

Rediscovery of the hummingbird *Heliodoxa rubricauda* (Boddaert, 1783) (Aves: Trochilidae) in Rio Grande do Sul, southern Brazil

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Abstract. We report the rediscovery of the hummingbird *Heliodoxa rubricauda* (Boddaert, 1783) in the Brazilian state of Rio Grande do Sul after nearly 130 years without confirmed records. We captured 3 males and 1 female, and found 2 other birds (including an immature) at 3 sites in the municipalities of São Francisco de Paula and Cambará do Sul, in the northeast of the state. All records were at the top of the Southern Brazilian Plateau escarpment, at altitudes of about 900 m and near the southern limit of the Atlantic Forest.

Key words. Atlantic Forest; *Araucaria* forest; Brazilian Ruby; *Clytolaema*; new records

The Brazilian Ruby *Heliodoxa rubricauda* (Boddaert, 1783) is endemic to the Atlantic rainforest of eastern Brazil, ranging from southeastern Bahia south through eastern Minas Gerais and Espírito Santo to Santa Catarina and northeastern Rio Grande do Sul (SCHUCHMANN & KIRWAN 2016). It inhabits tropical broadleaf and temperate mixed forests, montane thickets, banana plantations and wooded gardens from sea level to 2,100 m (SICK 1997, RIDGELY et al. 2015). The species has traditionally been classified in the monotypic genus *Clytolaema*, although its close affinity to *Heliodoxa* has long been recognized (WILLIS 1992, WILLIS & SCHUCHMANN 1993, MCGUIRE et al. 2009). Recently, the phylogenetic relationships of *Clytolaema* were accessed directly (MCGUIRE et al. 2014), confirming the previous suspicions that this genus should be merged into *Heliodoxa* (PIACENTINI et al. 2015).

In Rio Grande do Sul, the southernmost Brazilian state, *H. rubricauda* has been known with certainty for over a century

from a single specimen obtained by Hermann von Ihering at Taquara (29°40' S, 050°47' W; 40 m), which was sent by him in ethanol to Count Hans von Berlepsch in Germany (BERLEPSCH & IHERING 1885). This specimen, an adult male, was collected on an unknown date, but doubtless between June 1882 and December 1883, when Ihering lived at Taquara and collected birds in the vicinity.

The private collection of Count von Berlepsch was acquired by the Senckenberg Museum in Frankfurt after his death (PALMER 1928). The bird collection of this museum includes a study skin of an adult male *Clytolaema rubricauda* (#86,989) from “Taquara do Mundo Novo” (a former name for Taquara, in use at Ihering’s time), which is undoubtedly the same specimen reported by BERLEPSCH & IHERING (1885). The specimen label (Fig. 1) indicates that it was received from H. von Ihering in January 1883. The label also contains a note (in German) stating that the specimen was originally preserved in alcohol, having been skinned by the same person who wrote the label, presumably Berlepsch himself (“War in Spiritus conservirt – von mir abgebalgt” [sic]).

A second published record for Rio Grande do Sul is that of a male reported as having been collected north of Porto Alegre in July 1956 (RUSCHI 1956). Though accepted by BELTON (1984, 1994), this record was considered unfounded by BENCKE (2001) in view of the inconsistencies between the information presented in the original source and the voucher material that was supposed to provide support for it. These inconsistencies strongly suggest that this and other Ruschi’s records from Porto Alegre and surroundings lack documentation and credibility (BENCKE 2001). Ruschi’s record also lacks biogeographic



Figure 1. Specimen of *Heliodoxa rubricauda* from the Senckenberg Museum, Frankfurt, collected by Hermann von Ihering at Taquara, Rio Grande do Sul, southern Brazil, in the early 1880s. Photo by G. Mayr.

coherence, since woodlands around Porto Alegre are relatively poor in Atlantic Forest endemics compared to forests on the adjacent escarpment (e.g., at Taquara).

Here we present recent records of *H. rubricauda* for Rio Grande do Sul, representing its rediscovery in the state after nearly 130 years. Records were obtained at 3 localities in the municipalities of São Francisco de Paula and Cambará do Sul, at the top of the steep escarpment leading to the highlands of the Southern Brazilian Plateau, in northeastern Rio Grande do Sul (Fig. 2). At 2 of these localities, birds were captured with

mist nets during banding activities (capture permits SISBio/ICMBio 43005-2 and 49050). Below, records are organized by locality and from south to north. Key diagnostic features used to identify the birds on site or from photographs include tail pattern, color of underwing coverts and size, among others (GRANTSAU 1988, RIDGELY et al. 2015).

São Francisco de Paula. In late afternoon on 13 March 2010, MR observed individuals of 3 hummingbird species visiting flowers of *Fuchsia regia* (Onagraceae) at the edge of a late secondary forest at CPCN Pró-Mata, which is a private reserve and research station encompassing 3,100 ha of southern temperate (*Araucaria*) forests, second growth and grasslands, managed by the PUCRS university of Porto Alegre. Because of the rainy weather and poor light condition, it was not possible to identify a hummingbird that emitted a repetitive call while foraging. The unfamiliar voice was recorded in the background of other species' recordings (Fig. 3) and later identified as that of *H. rubricauda* by comparison with audio samples available for this species at the Xeno-canto website (<http://www.xeno-canto.org>). The site where the species was discovered (29°29'27" S, 050°11'13" W) is extensively forested and lies at an altitude of 900 m above sea level on the border of the escarpment that rises westward from the adjacent coastal plain.

The presence of *H. rubricauda* at this locality was further confirmed when an adult male (Fig. 4; Table 1) was mist-netted on 16 November 2014 by DGO, GC and PE during the third Bird Banding and Molt Analysis (BBMA) course. For this course, mist nets were placed in *Araucaria* forest, both old-growth and young secondary, and also around the main building of the research station (29°28'48" S, 050°10'25" W), where the bird was captured. The BBMA took place between 16–22 November, but *H. rubricauda* was captured only once in the morning preceding the course. The bird did not show either bill corrugations or pale spots on the head, which are juvenile characters in most hummingbird species (ORTIZ-CRESPO 1972, PYLE 1997), and thus was aged as “FAJ” or after-First Cycle Juvenile according to the molt-based ageing system of WOLF et al. (2010) and JOHNSON et al. (2011). This code is used when a bird can confidently be identified as non-juvenile but cannot be aged more precisely, which typically occurs when the pre-formative molt is complete and results in an adult-like plumage aspect (JOHNSON et al. 2011).

Additionally, on 16 December 2010, GAB and DBM photographed an immature *H. rubricauda* (Fig. 5) among a congregation of about 17 hummingbirds of 6 species around backyard feeders just south of the town of São Francisco de Paula (29°28'07" S, 050°34'38" W; 910 m). The bird appeared intermittently from 09:15 h on, but always for short periods, during which it was persistently harassed by male Violet-capped Woodnymphs, *Thalurania glaucopis*. The temperature

Table 1. Body mass and measurements of *Heliodoxa rubricauda* captured in Rio Grande do Sul, southern Brazil.

Locality	Sex	Body mass (g)	Wing chord (mm)	Tail length (mm)
CPCN Pró-Mata, São Francisco de Paula	Male	7.7	71	45
Aparados da Serra National Park, Cambará do Sul	Male	8.0	71	40
Aparados da Serra National Park, Cambará do Sul	Male	7.6	75	46
Aparados da Serra National Park, Cambará do Sul	Female	7.0	65	40

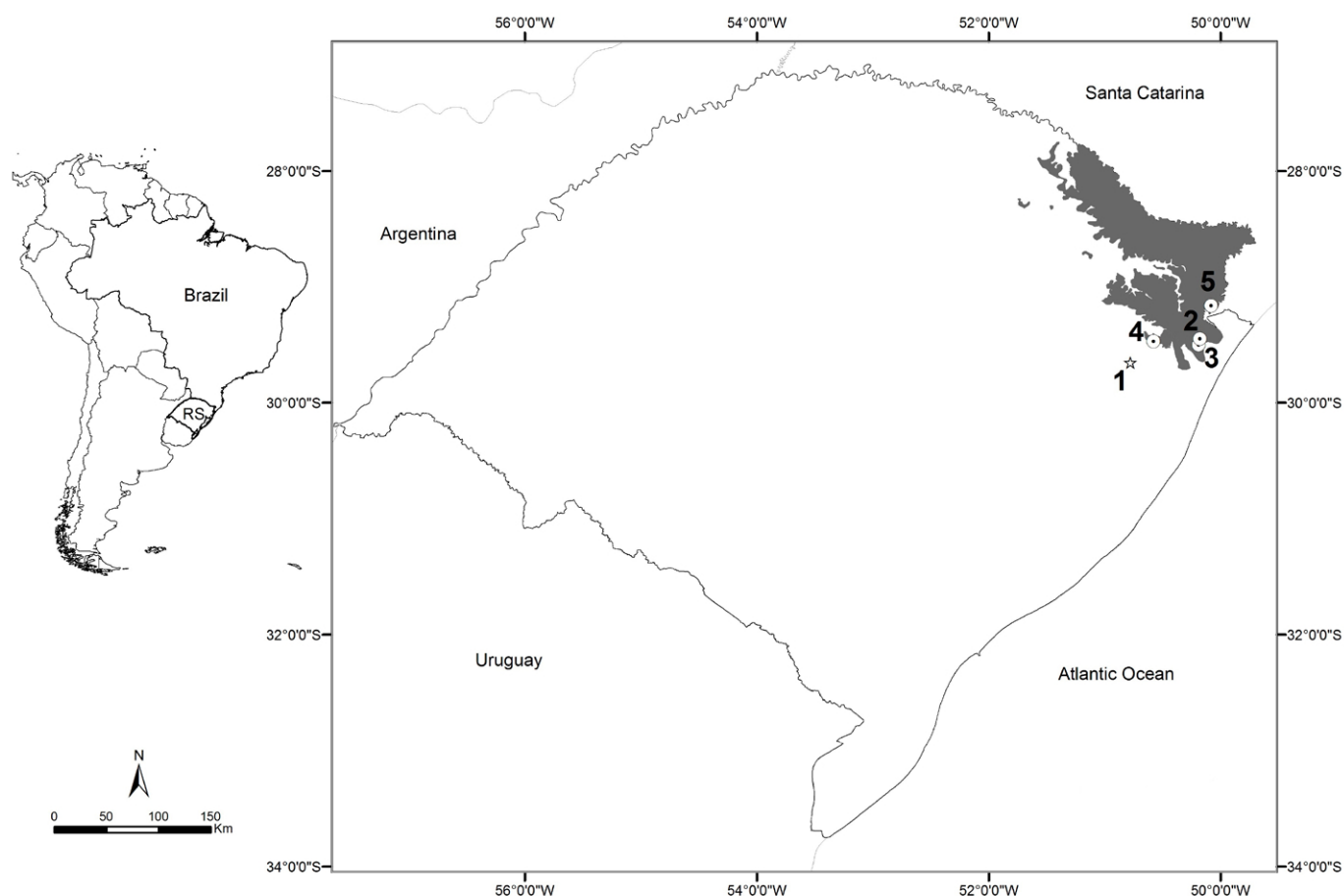


Figure 2. Map showing the locations of historical (star) and recent records of *Heliodoxa rubricauda* in Rio Grande do Sul, southern Brazil: (1) Taquara (Berlepsch and Ihering 1885); (2) and (3) CPCN Pró-Mata, São Francisco de Paula; (4) south of São Francisco de Paula; (5) Aparados da Serra National Park, Cambará do Sul. Records are numbered in chronological order. Areas above 900 m are shaded in gray.



Figure 3. Sonogram of *Heliodoxa rubricauda* calls, CPCN Pró-Mata, São Francisco de Paula, Rio Grande do Sul, 13 March 2010. Recorded with Sony PCM D50 combined with Sennheiser ME67 shotgun microphone. Spectrogram produced in Raven 1.5 (BIOACOUSTICS RESEARCH PROGRAM 2004) with the following parameters: DFT = 512 samples; frequency resolution = 188 Hz; time resolution = 2.1 ms and frame overlap = 50%. From an audio recording by M. Repenning.

was relatively low for the period (late spring) and the weather remained cloudy and windy throughout the day. The species was not recorded on 6 other visits to this area in March and May 2009, March and September 2010, March 2011, and October 2015. This site lies at the top of the escarpment rising northward from the adjacent Rio Rolante valley. Surrounding areas are mostly slopes and valleys covered with secondary and disturbed forests, clearings and small cultivated fields.

Cambará do Sul. In the morning of 11 January 2016, DF and field assistants captured 2 males in mist nets during a bird monitoring survey at the Aparados da Serra National Park (Figs. 6, 7; Table 1). In addition, a female was captured on 16 October (Fig. 8). The Aparados da Serra National Park covers about 10,000 ha of Atlantic rainforest interspersed with natural

grassland patches. The site where the specimens were captured (29°09'40" S, 050°04'49" W; 900 m) is close to the head of a steep canyon that opens southeastward into the narrow coastal plain across the Rio Grande do Sul/Santa Catarina border. The area is surrounded by approximately 800 ha of humid *Araucaria*-dominated forest with the understory primarily consisting of tree ferns (*Dicksonia sellowiana*).

The presence of *H. rubricauda* during the spring and summer in habitats potentially suitable for breeding, along with the record of an immature bird, suggests that the species may breed locally in northeastern Rio Grande do Sul. However, with so few records, it is too early to make any inferences about its breeding status and seasonality in the state. A southward range shift of this northerly species does not seem out of the question,



Figure 4. Male *Heliodoxa rubricauda* captured at CPCN Pró-Mata, São Francisco de Paula, Rio Grande do Sul, on 16 November 2014. The glittering red or pink gorget, in combination with the green underparts, is diagnostic in range. Photo by D. García-Olaechea.



Figure 5. Immature *Heliodoxa rubricauda* photographed on 16 December 2010 at São Francisco de Paula, Rio Grande do Sul. Tail pattern and color of underwing coverts (not apparent in this photograph), in combination with the straight bill and overall body size, were useful to identify this individual. Photo by G.A. Bencke.



Figure 6. Male *Heliodoxa rubricauda* captured and banded on 11 January 2016 at Cambará do Sul, Rio Grande do Sul. Note diagnostic tail pattern. Photo by D. Franco.



Figure 7. Male *Heliodoxa rubricauda* captured on 11 January 2016 at Cambará do Sul, Rio Grande do Sul. Note same distinctive features as in figures 4 and 6. Photo by D. Franco.

since at least 2 other hummingbird species are believed to be expanding their ranges in southern Brazil and into Rio Grande do Sul in recent years (STRAUBE et al. 2006, DAMIANI 2009, PETERSEN & PETRY 2009).

Our records were in localities situated at the top of the east- and southeast-facing slopes of the southern Brazilian highlands, in areas still extensively covered with upper mon-

tane and *Araucaria*-dominated mixed forests, now mostly secondary or disturbed. Because of their topographic position and proximity to the coast, these forests are often exposed to orographic precipitation and cloud formation, and are thus very humid. In fact, the average rainfall around São Francisco de Paula exceeds 2,250 mm per year and is reported to be the highest in southern Brazil, south of São Paulo (BACKES 2007).



Figure 8. Female *Heliodoxa rubricauda* captured on 16 October 2016 at Camará do Sul, Rio Grande do Sul. The extensively cinnamon underparts are diagnostic in range. Photo by D. Franco.

In Rio Grande do Sul, a number of bird taxa are clearly associated with the humid forests of this narrow elevation zone along the seaward border of the Southern Brazilian Plateau. These include the Atlantic Forest race of the Spectacled Owl, *Pulsatrix perspicillata pulsatrix*; the southern race of the Pale-browed Treehunter, *Cichocolaptes leucophrus holti*; the Black-capped Piprites, *Piprites pileata*; the Swallow-tailed Cotinga, *Phibalura flavirostris*; the Serra do Mar Tyrannulet, *Phylloscartes difficilis*; and, to a lesser extent, the Bare-throated Bellbird, *Procnias nudicollis*, and the Bay-chested Warbling-Finch, *Poospiza thoracica* (BENCKE et al. 2003). *Heliodoxa rubricauda* may present a similar distribution pattern in the southern reaches of its range.

In addition to our records, *H. rubricauda* has recently been documented in the municipality of Mampituba (29°13' S, 049° 56' W; ca. 35 m), on the border with Santa Catarina (NUNES 2015). This record along with the specimen from Taquara are so far the only records for the lowlands of Rio Grande do Sul. In southeastern Brazil, the species is believed to migrate altitudinally to lower elevations during the winter (WILLIS & ONIKI 2002, 2003, RIDGELY et al. 2015). Taquara is only about 27 km downslope from São Francisco de Paula and now mostly deforested. We speculate that *H. rubricauda* might have been a scarce winter visitor from the nearby highlands to this and other lowland locations of Rio Grande do Sul in the past.

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LITERATURE CITED

- BACKES, A. 2007. Precipitação pluviométrica e concentração de nutrientes minerais na água de chuva na região da Floresta Nacional de São Francisco de Paula, Rio Grande do Sul, Brasil. *Pesquisas Botânica* 58: 331–346
- BELTON, W. 1984. Birds of Rio Grande do Sul, Brazil. Part 1: Rheiidae through Furnariidae. *Bulletin of the American Museum of Natural History* 178: 369–636. <http://digitallibrary.amnh.org/handle/2246/576>
- BELTON, W. 1994. Aves do Rio Grande do Sul, distribuição e biologia. São Leopoldo: Unisinos. 584 pp.
- BENCKE, G.A. 2001. Lista de referência das aves do Rio Grande do Sul. Porto Alegre: Fundação Zoobotânica do Rio Grande do Sul (Publicações Avulsas FZB, 10). 102 pp.
- BERLEPSCH, H.V. & H.V. IHERING. 1885. Die Vögel der Umgegend von Taquara do Mundo Novo, Prov. Rio Grande do Sul. *Zeitschrift für die gesammte Ornithologie* 2: 97–184
- BIOACOUSTICS RESEARCH PROGRAM. 2004. Raven Pro: Interactive Sound Analysis Software (Version 1.5) [computer software]. Ithaca, NY: The Cornell Lab of Ornithology. Available from <http://www.birds.cornell.edu/raven>
- DAMIANI, R.V. 2009. Primeiro registro de *Phaethornis pretrei* (Aves, Trochilidae) para o Rio Grande do Sul, Brasil. *Biotemas* 22: 199–202. <https://doi.org/10.5007/2175-7925.2009v22n2p199>
- GRANTS AU, R. 1988. Os beija-flores do Brasil. Rio de Janeiro: Expressão e Cultura. 233 pp.
- JOHNSON, E.I., J.D. WOLFE, T. BRANDT RYDER & P. PYLE. 2011. Modifications to a molt-based ageing system proposed by Wolfe et al. (2010). *Journal of Field of Ornithology* 82: 422–424. <https://doi.org/10.1111/j.1557-9263.2011.00345.x>
- MCGUIRE, J.A., C.C. WITT, J.V. REMSEN JR., R. DUDLEY & D.L. ALTSHULER. 2009. A higher-level taxonomy for hummingbirds. *Journal of Ornithology* 150: 155–165. <https://doi.org/10.1007/s10336-008-0330-x>
- MCGUIRE, J.A., C.C. WITT, J.V. REMSEN, A. CORL, D.L. RABOSKY, D.L. ALTSHULER & R. DUDLEY. 2014. Molecular phylogenetics and the diversification of hummingbirds. *Current Biology* 24: 910–916. <https://doi.org/10.1016/j.cub.2014.03.016>
- NUNES, I. 2015. [WA2078292, *Clytolaema rubricauda* (Boddaert, 1783)]. Wiki Aves – a enciclopédia das aves do Brasil. Accessed at <http://www.wikiaves.com/2078292>, 15 July 2016.
- ORTIZ-CRESPO, F.I. 1972. A new method to separate immature and adult hummingbirds. *The Auk* 89: 851–857. <https://doi.org/10.2307/4084114>
- PALMER, T.S. 1928. Notes on persons whose names appear in the nomenclature of California birds. *The Condor* 30: 261–307
- PETERSEN, E.S. & M.V. PETRY. 2009. Confirmação do beija-flor-de-tesoura (*Eupetomena macroura*) (Aves, Trochilidae) no Estado do Rio Grande do Sul. *Biotemas* 22: 241–242. <https://doi.org/10.5007/2175-7925.2009v22n4p241>
- PIACENTINI, V.Q., A. ALEIXO, C.E. AGNE, G.N. MAURÍCIO, J.F.

- PACHECO, G.A. BRAVO, G.R.R. BRITO, L.N. NAKA, F. OLMOS, S. POSSO, L.F. SILVEIRA, G.S. BETINI, E. CARRANO, I. FRANZ, A.C. LEES, L.M. LIMA, D. PIOLI, F. SCHUNCK, F.R. AMARAL, G.A. BENCKE, M. COHN-HAFT, L.F.A. FIGUEIREDO, F.C. STRAUBE & E. CESARI. 2015. Annotated checklist of the birds of Brazil by the Brazilian Ornithological Records Committee. *Revista Brasileira de Ornitologia* 23: 91–298
- PYLE, P. 1997. Identification guide to North American birds, part I. Bolinas, CA: Slate Creek Press. 732 pp.
- RIDGELY, R.S., J.A. GWYNNE, G. TUDOR & M. ARGEL. 2015. Aves do Brasil. Vol. 2. Mata Atlântica do Sudeste. São Paulo: Editora Horizonte. 432 pp.
- RUSCHI, A. 1956. A trochilifauna de Porto Alegre e arredores. *Boletim do Museu de Biologia Prof. Mello-Leitão, Série Biologia* 18: 1–9.
- SCHUCHMANN, K.L. & G.M. KIRWAN. 2016. Brazilian Ruby (*Clytolaema rubricauda*); in: J. DEL HOYO, A. ELLIOTT, J. SARGATAL, D.A. CHRISTIE & E. DE JUANA (eds.). Handbook of the birds of the world alive. Barcelona: Lynx Edicions. Accessed at <http://www.hbw.com/node/55530>, 25 April 2016
- SICK, H. 1997. Ornitologia brasileira. Rio de Janeiro: Editora Nova Fronteira. 912 pp.
- STRAUBE, F.C., A. URBEN-FILHO & V.Q. PIACENTINI. 2006. O beija-flor-tesoura *Eupetomena macroura* (Gmelin, 1788) e sua ampliação de distribuição pelo sul do Brasil. *Atualidades Ornitológicas* 132. <http://www.ao.com.br/download/tesoura.pdf>
- WILLIS, E.O. 1992. Zoogeographical origins of eastern Brazilian birds. *Ornitologia Neotropical* 3: 1–15
- WILLIS, E.O. & K.-L. SCHUCHMANN. 1993. Comparison of cloud-forest avifaunas in southeastern Brazil and western Colombia. *Ornitologia Neotropical* 4: 55–63
- WILLIS, E.O. & Y. ONIKI. 2002. Birds of Santa Teresa, Espírito Santo, Brazil: do humans add or subtract species? *Papéis Avulsos de Zoologia* 42: 193–264
- WILLIS, E.O. & Y. ONIKI. 2003. Aves do Estado de São Paulo. Rio Claro: Editora Divisa. 398 pp.
- WOLFE, J.D., T.B. RYDER & P. PYLE. 2010. Using molt cycles to categorize the age of tropical birds: an integrative new system. *Journal of Field Ornithology* 81: 186–194. <http://www.jstor.org/stable/40983874>

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