

**A new species of *Zimmerius* tyrannulet from the upper
Madeira-Tapajós interfluvium in central Amazonian Brazil:
Birds don't always occur where they "should"**

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On 8 August 2009, while guiding a Field Guides tour group in undisturbed *campina* habitat on the left bank of the Rio Madeirinha near the "Pousada Rio Roosevelt" in southern Amazonas state, Brazil, BMW's attention was drawn to a faint but distinctive, two-note call of unknown identity. Playback of a recording of the vocalization led to fine views of a *Zimmerius*³ tyrannulet that was clearly a vocally distinctive, close relative of the recently described *Z. villarejoi* (Mishana Tyrannulet; Álvarez and Whitney 2001) in northeastern Amazonian Peru. A good recording of calls of the tyrannulet was made that day, and in September, 2011, Mario Cohn-Haft recorded calls of and collected a fine specimen along the BR-230 ("Transamazônica") highway west of the town of Apuí, Amazonas that he located with playback of BMW's recording, but it was not until December of that year that a proper field expedition could be mounted to secure a series of voice-recorded specimens to permit a well-documented description. On that expedition, BMW and FS were able to adequately record the vocal repertoire, learn more about the habitat and foraging behavior of the bird, make photographs and some high-definition video of several individuals, and gain a better knowledge of the new species' distribution. We are now pleased to introduce it as:

Zimmerius chicomendesi

Chico's Tyrannulet

Poiaeiro-de-chicomendes (Portuguese)



Holotype.— Museu de Zoologia da Universidade de São Paulo (MZUSP) 92429, adult male from Brazil: Amazonas; Municipality of Humaitá on the BR-230 ("Transamazônica") highway (07°47'22"S/62°23'32"W), at about 70 m elevation; collected 8 December 2011 by Fabio Schunck, prepared by Marcelo Félix. Voice recorded by Bret M. Whitney, original numbers BMW 14795-97; Macaulay Library of Natural Sounds (ML) 169981. Pectoral muscle tissue preserved in ethanol (MZUSP 92429), field number FST-07.

Diagnosis: Morphology.— Based on the series at hand, *Zimmerius chicomendesi* appears to be indistinguishable in plumage or colors of soft parts from *Zimmerius villarejoi* or the disjunct "Moyobamba population" probably closely related to that species (Álvarez and Whitney 2001; hereafter referred to as *Z. aff. villarejoi*). It is notably smaller than these two and females have significantly shorter wing and culmen (both $P < 0.05$), and lighter mass ($P < 0.02$) than females of *Z. villarejoi*; there is almost no morphometric overlap with *Z. aff. villarejoi* (see SI). Specimens of all these forms, including the entire series of *Z. villarejoi* and four of the five *Z. aff. villarejoi*, were examined together at the LSUMNS by BMW in March 2012. **Voice.**— All vocalizations are immediately and primarily distinguishable from homologous ones of *Z. villarejoi* and *Z. aff. villarejoi* in the field and in spectrographic analysis by their significantly lower frequency, among other characteristics (described below).

Distribution.— Restricted to central Amazonian Brazil from

about 60 km east of the Rio Madeira thence east possibly only to the left bank of the Aripuanã/Roosevelt/Madeirinha system, in the state of Amazonas; northern and southern range limits more poorly understood, but not known north of about 7°40' south latitude about 45 km west of the mouth of the Rio Roosevelt or south of about 8°40' on the left bank of the Rio Madeirinha (Fig. 1). Presently documented only from Amazonas, but we expect that it will eventually be found in northeastern Rondônia and northwestern Mato Grosso, perhaps only west of the Rio Madeirinha. It is important to note that the species apparently does not occupy some enclaves of suitable habitat near confirmed points of occurrence (see "Range delimitation and Conservation," below).

Description of holotype.— See color illustration and Figure 2. Several photos (FS and BMW) and some high-definition video (BMW) of the holotype and its mate were made at the time of collection and are archived at the MZUSP. Capitalized color designations (corresponding number in parentheses) from Smithe (1975). Plumage fresh and unworn, no wing or tail molt, tail complete; skull 30% ossified. Upperparts from base of bill to uppertail coverts uniform olive, individual feathers with Greenish Olive (color 49) bases and Olive Green (S47) tips. Facial region, throat, breast and sides slightly paler greenish (weak contrast with upperparts) washed yellow (throat weakly grayish yellow), becoming clear yellow (brighter than Sulphur Yellow 157) on the belly and undertail coverts. Wings dull blackish with a faint olive cast, lesser upperwing coverts with Olive Green (S47) fringes, median and greater upperwing coverts with well-defined and more contrasting yellow (near Sulphur Yellow 157) margins to distal webs (barely extending to proximal web near rachis on some feathers). Primaries 8 and 7 are of equal length and longest, perhaps just fractionally longer than P9, followed by P6>P5. Three

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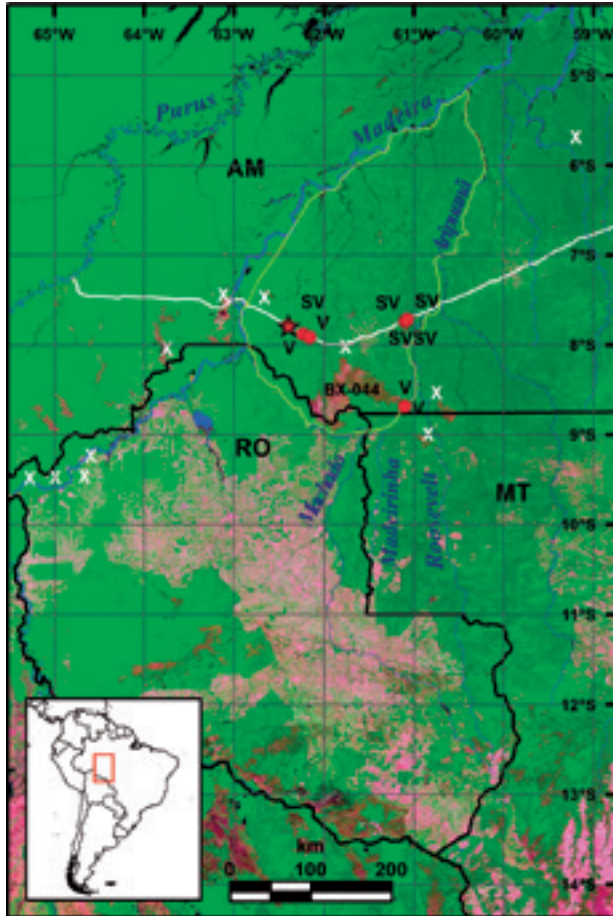
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³ Genus *Zimmerius* 9: 295.

Figure 1.

Geographic distribution of *Zimmerius chicomendesi* in south-central Amazonian Brazil.

A red star marks the type locality and letters adjacent to red locality dots provide documentation: S = specimen; V = vocal recording. A white X marks places searched for *Z. chicomendesi* where we are reasonably to very confident it is absent. A yellow outline encompasses points of confirmed occurrence within a significantly more extensive region that has not been inventoried where we expect the species is present in appropriate habitat. The "BX-044 polygon," a natural enclave of mostly cerrado-like habitats, is labeled on the image. Open areas including campinas appear pinkish due primarily to high reflectance at mid-infrared wavelengths, with recently cleared areas such as those across much of Rondônia appearing paler pink than undisturbed habitats. Black lines mark the boundaries of Brazilian states as indicated by their official abbreviations: AM = Amazonas; RO = Rondônia; MT = Mato Grosso. The federal highway BR-230 ("Transamazônica") is shown in white.



longest primaries are 4.7 mm longer than the shortest pair (P10 = P4 and three inner primaries). Outer webs of primaries and, especially, secondaries very narrowly fringed same yellow as edging on upperwing coverts and contrasting inside the dark primary stack; primary coverts unmarked. Secondaries and inner primaries, especially on distal portions, similarly but more narrowly margined yellow, lacking any expansion of this color near tip of secondaries. Underwing coverts clear, pale yellow becoming slightly dusker at the wrist. Tail same as wing but rectrices narrowly fringed with Olive Green (S47), only weakly contrasting with upperparts. **Soft parts in life:** iris white, maxilla brownish red, especially along tomtia, mandible reddish pink, gape reddish, legs blackish. **Standard measurements:** total length

(just before specimen preparation) 100 mm; bill (culmen from base at skull) 8.3 mm; bill from anterior edge of nares 3.7 mm; bill width at anterior edge of nares 2.6 mm; wing (chord) 43.8 mm; tail 39.6 mm; tarsus 13.3 mm; mass 5.5 g.

Etymology.— Francisco "Chico" Alves Mendes Filho (1944-1988) was a man wise beyond the borders of his time and space. He learned to use the Amazon rainforest by living in it and understood the fundamental importance of preservation of natural resources as well as the dire socio-economic consequences of their destruction – and Chico Mendes, through perseverance and, we can only guess (and admire), excellent "politicizing," was able to make that knowledge count in the international arena. We have no doubt that Mendes and his message, during the last few years of his short life, did more to educate such agencies as the Interamerican Development Bank to more wisely distribute funding toward sustainable uses in Amazonia than has any other individual. If Mendes were alive today, we cannot help but imagine that Brazil would be far ahead of where it is in the development of a truly sustainable Amazonia in reasonable harmony with indigenous peoples and colonists. In bringing this obscure little bird to the light of science, we call up the spirit of Chico Mendes to help us all get it right.

REMARKS

Type series.— The following twelve specimens are the paratypes of *Zimmerius chicomendesi*: MZUSP 92419-92424 female, female, male, female, female, male, respectively (AM; BR-230 at 07°44'15"S/61°05'20"W); and 92427 female, 92428 male, and 92430 female (AM; BR-230 at 07°47'22"S/62°23'32"W); Louisiana State University Museum of Natural Science (LSUMNS) 182843 female and 182844 male (AM; BR-230 at 07°47'22"S/62°23'32"W); Instituto Nacional de Pesquisas da Amazônia (INPA) 2232 male (AM; rodovia BR-230 ca. 145 km wsw Apuí at "campo do coca-cola" 07°43'S/61°04'W). A skeleton ("schmoo") was prepared from MZUSP 92419 and spread wings were prepared from this specimen and MZUSP 92420.

Within the series, there is no significant variation from the holotype in plumage coloration or markings, but there is striking, sometimes shocking, sexual dimorphism in size, with males about 5-15% larger in wing and tail measurements (see SI). Three mated pairs were collected. Figure 3 shows one of them (male is MZUSP 92428, female 92427) perched on the same branch and about the same distance from the camera lens. Tail length and wingspan of the male were 23% and 13% (155 vs. 135

Figure 2.

Zimmerius chicomendesi in habitat. A) Birds responded aggressively to playback of conspecific vocalizations by approaching the speaker and cocking the tail; note the white (previously regurgitated) mistletoe berry. B) One typical, undisturbed posture. C) The underparts may appear vaguely streaked depending on the lighting and arrangement of the feathers (see also Fig. 3). D) Foraging on the mistletoe *Oryctanthus alveolatus*. All images by Fabio Schunck (cameras) and Bret Whitney (playback), December, 2011, along the BR-230 ("Transamazônica") highway. High-definition videos of some of these encounters are available for viewing on the IBC website.





mm) greater than those of his mate, and mass was 21% heavier. To our knowledge, this level of size dimorphism has not been reported in tyrannids having no specialized feather structures (e.g., *Ytapa*, *Alectrurus*, *Muscivora*). None of *Z. villarejoi*, *Z. aff. villarejoi*, or *Z. chicomendesi* ever seems to attain complete skull ossification, and more than 50% ossification is unusual. One specimen of *Z. chicomendesi* (MZUSP 92423) is an immature replacing worn, apparently juvenal plumage (rectrices noticeably narrower and more pointed than those of adults) with fresh adult feathering.

Ecology and behavior.— *Zimmerius chicomendesi* inhabits only *campina* woodland and scrub growing on flat, sandy, often poorly drained ground (Fig. 4A), or on compacted, rock-like sand in well-drained, hillier and grassier terrain (Fig. 4B). Structure of woody vegetation is similar on these rather different substrates, dense and interlocking around irregular openings almost devoid of vegetation; average height varies from about 2 m around openings to roughly 6 m in the densest areas, with scattered, mostly *Caraipa* spp. (Clusiaceae) trees reaching about 10 m in height.



Zimmerius chicomendesi forages regularly, perhaps mostly, on fruits of the widespread mistletoe (Loranthaceae) *Oryctanthus alveolatus* (Kunth) Kuijt and regurgitates the sticky seeds, which are wiped on twigs and branches of trees and shrubs, effectively dispersing the plants. This is the same plant identified as an important food source of *Z. villarejoi*, and foraging behavior is the same as described for that species (Álvarez and Whitney 2001) except that we did not observe *Z. chicomendesi* perform a single foraging maneuver obviously directed at capture of arthropod prey. Examination of stomach contents of 8 individuals revealed only fruit-pulp residue and a few seeds that appeared to belong to the mistletoe identified above. A few minute insect fragments may have been ingested incidentally with mistletoe berries, but the bird must also eat some arthropods, the diet perhaps varying seasonally.

Two other small, mistletoe-specialist tyrannids are sympatric with *Zimmerius chicomendesi*: *Z. acer* (Guianan Tyrannulet) and *Tyrannulus elatus* (Yellow-crowned Tyrannulet). Both of these species are larger than *Z. chicomendesi*, sex for sex, and a *Z. acer* pair recorded and collected 11 December 2011 (MZUSP 92406 male and 92407 female) showed size dimorphism similar to that described above for *Z. chicomendesi*. Both *Z. acer* and *T. elatus* prefer taller trees and forest-edge such as that found around the borders of *campina*. Recording playback of *Z. chicomendesi* at the ecotone of *campina* with tall forest brought the above-mentioned pair of *Z. acer* immediately down into the *campina* where one of them rapidly chased off a *Z. chicomendesi*. Further playback of *chicomendesi* caused the *acer* to stay in the edge of the *campina*, guarding two large clumps of *Oryctanthus* mistletoe; it was clearly dominant over *Z. chicomendesi* but meetings between these two must be limited to the ecotone, as neither significantly infiltrates the realm of the other. A pair of *Tyrannulus elatus* well out into the *campina* but keeping to a copse of taller trees also displayed dominance over neighboring *Z. chicomendesi* after being agitated with whistled imitations of its song. It seems plausible, even probable, that interspecific interactions of *Z. chicomendesi* with these two tyrannulets could have a limiting effect on its ability to disperse through taller forest separating isolated *campinas*.

We found *Z. chicomendesi* in mated pairs in about half of our observations in December; we did not note any behavior that suggested nesting and gonads were not well developed at this (early wet) season; BMW's more limited observations in much drier August did not suggest breeding at that time, either. On three occasions (recorded once in response to recording playback of the song, BMW-14932), males were observed to produce a single brief, quiet, mechanical buzz with the wings while flying between perches in neighboring trees. No unusual flight trajectory or other posturing during production of the mechanical sound was discernible. High-definition video of *Zimmerius chicomendesi* in habitat may be viewed on the Internet Bird Collection (IBC) website.

Vocalizations.— Of twelve specimens collected in December, 2011, eleven were recorded first. In addition, we have calls and

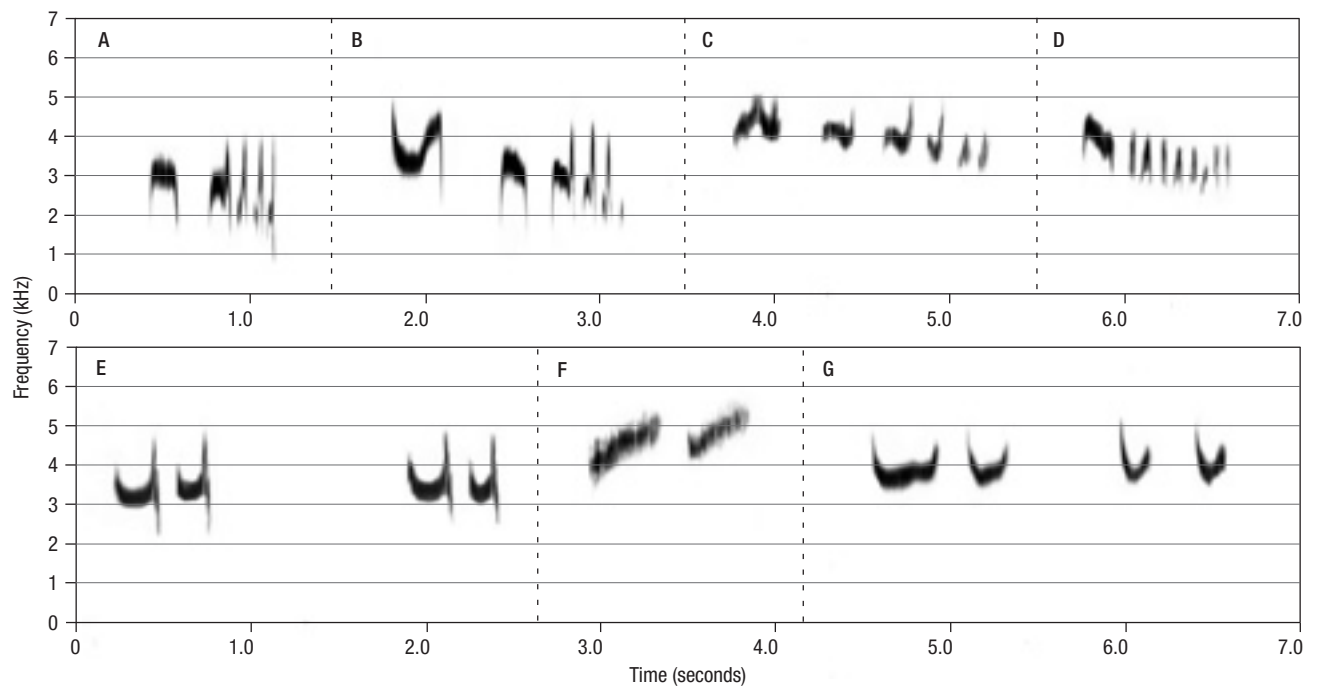
Figure 3.

A mated pair of *Zimmerius chicomendesi*. The sexes are often, but not always, of remarkably different size, males (upper bird) larger than females. See SI for a photo of this pair after specimen preparation. Image by Fabio Schunck (cameras) and Bret Whitney (playback), December, 2011, along the BR-230 ("Transamazônica") highway.

Figure 4.

Two *campina* biotopes inhabited by *Zimmerius chicomendesi*. A) Flat, loosely sandy (quartzitic) ground along the BR-230 ("Transamazônica") highway. Fragile *campina* vegetation may never recover from damage caused by roads. Image by Fabio Schunck December, 2011 (wet season). B) Undisturbed *campina* growing on well-drained, compacted, rock-like sand at the site of the species' discovery on the left bank of the Rio Madeirinha in southern Amazonas. *Zimmerius acer* and *Tyrannulus elatus* are present in the taller forest in the background. Image by Bret Whitney August, 2009 (dry season).

Figure 5. Vocalizations of *Zimmerius chicomendesi* in south-central Amazonian Brazil in comparison to homologous vocalizations of its presumed closest relatives, in Peru. (A) One typical song of *Z. chicomendesi* (BMW-14976, holotype MZUSP 92430); (B) Infrequently heard variant of song of *Z. chicomendesi* featuring distinctive introductory note (BMW-14932, LSUMNS 182844, 10 December 2011); (C) One typical song of *Z. villarejoi* (Peru: Loreto; about 24 km west of Iquitos at Allpahuayo-Mishana Reserve, 1 Aug 1997; Whitney); (D) One song of *Z. villarejoi* (Peru: San Martín; Quebrada Upaquiuhua se of Tarapoto, July 2003, Daniel F. Lane); (E) Two typical two-note calls of *Z. chicomendesi* (Brazil: Amazonas; left bank of Rio Madeirinha 08 August 2009; Whitney); (F) Typical two-note call of *Z. villarejoi* (Peru: Loreto; about 24 km west of Iquitos at Allpahuayo-Mishana Reserve, 1 Aug 1997; Whitney); (G) Two variants of two-note calls from a single individual of *Z. villarejoi* (Peru: San Martín; Quebrada Upaquiuhua se of Tarapoto, July 2003, Daniel F. Lane).



songs of at least four individuals recorded well by BMW on the left bank of the Rio Madeirinha above “Pousada Rio Roosevelt” in August 2009 and in December 2010, 2011, and 2012. We documented four types of vocalizations of *Zimmerius chicomendesi*: song and common call (both heard and recorded regularly); call series (heard once in the field and recorded once from a bird in hand), and a snarl (quiet but aggressive sound emitted after recording playback and probably used in natural, aggressive interactions). This repertoire parallels those documented for *Z. villarejoi* (Álvarez and Whitney 2001) and *Z. aff. villarejoi* (Daniel F. Lane recordings), including basic syntax of most vocalizations, but all sounds are notably lower in frequency (see Fig. 5 for inter-taxon comparisons, and it is recommended that interested readers also listen to the sounds on the IBC website; an audio comparison is “worth a thousand words”). Both sexes emit all of the above vocalizations, and their voices are essentially indistinguishable. The most frequently heard vocalization is a distinctly two-noted call, with one- and three-note calls delivered less regularly. Individuals are capable of tweaking these notes to make them shorter or longer, or add inflections, which we suppose could function to relay different kinds of information. Unfortunately, we were not able to record the dawn song of *Z. chicomendesi*, but based on a vocalization heard early one drizzly morning by BMW before he could get the microphone ready, it may be a single note like one of the notes in the normal call repeated at intervals of about 3–5 seconds.

Relationships and taxonomy.— When a taxon-complete, DNA-based phylogenetic analysis is eventually undertaken for the genus *Zimmerius*, *Z. chicomendesi* will surely prove to be in a well-defined clade with the recently described *Z. villarejoi* (Mishana Tyrannulet, Álvarez and Whitney 2001), another rare bird of highly local distribution in *varillales* (as *campinas* described above are called in northern Peru) near Iquitos, Peru. For the description of *Z. villarejoi*, the single specimen from near Moyobamba, Departamento San Martín (Field Museum of Natural History [FMNH] 49405), was examined but not included as a paratype because it was taken quite some distance from the type locality of *villarejoi*, its habitat was not recorded, and its voice was unknown. In July, 2003, Daniel F. Lane located this Moyobamba population (in this paper called *Zimmerius aff. villarejoi*) at “Quebrada Upaquiuhua” about 26 km south-southeast of Tarapoto and tape-recorded and collected five males; subsequently, this form has been found throughout the Río Mayo valley and along the middle Río Huallaga, in drier and white-sand habitats. It was considered a disjunct, conspecific population of *Z. villarejoi* by Schulenberg *et al.* (2007). This vocally and mor-

phologically divergent population will just as certainly fit into the above clade but as a separate species, probably as sister to *Z. villarejoi*; its description will be published elsewhere (Lane *et al.* in prep.).

Figure 6 shows the distributions of the three members of the postulated *Zimmerius villarejoi* complex. Other, undiscovered members should now be sought in unexplored regions of the Amazon basin, perhaps especially south of the Marañón/Solimões rivers in Peru and Brazil. Álvarez and Whitney (2001) considered all of the “red-billed” *Zimmerius* tyrannulets, including the significantly larger and vocally further-differentiated *Z. cinereicapillus* (Red-billed Tyrannulet), to form a natural group more closely related to each other than to any other species. We agree that *Z. villarejoi*, in a complex including the two more recently identified taxa above, will prove to be sister to *Z. cinereicapillus*, which seems to be patchily distributed in the foothills of the east slope of the Andes from central Ecuador south to northern Bolivia. This relationship has been partially validated very recently by the finding of Rheindt *et al.* (2013) that *Z. cinereicapillus* is sister to *Z. aff. villarejoi*, which they considered conspecific with *Z. villarejoi*. The work of Rheindt *et al.* (2013) provided significantly better resolution of the evolutionary history of the genus *Zimmerius* than that presented in Rheindt *et al.* (2008). Our knowledge of diversification in the genus will take another leap forward when more outstanding taxa, such as *Z. villarejoi* and *Z. chicomendesi*, are included. Furthermore, a major expansion of the *Zimmerius* radiation to include the Atlantic Forest biome of eastern Brazil will likely result from inclusion of *Phyllomyias griseocapilla* (Gray-capped Tyrannulet) in the phylogeny (BMW *pers. obs.*).

Range delimitation and Conservation.— That *Zimmerius chicomendesi* is among the most locally distributed (among known!) species in all of Amazonia and requires a rare habitat type within its range raises immediate concern despite that fact that it is common where it does occur. The species is, however, difficult to find if its voice is not recognized, and it was not detected during previous visits to the site of discovery (*e. g.*, Whittaker 2009). Broadcast of recordings of the calls and song in appropriate habitat in both dry and wet seasons elicits a response within 1–20 minutes (almost always less than 5 min) if the species is present.

For conservation purposes, *Zimmerius chicomendesi* is appropriately viewed as an “interfluvial *campina* specialist [ICS],” an idea easily understood when *campinas* in the Madeira-Aripuanã interfluvium, or other Amazonian interfluvia, are identified in satellite images as scattered and often small patches

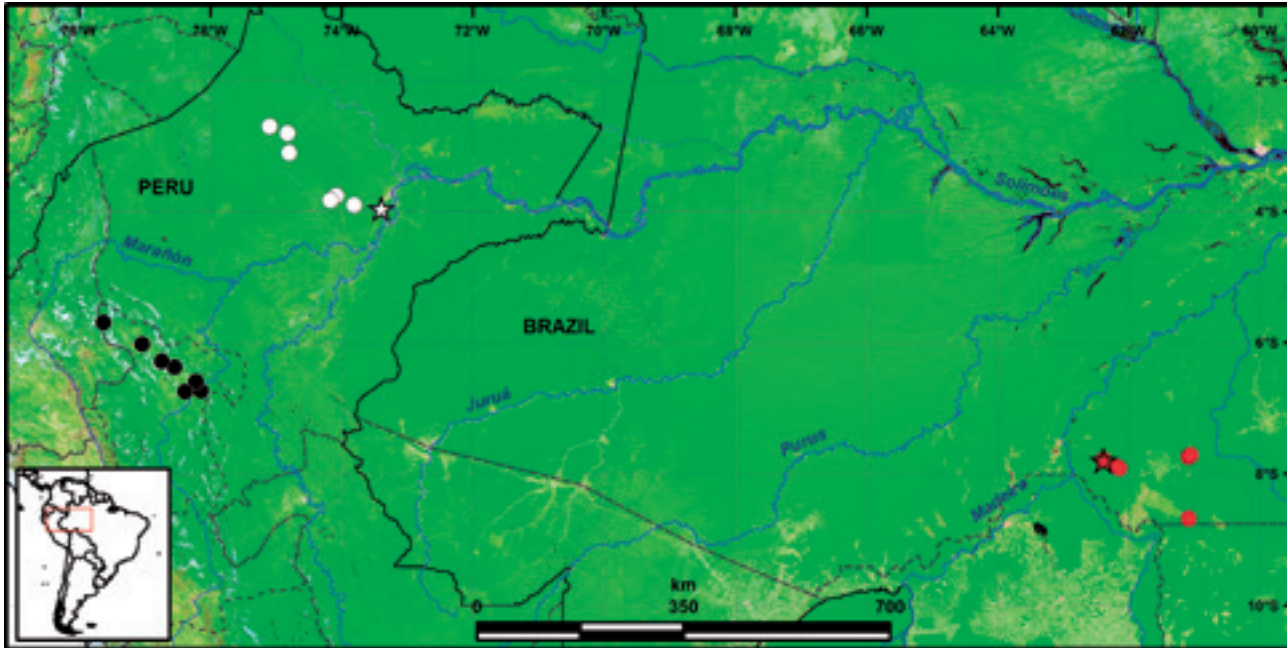


Figure 6. Distribution of the postulated *Zimmerius villarejo* complex in South America. White dots are *Z. villarejo* in Loreto, Peru (white star marks the type locality at the Allpahuyo-Mishana Reserve outside Iquitos); black dots are *Z. aff. villarejo* in San Martín, Peru, referred to as “Moyobamba population” in Álvarez and Whitney (2001); and red dots are *Z. chicomendesi* in Amazonas, Brazil (red star marks the type locality along the BR-230 [“Transamazônica”] highway). Additional close relatives, as yet undiscovered, should be sought in campinas, perhaps especially in the vast, largely unexplored region south of the Marañón/Solimões rivers in Peru and northwestern Amazonian Brazil.

(Fig. 1, viewable in much greater detail online in SI). We used examination of satellite imagery to mount our highly successful December, 2011, expedition to collect a series of the new *Zimmerius* based on expectation that easily accessible *campinas* identifiable along the BR-230 (through which BMW had hitchhiked several times without stopping) would likely produce it. We had employed the same reasoning, however, in a previous (August, 2011), failed attempt to find the bird in an extensive *campina* that appeared to be appropriate in satellite imagery on the left bank of the Rio Roosevelt about 60 km southeast of the site of discovery of the species and, most recently (December, 2012), at a *campina* only 26 km distant on the right bank of the Roosevelt.

Assuming that our search of what we are confident was ideal habitat at all of these sites and more cursory inspection of another one about 80 km northwest of the site of original discovery but of somewhat different plant composition and structure would have revealed the presence of the bird if it occurs at these places, this indicates that *Z. chicomendesi* does not occupy all potentially suitable habitat quite near to known points of occurrence. Thus, our “educated modeling” exercise – visual inspection of satellite imagery to identify suitable *campinas* followed up by ground-truthing to verify habitat suitability – proved inadequate to predict *either occurrence or absence* of the new species and indicates that other, paleohistorical and geographical factors, probably in combination with dispersal capability and competition from ecological correlates, have had deterministic effects in restricting its contemporary distribution.

This case highlights the critical importance of ground-truthing specific sites evaluated as being appropriate for organisms to document actual presence or, just as importantly, absence there, especially in the cases of rare and endangered species. Of course, the validity of our exercise is based on how accurately or completely we evaluated habitat suitability and also absence of the species in places it was expected to occur in and around the area of known occurrence. We would welcome with great interest the results of future research, including our own, that might show that our evaluations were erroneous; for the time being, the burden of proof lies there. We looked for *Z. chicomendesi* or relatives of it in four additional *campinas* more remote from known points of occurrence, four east of the Rio Madeira south of Jaci-Paraná, Rondônia and one on the left bank of the Rio Sucunduri (5°48'S/59°16'W), but it was apparently absent in all of these places. Fieldwork in *campinas* west of the Rio Madeira between Porto Velho, Rondônia and Humaitá, Amazonas has probably been extensive enough to establish absence of the species-complex there as well.

The survival outlook for *Zimmerius chicomendesi* currently is not alarming as much of its range is remote from human

presence. The yellow outline in Figure 1 on the right bank of the Rio Madeira encompasses 69,706 km² within the Aripuanã-Madeirinha-Machado interfluvium. Our working hypothesis, after determining absence of *Z. chicomendesi* in suitable habitat across the Madeirinha and Roosevelt rivers and in recognition of the emerging pattern of endemism in this “speciation block” or “mini-interfluvium” (Cohn-Haft *et al.* 2007), is that *Z. chicomendesi* occurs only or almost entirely within this area. Under IUCN (2001) definition, this is the species’ estimated “extent of occurrence”. The approximate total area of what appears in satellite imagery to be potentially suitable *campina* habitat within this outline is 5442 km². Of this, a large enclave of relatively open habitats known as the BX-044 polygon (Aleixo and Poletto 2007) accounts for about 2500 km². We are confident that *Z. chicomendesi* almost certainly does not occupy the great majority of the BX-044, which is dominated by inappropriate grasslands, *cerrado*-like plant associations, and gallery forests (Aleixo and Poletto 2007 and ground-truthed by BMW and FS December, 2011), with *campina/campinarana* distributed mainly around parts of the periphery. Notwithstanding that few areas of the BX-044 have been adequately searched for the new species, the only records of it are those from the extreme southeastern tip.

We drew a line 1 kilometer wide around the BX-044 to approximate a belt of *campina* habitat that was, in available satellite imagery, difficult to discern, in an attempt to estimate the area of habitat potentially appropriate for the bird. This was 630 km². Thus, we arrived at a total of 3572 km² of habitat within our yellow outline that we expect is the “area of occupancy” (IUCN 2001) of *Zimmerius chicomendesi*. We estimate that the population density averages about three pairs/km², which results in a global population estimate of 10,700 pairs. Whether or not this calculation proves to be nearly accurate, we do expect that the present population size of *Z. chicomendesi* is not much different from what it was before the Transamazônica was pushed through in the 1970s; in other words, it is almost certainly still close to its natural equilibrium.

Some 50% of the postulated range of *Zimmerius chicomendesi* lies within several indigenous reserves, the recently created Campos Amazônicos National Park, and some other smaller federal and state conservation areas, but we can anticipate specific threats that must be addressed. The most serious of these centers on consequences of the Brazilian government eventually deciding to pave (or try to pave) the BR-230, which cuts through much excellent *campina* habitat in the Madeira-Aripuanã interfluvium (Fig. 7). As it is (still a dirt road), the “Transamazônica” highway completely traverses the range of *Z. chicomendesi* and raw materials for paving it, mainly sand, would be quarried heavily resulting in irreversible damage to

Figure 7.

The federal highway BR-230 (the "Transamazônica") was constructed in the 1970s. This dirt road traverses the entire Madeira-Tapajós interfluvium, passing through many *campinas* inhabited by *Zimmerius chicomendesi* and several other similarly range-restricted birds. Clearing along either side of the highway currently ranges from about 10 meters to more than five kilometers. When the Brazilian government eventually decides to pave the Transamazônica, fragile *campina* habitats near the road, all currently unprotected except where they are marginally safer in indigenous reserves, will be heavily and probably irreversibly damaged. Now is the time to ensure that this habitat is preserved. Perhaps the most efficient and effective way to do this would be to incorporate these *campinas* in the nearby Campos Amazônicos National Park, with signs clearly marking the stretches of the highway where no extractive activities or other damage, such as fire or homesteading, are permitted. Image by Fabio Schunck, December, 2011.



fragile, incredibly slow-growing *campina* habitats (Fig. 4A). Intricate but vitally important local drainage patterns would be interrupted haphazardly with dire consequences for *campina* plant communities. And because *campina* is not a fire-adapted habitat (different from some other low-stature, open-vegetation communities), there would most definitely be damaging burns concomitant with roadwork and the inevitable encroachment of human settlement, or simply with increased traffic through this still-remote region. Significant stretches along the BR-230 in the western Madeira-Tapajós interfluvium are somewhat protected by indigenous territories, which is fortunate because these native people do not tend to exploit *campinas* for resources that result in habitat degradation – although it is to be expected that exploitation would accelerate suddenly as a paved BR-230 would stimulate expansion of roadside villages, leading to quarrying of sands for construction.

Right now, before invasive activities begin, official protection of the *campinas* bordering the BR-230 could be established with delimitation of them as protected habitats that cannot be exploited for construction material or other resources and must not be settled or burned. Ideally, we suggest, these *campinas* should be incorporated in nearby Campos Amazônicos National Park and signs marking their status as protected areas of the park should be posted along the highway. Of course, official protection of the *campinas* would not guarantee their effective protection, but it would be enormously wise and helpful.

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