Four more records of Rusty Tinamou *Crypturellus brevirostris* in Colombia and a revision of its known range

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Reportamos aquí cuatro registros adicionales de la Panguanita Oxidada *Crypturellus brevirostris* en la Amazonía colombiana y realizamos una revisión de su distribución conocida. A partir de un muestreo acústico pasivo, detectamos cuatro sitios adicionales a los reportados recientemente en los alrededores de Araracuara, departamento de Caquetá, Colombia. Estos registros pueden soportar iniciativas de uso sostenible de biodiversidad por parte de las comunidades de Araracuara; por ejemplo, fortaleciendo actividades de aviturismo. Futuro trabajo colaborativo con comunidades locales podría ayudar a entender mejor la biología de este poco conocido especialista de suelos pobres amazónicos que muy probablemente es residente de Colombia.

Rusty Tinamou *Crypturellus brevirostris* is a forest-dwelling species discontinuously distributed in northern Amazonia and the Guiana Shield[4,8]. As with other members of the genus *Crypturellus*[19,23], its vocalisations are often the first and only way to detect it in the field[5]. Although this species has been described as "fairly common"[29], there is a lack of studies providing estimates of its global population size and information on its life history[4,8]. Not even its habitat preferences are well known, being reported both in *terra firme*[21,24] and seasonally flooded forests[8,24]. Once thought to be endemic to the upper Amazon basin, *C. brevirostris* was until recently considered hypothetical for north-western Amazonia[3,10,12,16,25].

Recently, Socolar *et al.*[25] reported substantial range extensions for birds near the Araracuara area in the central Amazon of Colombia, including *C. brevirostris*. The study also discusses the distribution of white-sand and other poor-soil specialists in north-western Amazonia, which have proved more widespread and less patchy than previously thought[25,26]. Before Socolar *et al.*'s expeditions[25], *C. brevirostris* was only hypothetical in Colombia[10], with a single observation from Serranía de Naquen in Guainía[16] that prompted its inclusion in Colombian field guides[3]. By the time of Socolar *et al.*'s first expeditions to the remote area of Araracuara (August 2019)[25], OAC was coordinating a research agenda on acoustics for the Instituto Humboldt in Colombia[15] and oversaw the deployment of six autonomous Acoustic Recording Units (hereafter, ARUs)[1] at Loma de Cotudos (Fig. 1)[25]. Revisiting the acoustic data, we detected a vocalisation of *C. brevirostris*. We contextualised our record by reviewing the available distribution information of the species[5,8,9,21,24,25].

Methods

Six ARUs were deployed on a transect at Loma de Cotudos[1,25], Yarí River (Fig. 1), from 8–12 August 2019. The ARUs were programmed to be active for 1 minute and inactive for 9 minutes, gathering 144 recordings per day per site ($n = 3{,}260$ recordings) at a sample rate of 44.1 kHz and at 16-bit resolution. We used ARBIMON portable recorders, which consist of LG cell phones containing the ARBIMON touch app. The recordings were normalised to ~3 kHz[2], then uploaded to the Rainforest Connection ARBIMON platform (https://rfcx.org), where we reviewed some of the recordings in a non-systematic way. With a single detection of *C. brevirostris* at 20h10 on 11 August 2019 at the site ARU1 (0°32'34.8" S, 72°15'25.2" W; 175 m elevation), we ran a Pattern Matching (PM) model that returned another three detections (Fig. 2A–D). This PM model is a supervised template-matching analysis included in ARBIMON. It uses a window of the spectrogram (a template) to search for similar sounds in time-frequency domain coordinates within a user-defined playlist of recordings[14,20], in our case the entire audio dataset.

To contextualise our records within the distribution of the species, we searched for physical specimens in the Global Biodiversity Information Facility ($n = 18$; only 5 georeferenced). We also extracted eBird records *sensu lato* ($n = 50$) and filtered the records to include only complete checklists (travelling or stationary) $\leqslant 5$ km or $\leqslant 5$ h[13], which significantly reduced the number of records (n = 7). (For reference, the R code used in these procedures is at https://github.com/OACColombia/RustyTinamou[11,30].) Additionally, we extracted acoustic records from xeno-canto ($n = 13$; http://tinyurl.com/xeno-canto) and Macaulay Library ($n = 6$; http://tinyurl.com/MacaulayLibrary). Then, using the program QGIS v3.14, we combined all these

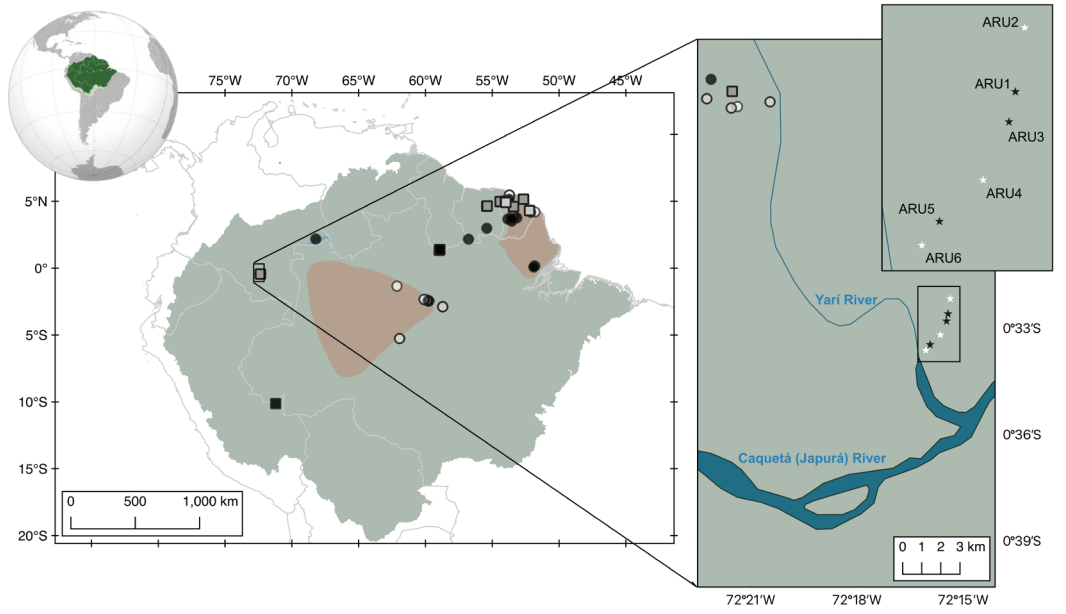

Figure 1. Distribution and records of Rusty Tinamou *Crypturellus brevirostris* in the Amazon basin. The Amazon basin is marked in green, the species' range according to BirdLife International[4] in brown. Black squares = specimen records; dark grey squares = acoustic records from Macaulay Library; pale grey squares = acoustic records from xeno-canto.org; black dots = records from the literature; other dots = eBird observations (white dots = unfiltered records; grey dots = records filtered by a sampling protocol[13]). To the right, the inset map shows the Loma de Cotudos site[25], on the left bank of the Yarí River, Caquetá, Colombia. The enlarged area displays the location of autonomous Acoustic Recording Units (ARUs): black stars = locations where the species was detected; white stars = locations where the species was not detected.

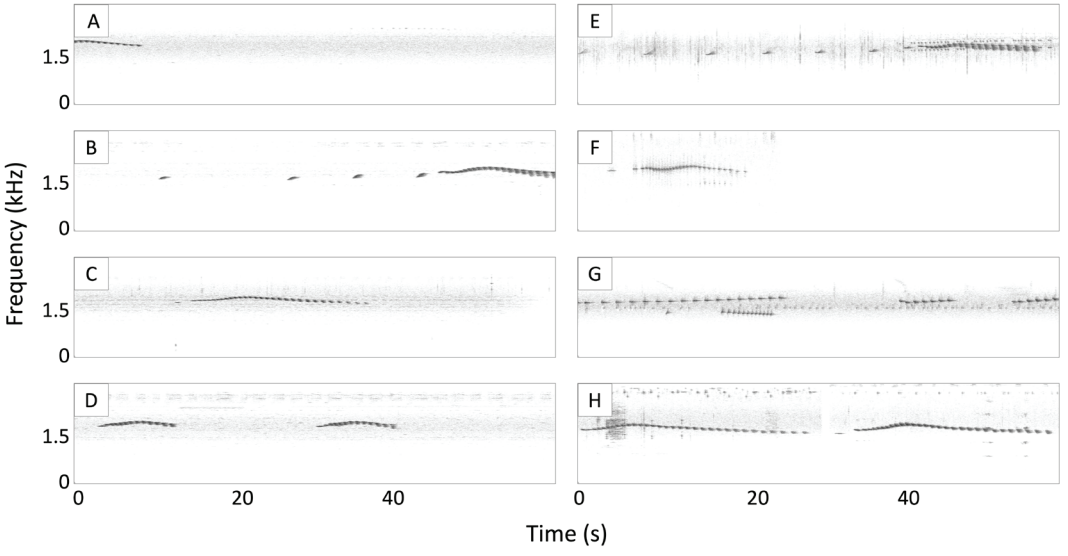

Figure 2. Spectrograms of Rusty Tinamou *Crypturellus brevirostris* from autonomous Acoustic Recording Units (ARUs) in the Araracuara area of Colombian Amazonia (A–D), and comparison with vocalisations from Colombia (E; xeno-canto.org, recording XC585282 by J. Socolar) and French Guiana (F; xeno-canto.org, recording XC253198 by O. Claessens). Similar songs include Bartlett's Tinamou *Crypturellus bartletti* (G; xeno-canto.org, recording XC779214 by OAC) or Barred Tinamou *Crypturellus casiquiare* (H; same individual in xeno-canto.org recordings XC302248 and XC302267 by J. Socolar). All recordings were resampled to 6 kHz, applying a low-pass filter of 1.9 kHz and a high-pass filter of 1.0 kHz, normalised to 0 dB (maximum amplitude) and cut to a 1-minute temporal window.

records with the species distribution according to BirdLife International[4], *Birds of the world*[8] and the literature[5,9,21,24,25] (Fig. 1).

Results and discussion

Working chronologically, the first record detected by the PM model was from the site ARU5 (0°33'28.8" S, 72°15'57.6" W; 170 m elevation) at 17h50 on 8 August 2019 (Fig. 2A), and the second record was at the site ARU1 at 22h20 on the same day (Fig. 2B). The PM detected a third vocalisation at the site ARU3 (0°32'49.2" S, 72°15'28.8" W; 165 m) at 23h10 on 10 August 2019 (Fig. 2C), and the fourth and final record (i.e., the original discovery) was at ARU1 (Fig. 2D). We based our identification of the vocalisations as *C. brevirostris* on similarities with documented sounds from Colombia (Fig. 2E) and French Guiana (Fig. 2F), and contrasted them with species with similar vocalisations such as Bartlett's Tinamou *C. bartletti* (Fig. 2G) and Barred Tinamou *C. casiquiare* (Fig. 2H). Previous studies have confused *C. brevirostris* with these and other species[9] (e.g., Great Tinamou *Tinamus guttatus* and Variegated Tinamou *C. variegatus*).

Detailed examination of acoustic recordings could not only help improve knowledge of the distribution of this species, as it has with others[22,23], but also provide information about its behaviour. For example, our four records match the description of *C. brevirostris* primary song, and one included the secondary song (Fig. 2B and compare with Fig. 2E), which is apparently a duet[5]. In French Guiana, Vincent Rufray (*in litt.* 2023) reports *C. brevirostris* as associated with *terra firme* forests and particularly with forests on poor soils, such as saprolite soil, white-sand forest and forests around inselbergs. Thus, it seems that both *C. brevirostris* and *C. casiquiare* inhabit unflooded poor-soil forests and might coexist or compete in north-western Amazonia.

Potential niche partitioning between *C. brevirostris* and *C. casiquiare* in poor-soil forests could include distinct diel, annual or seasonal acoustic activity. Although we lack data like those provided elsewhere for Undulated Tinamou *C. undulatus*[17–19], it is likely that *C. brevirostris* vocalises year-round, with more recordings made between August and October (Fig. 3). Also, *C. brevirostris* is likely continuously active during the night, but with crepuscular peaks of activity (Fig. 3). However, its apparent behaviour of vocalising only sporadically makes any preliminary analysis from different sources inconclusive. The diel and annual acoustic activity could be tested easily in Loma de Cotudos, the Araracuara area or other locations in north-western Amazonia that contain poor soils.

The use of passive acoustic sampling, as we demonstrate here, will help understand the diel acoustic activity of this secretive species, and

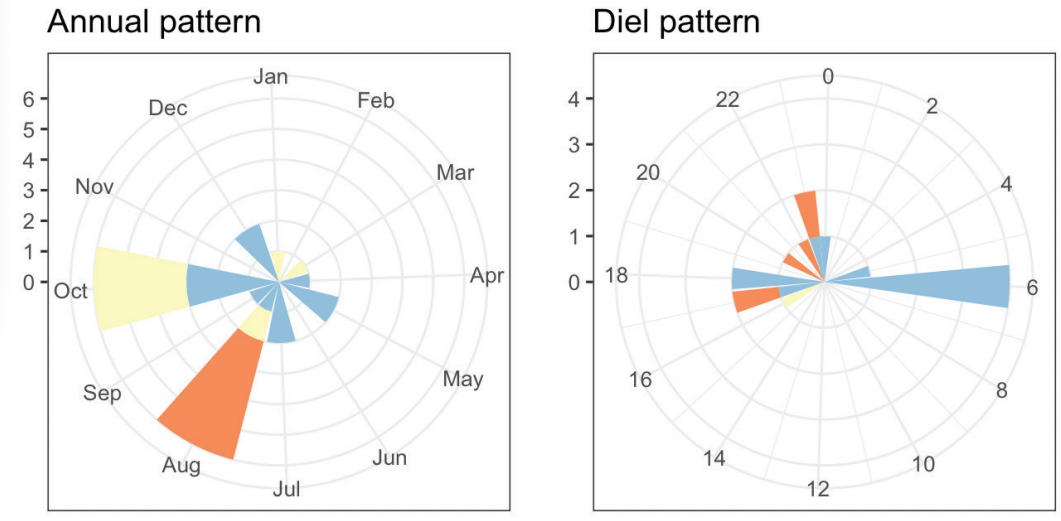

Figure 3. Annual and diel acoustic pattern of activity of Rusty Tinamou *Crypturellus brevirostris*. Acoustic activity is inferred from acoustic records in three platforms (orange = records from the present study; yellow = Macaulay Library records; and blue = xeno-canto.org records). The ordinate represents the number of recordings per year (annual) and day (diel). Activity seems constant across the year and night, but peaks in August and October, and at 06h and 18h. The code and data can be found at https://github.com/OACColombia/RustyTinamou.

with this note we invite others to search for the species, specifically in the departments of Caquetá, Amazonas, Vaupés and Guainía in Colombia, and in northern Peru[26,31]. During these searches, we encourage the inclusion of traditional and local ecological knowledge of indigenous people, providing an interdisciplinary effort to understand Amazonian fauna[27].

Our records of *C. brevirostris* not only confirm a significant extension to its known distribution but also reveal the species' habitat preference to be broader than previously thought. Prior reports from the east of its range suggested that this species prefers high-nutrient *varzea* and *terra firme* forests, but this newly discovered population in the poor-soil forests of Araracuara forms part of an avian community typical of white-sand forests[25]. As mentioned earlier, Vincent Rufray (*in litt*. 2023) confirmed this same pattern of association with poor soils in French Guiana[24]. Patchily distributed poor-soil forests are known to be high in endemism[7], but evidence suggests that some white-sand-forest specialists may also use other types of poor-soil forest such as *igapó* (forests seasonally flooded by low nutrient black water)[6] and peatlands[26,31]. To better understand habitat specialisation, a possible driving force behind biodiversity maintenance in the Amazon rainforest, more focused survey efforts are needed. Targeted passive acoustic monitoring studies have been shown to be an effective tool for this task in white-sand forests[28], and we therefore recommend further implementation of this technique in long-term studies including poor-soil habitats of the Amazon.

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References

1. Acevedo-Charry, O., Murillo-Bedoya, D., Buitrago-Cardona, A., Ospina-L, A. M., Medina-Uribe, C. A., Colón-Piñeiro, Z., Gómez-Valencia, B., Herrera-Varón, Y. & Ochoa-Quintero, J. M. (2021) Passive acoustic sampling data of the Colección de Sonidos Ambientales Mauricio Álvarez-Rebolledo – Instituto Humboldt (IAvH-CSA) during 2018 and 2019 in Colombia. *Data Br*. 34: 106648.
2. Acevedo-Charry, O., Ospina-L, A. M., Buitrago-Cardona, A. & Borja-Acosta, K. G. (2021) Recomendaciones para registrar y almacenar señales acústicas como especímenes digitales en Colombia. *Biodiver. Práctica* 6(1): e932.
3. Ayerbe Quiñones, F. (2022) *Guía ilustrada de la avifauna colombiana*. Tercera edición. Bogotá: Wildlife Conservation Society.
4. BirdLife International (2024) Species factsheet: *Crypturellus brevirostris*. http://datazone.birdlife.org/species/factsheet/rusty-tinamou-crypturellus-brevirostris (accessed 1 May 2023).
5. Boesman, P., Claessens, O., Costa, T. V. V., Pelletier, V., Ingels, J. & Renaudier, A. (2018) Songs of Rusty Tinamou *Crypturellus brevirostris* and duetting in *Crypturellus* species. *Bull. Br. Orn. Cl*. 138: 69–78.
6. Borges, S. H., Cornelius, C., Moreira, M., Ribas, C. C., Cohn-Haft, M., Capurucho, J. M., Vargas, C. & Almeida, R. (2016) Bird communities in Amazonian white-sand vegetation patches: effects of landscape configuration and biogeographic context. *Biotropica* 48: 121–131.
7. Borges, S. H., Cornelius, C., Ribas, C., Almeida, R., Guilherme, E., Aleixo, A., Dantas, S., Santos, M. P. D. & Moreira, M. (2016) What is the avifauna of Amazonian white-sand vegetation? *Bird Conserv. Int*. 26: 192–204.
8. Cabot, J., Christie, D. A., Jutglar, F., Sharpe, C. J. & Boesman, P. F. D. (2020) Rusty Tinamou (*Crypturellus brevirostris*), version 1.0. In: del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. A. & de Juana, E. (eds.) *Birds of the world*. Ithaca, NY: Cornell Lab of Ornithology. https://doi.org/10.2173/bow.rustin1.01 (accessed 1 May 2023).
9. Cohn-Haft, M., Whittaker, A. & Stouffer, P. C. (1997) A new look at the "species-poor" central Amazon: the avifauna north of Manaus, Brazil. *Orn. Monogr*. 48: 205–235.
10. Echeverry, M. Á., Acevedo-Charry, O., Avendaño, J. E., Stiles, F. G., Estela, F. A. & Cuervo, A. M. (2022) Lista oficial de las aves de Colombia 2022: adiciones, cambios taxonómicos y actualizaciones de estado. *Orn. Colomb*. 22: 25–51.
11. Hijmans, R. J., Phillips, S., Leathwick, J. & Elith, J. (2011) 'dismo'. http://cran.r-project.org/web/packages/dismo/index.html (accessed 1 May 2023).
12. Hilty, S. L., & Brown, W. L. (1986) *A guide to the birds of Colombia*. Princeton, NJ: Princeton University Press.
13. Johnston, A., Hochachka, W. M., Strimas-Mackey, M. E., Ruiz Gutiérrez, V., Robinson, O. J., Miller, E. T., Auer, T., Kelling, S. T. & Fink, D. (2021) Analytical guidelines to increase the value of community science data: an example using eBird data to estimate species distributions. *Divers. Distrib*. 27: 1265–1277.
14. LeBien, J., Zhong, M., Campos-Cerqueira, M., Velev, J. P., Dodhia, R., Ferres, J. L. & Aide, T. M. (2020) A pipeline for identification of bird and frog species in tropical soundscape

recordings using a convolutional neural network. *Ecol. Inform*. 59: 101113.
15. Mendoza-Henao, A. M., Acevedo-Charry, O., Martínez-Medina, D., Barona-Cortés, E., Córdoba-Córdoba, S., Caycedo-Rosales, P., Ulloa, J. S., Borja-Acosta, K. G., Buitrago-Cardona, A. & Pantoja-Sánchez, H. (2023) Past, present, and future of a tropical sounds collection from Colombia. *Bioacoustics* 19: 1–17.
16. Newman, J. (2008) Sight records of five bird species new to Colombia from Serranía de Naquen, dpto. Guainía. *Cotinga* 29: 160–161.
17. Pérez-Granados, C. & Schuchmann, K. (2021) Nocturnal vocal behaviour of the diurnal Undulated Tinamou (*Crypturellus undulatus*) is associated with temperature and moon phase. *Ibis* 163: 684–694.
18. Pérez-Granados, C., Schuchmann, K. & Marques, M. I. (2020) Vocal behavior of the Undulated Tinamou (*Crypturellus undulatus*) over an annual cycle in the Brazilian Pantanal: new ecological information. *Biotropica* 52: 165–171.
19. Pérez-Granados, C. & Schuchmann, K.-L. (2021) Seasonal climate impacts on vocal activity in two Neotropical nonpasserines. *Diversity* 13: 319.
20. Ribeiro, J. W., Harmon, K., Leite, G. A., De Melo, T. N., LeBien, J. & Campos-Cerqueira, M. (2022) Passive acoustic monitoring as a tool to investigate the spatial distribution of invasive alien species. *Remote Sens*. 14: 4565.
21. Robbins, M. B., Braun, M. J., Milensky, C. M., Schmidt, B. K., Prince, W., Rice, N. H., Finch, D. W. & O'Shea, B. J. (2007) Avifauna of the upper Essequibo river and Acary mountains, southern Guyana. *Orn. Neotrop*. 18: 339–368.
22. Rocha-López, D. & Acevedo-Charry, O. (2023) First documented record of Bartlett's Tinamou *Crypturellus bartletti* (Tinamidae) in Colombia. *Orn. Colomb*. 23: 38–43.
23. Rocha-López, D., Quiñónez-Calle, M., Carantón-Ayala, D., Betancur-López, A. & Acevedo-Charry, O. (2021) La importancia de obtener evidencia multimedia: el caso de los semilleros piquigordos de Colombia, con registros de *Sporophila atrirostris* y un llamado a buscar *Sporophila maximiliani*. *Bol. SAO* 30: 22–31.
24. Rufray, V., Pelletier, V. & Ingels, J. (2014) First photographs and new records of the Rusty Tinamou *Crypturellus brevirostris* from French Guiana. *Neotrop. Birding* 15: 15–19.
25. Socolar, J. B., Castaño, J. F. & Arango, J. (2022) Noteworthy bird records from the Araracuara area, Amazonas and Caquetá, Colombia. *Orn. Colomb*. 21: 2–10.
26. Socolar, J. B., Díaz-Alván, J., Del Castillo, P. S., Pomara, L. Y., O'Shea, B. J., Poclin, S. C., Stotz, D., Schmitt, F., Graham, D., Carnes, B. H. & Ruelas Inzunza, E. (2018) Noteworthy bird records from northeastern Peru reveal connectivity and isolation in the western Amazonian avifauna. *Wilson J. Orn*. 130: 94–111.
27. Stern, E. R., & Humphries, M. M. (2022) Interweaving local, expert, and Indigenous knowledge into quantitative wildlife analyses: a systematic review. *Biol. Conserv*. 266: 109444.
28. Stevens, H. C., Metz, E. M., Saboya Del Castillo, P., Alván, J. D. & Bowler, M. T. (2019) Use of autonomous audio recordings for the rapid inventory of birds in the white-sand forests of the Peruvian Amazon. *J. Field Orn.* 90: 70–79.
29. Stotz, D. F., Fitzpatrick, J. W., Parker, T. A. & Moskovits, D. K. (1996) *Neotropical birds: ecology and conservation*. Chicago, IL: University of Chicago Press.
30. Strimas-Mackey, M., Miller, E. & Hochachka, W. (2018) auk: eBird data extraction and processing in R. https://cornelllabofornithology.github.io/auk/ (accessed 1 May 2023).
31. Vásquez-Arévalo, F. A., Zárate-Gómez, R., Socolar, J. B., Díaz-Alván, J. & Pérez-Peña, P. E. (2020) First record of the Gray-legged Tinamou, *Crypturellus duidae*, and other poor-soil specialist birds from peatlands in the Putumayo River basin, Loreto, Peru. *Acta Amazon*. 50: 155–158.

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