus 0.64 sec for *spodiops*), comprised of fewer notes (mean of 8.1 for *cohnhafti* versus 32.7 for *spodiops*), and in having a much lower peak frequency

(mean of 2.29 kHz for *cohnhafti* versus 2.91 kHz for *spodiops*). The pace of *cohnhafti* songs was also significantly slower than those of *spodiops* (mean of 36.5 notes/sec versus 50.8 respectively), but song pace was not considered a diagnostic character because the ranges of the samples overlapped. Songs of the two species also differed diagnostically in “peak frequency pattern”, which describes how the highest frequencies of individual notes change from one note to the next within a multi-note vocalization. To compare peak frequency patterns, we measured peak frequency of the first, second, fourth, middle and terminal notes of songs. There was no difference between the two species in the peak frequency of either initial or terminal notes of songs, but the peak frequencies of the 4<sup>th</sup> and middle notes were diagnostically higher for *H. spodiops* ( $n = 11$  individuals; means of 2.87 kHz and 2.75 kHz respectively) than for *H. cohnhafti* ( $n = 6$  individuals; means of 2.24 kHz and 2.25 kHz respectively). The mean peak frequency of 2<sup>nd</sup> notes also differed significantly (2.55 kHz for *spodiops* versus 2.24 kHz for *cohnhafti*), but, again, did not meet our definition of a diagnostic character because of overlapping ranges of the two samples. We also examined how the peak frequency changed from the first note to the second ( $= \Delta 1$ ), from the second to the fourth ( $= \Delta 2$ ), from the first note to the highest note ( $= \Delta 3$ ) in the song (regardless of position), and from the highest individual note to the terminal note ( $= \Delta 4$ ). Both  $\Delta 3$  and  $\Delta 4$  were diagnostically lower for *H. cohnhafti* (means of 0.09 kHz and 0.16 kHz respectively) compared to *H. spodiops* (means of 0.81 kHz and 0.82 kHz). Songs of both species begin and end at relatively low peak frequencies, but those of *H. spodiops* rise more steeply at the beginning, peak at a much higher frequency through the middle, and drop more steeply at the end.

Individuals of *H. cohnhafti* occasionally deliver 2–4 (most often 3) songs in very rapid succession, in which the gap between trills is roughly equivalent to the duration of a single trill or less. Such “song bursts” are often given in response to playback, but may also be delivered spontaneously. They are also a regular part of the vocal repertoire of *Poecilatriccus senex* (which may string together 8–10 trills in a single “burst”), at least some populations of *H. minor*, and apparently also of *H. spodiops* (Remsen *et al.* 1982, Cohn-Haft 1996), although there was none present in our inventory of recordings of more than 20 individuals of the latter. One individual of *H. cohnhafti* dramatically altered its song in response to playback, delivering ten much longer trills of 23–38 notes that superficially resembled songs of *H. spodiops*. Spectrographic analysis revealed that these “agonistic songs” were still of significantly shorter duration (mean = 0.47 sec), and lower peak frequency (mean = 2.25 kHz), and delivered at a much faster pace (mean = 64.6 notes/sec) than songs of *H. spodiops*. Agonistic songs containing more than double the normal number of notes and delivered at faster than normal pace are a common response of some species of tody-tyrants to playback, among them *P. senex* and some populations of *H. minor* (KJZ recordings).

Like most tody-tyrants, *H. cohnhafti* has a variety of structurally simple calls, most of which appear to serve as contact signals between mates, or as precursors to more structurally complex vocalizations employed during agonistic encounters with conspecifics. Most of these are single-note “skeep” or “keek” calls (ranging in peak frequency from ca. 2.5 kHz to 3.2 kHz), or lower frequency “kup” calls (mean peak frequency = 1.99 kHz), delivered separately at sporadic intervals, or sometimes strung together in a sputtering series. We identified one stereotyped call ( $n = 15$ ), consisting of a low “kup” note, followed by an average gap of 0.5 sec, and either one or two more closely spaced and much higher frequency (mean peak frequency = 3.11 kHz) “keek” notes (“kup keek” or “kup keek-keek”), that is seemingly unique to *H. cohnhafti*. A possibly homologous call ( $n = 8$ ) of *H. spodiops* sounds like “tree trunk”, and consists of 2–3 very closely spaced (mean = 0.01 sec) low frequency (mean peak frequency = 2.3 kHz) notes (sounding like a single note to the human ear), followed by a larger gap (mean = 0.11 sec) and then a distinctly lower frequency terminal note (mean peak frequency = 2.05 kHz). *H. spodiops* also has a complex “kreereep” call consisting of 9–10 closely spaced notes that ascend incrementally in frequency from one note to the next through the middle of the



**Figure 4.** Acre Tody-Tyrant (*Hemitriccus cohnhafti*) photographed near the type locality, Acre, Brazil, September 2009 by Andrew Whittaker. Note the distinctive buffy loreal region, the dark-centered crown feathers and the bronzy edging to the tertials, all of which are important plumage characters. This individual appeared rather worn, which, along with feather arrangement, accounts for the abraded look of the wing bars. Iris color is individually variable: this individual has brownish-orange irides.

call, and then ascend steeply over the final 2–3 notes. This call sounds very similar to a common vocalization of *Lophotriccus pileatus* (KJZ pers. obs.) and has no analog or homolog that we could identify in our sample of *H. cohnhafti* vocalizations.

**Phylogenetic relationships.**— DNA sequence data for the mitochondrial gene cytochrome *b* (cyt *b*, 1026 bases pairs) were obtained for 10 individuals of *Hemitriccus zosterops*, *H. minor*, *H. spodiops*, and *H. cohnhafti* from 10 locations (see Table 2 in the SI file for a list of specimens sequenced). Trees were rooted in *H. zosterops*, recovered previously as the sister group to the subgenus *Snethlaga* by Cohn-Haft (2000). Phylogenies by maximum-likelihood and Bayesian inference methods (see details in SI) confirmed the genetic differentiation of *H. cohnhafti* and its placement with high statistical support as sister to *H. spodiops* (Fig. 2). These two species, in turn, were found to be sister to *H. minor pallens*, confirming earlier analyses carried out without samples of *H. cohnhafti* (Cohn-Haft 2000, Sardelli 2005). The fact that the phylogenies recovered *H. spodiops* and *H. cohnhafti* as reciprocally monophyletic taxa with strong statistical support (Fig. 2), along with their morphological, vocal, and ecological differentiation, supports their recognition as valid species-level taxa (De Queiroz 2007).

**Conservation.**— Given that *Hemitriccus cohnhafti* occupies at least some second-growth and forest-edge habitats in a fragmented landscape, we can assume that there are no imminent threats to its survival. However, our brief regional surveys failed to locate additional sites other than the type locality, so the species' distribution is seemingly patchy. Anthropogenic habitat modification (particularly clear-cutting for cattle ranching) surrounding the type locality is both extensive and ongoing, and, if *H. cohnhafti* proves to have a geographically tiny range, it is likely to be at some level of risk. For now, its status is best considered *Data deficient*.

**Acknowledgments.**— Our special thanks to Barbara and Earl Doolin for their generous support of the September 2009 trip to Acre that resulted in the discovery of *H. cohnhafti*. We thank the curators and curatorial assistants of the following collections for allowing us to use skins, tissues, and vocal recordings under their care: AMNH, LSUMZ, and MLS. Greg Budney and Tammy Bishop of the Macaulay Library of Natural Sounds provided critical assistance in accessing sound recordings of *H. spodiops* from the ML archives. Several xeno-canto recordists and Mario Cohn-Haft also generously allowed us to analyze recordings from their personal archives. We are grateful to Mort Isler for advice concerning the vocal analysis, and to Phyllis Isler for

kindly preparing the finished spectrograms. Field and laboratory work related to this study was funded through CNPq (“INCT em Biodiversidade e Uso da Terra da Amazônia” # 574008/2008-0, and grants # 474592/2010-3, and 471342/2011-4). AA is supported by a productivity fellowship from CNPq. Hilary Burn painted the illustration.

#### Literature Cited

- Chakrabarty, P. (2010). Genotypes: A concept to help integrate molecular phylogenetics and taxonomy. *Zootaxa* **2632**: 67–68.
- Cohn-Haft, M. (1996). Why the Yungas Tody-Tyrant (*Hemitriccus spodiops*) is a *Snethlaga*, and why it matters. *Auk* **113**: 709–714.
- Cohn-Haft, M. (2000). A case study of Amazonian biogeography: vocal and DNA-sequence variation in *Hemitriccus* flycatchers. PhD Dissertation, Department of Biological Sciences, Louisiana State University, Baton Rouge, LA.
- De Queiroz, K. (2007). Species concepts and species delimitation. *Systematic Biology* **56** (6): 879–886.
- Fitzpatrick, J. W. (1976). Systematics and biogeography of the tyrannid genus *Todirostrum* and related genera (Aves). *Bulletin of the Museum of Comparative Zoology* **147**: 435–463.
- Fitzpatrick, J. W., J. M. Bates, K. S. Bostwick, I. C. Caballero, B. M. Clock, A. Farnsworth, P. A. Hosner, L. Joseph, G. M. Langham, D. J. Lebbin, J. A. Mobley, M. B. Robbins, E. Scholes, J. G. Tello, B. A. Walther, and K. J. Zimmer. (2004). Family Tyrannidae (Tyrant-flycatchers). Pp. 170–463 in: del Hoyo J., A. Elliott, and D. A. Christie (eds.) (2004). *Handbook of the Birds of the World*. Vol. 9: Cotingas to Pipits and Wagtails. Lynx Edicions, Barcelona.
- Isler, M. L., P. R. Isler, and B. M. Whitney (1998). Use of vocalizations to establish Species-limits in antbirds (Passeriformes: Thamnophilidae). *Auk* **115**: 577–591.
- Isler, M. L., P. R. Isler, B. M. Whitney, and K. J. Zimmer (2007). Species limits in the “*Schistocichla*” complex of *Percnostola* antbirds (Passeriformes: Thamnophilidae). *Wilson Journal of Ornithology* **119**: 53–70.
- Johns, A. D. (1991). Responses of Amazonian rain forest birds to habitat modification. *J. of Tropical Ecology* **7**: 417–437.
- Remsen, J. V., Jr., T. A. Parker III, and R. S. Ridgely (1982). Natural history notes on some poorly known Bolivian birds. *Gerfaut* **72**: 77–87.
- Sardelli, C. H. (2005). Variação geográfica e genética de *Hemitriccus minor* (Aves–Tyrannidae) na Bacia do Madeira, AM/Brasil. MSc Thesis, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil.
- Schulenberg, T. S., D. F. Stotz, D. F. Lane, J. P. O'Neill and T. A. Parker III (2007). *Birds of Peru*. Princeton and Oxford: Princeton University Press, 664 pp.
- Smithe, F. B. (1975). *Naturalist's color guide*. American Museum of Natural History, New York.