

Aves, Finca Estrella de Agua – Páramo de Frontino, municipality of Salento, Quindío, Colombia

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ABSTRACT: We present a list of 92 bird species from Finca Estrella de Agua – Páramo de Frontino section (3,100 – 3,400 m) in Salento municipality, Quindío Department, Central Andes of Colombia. The list was made by a combination of visual and aural records and mist net captures during 2005, and complemented by opportunistic records during three consecutive years. Notably, our list includes three Colombian endemics and semi-endemics: *Eriocnemis derbyi* (DeLattre and Bourcier, 1846), *Eriocnemis mosquera* (DeLattre and Bourcier, 1846) and *Myioborus ornatus* (Boissonneau, 1840). Three threatened species were detected: *Andigena hypoglaucha* (Gould, 1833), *Bolborhynchus ferrugineifrons* (Lawrence, 1880), and *Buthraupis wetmorei* (Moore, 1934). Records led to altitudinal range extensions of four species: *Pipreola riefferii* (Boissonneau, 1840), *Glaucidium jadinii* (Bonaparte, 1855), *Margarornis squamiger* (d'Orbigny and Lafresnaye, 1838), and *Pachyrhamphus versicolor* (Hartlaub, 1843). We highlight the importance of this area for conservation plans.

INTRODUCTION

The Andes of South America span a length of 10,000 km and cover an area of 1,800,000 km². They contain some of the most diverse and threatened bird faunas worldwide, with almost 17% of all the global bird species recorded in an area of only 1.3% of the world's land surface (Fjeldså and Krabbe 1990; Kessler and Herzog 1998). In Colombia, Andean ecosystems persist mainly as fragments with different sizes and isolation levels (Kattan 2002). Therefore, it is important to have available inventories of the species persisting in such fragments in order to understand the conservation requirements of species (Stiles and Roselli 1998) and to promote additional biological studies.

In general, for Colombia, there are several studies that describe the distribution, behavior, and ecology of bird species in the Andes (e.g. Stiles *et al.* 1992; Stiles and Roselli 1998; Cuervo *et al.* 2003; Krabbe *et al.* 2006). Despite those and other recent works dealing with bird species richness of the Central Andes of Colombia (e.g. Rodríguez 2003; Marín-Gómez 2005; Cuervo *et al.* 2008a; b; Donegan *et al.* 2009) the local bird diversity of these mountains is still unknown for many localities as is exemplified by the description of new species from this zone during the last years (e.g. Cuervo *et al.* 2005).

Although there are some ornithological studies in the highlands of Quindío department (Chapman 1917; Renjifo 1994), studies dealing with birds in this part of the Central Andes have been conducted mainly in altitudes below 3,000 m (Renjifo and Andrade unpublished data; Renjifo 1991; 1999; 2001; Marín-Gómez 2005; 2007). The aim of this study is to present a list of the bird species of a well preserved and scientifically unexplored highland region, between 3,100 - 3,400 m, in the Quindío department, Central Andes of Colombia. Results were discussed in terms of the need of biodiversity conservation in this Colombian region.

MATERIALS AND METHODS

Study site

This study was conducted on the western slope of the Central Andes of Colombia at the northeastern section of Quindío Department (Figure 1), Salento municipality, in a zone between Finca Estrella de Agua (3,100 m, 04°37'23.9" N, 75°25'52.3" W) and Páramo de Frontino (3,400 m, 04°37'9.1" N, 75°25'30" W). This locality is different from Páramo de Frontino, Antioquia, Western Andes (Krabbe *et al.* 2006). Mean precipitation is around 1,400 mm/year, and mean temperature ranges between 6 and 12°C (Suarez and Cuadros unpublished data). The area is located near Los Nevados Natural National Park. Two main vegetation types are characteristic of this region: cloud forest and páramo (Figure 2).

The cloud forest is located between 3,100 and 3,300 m, and the vegetation is composed of trees, bushes and ferns. Some representative plant species of this forest are: *Hedyosmum cumbalence*, Chloranthaceae; *Weinmannia mariquitae*, Cunnoniaceae; *Tibouchina grossa*, Miconia latifolia, Melastomataceae; *Calamagrostis effusa*, *Chusquea tessellata*, Poaceae; *Pentacalia silvicola*, *Baccharis*, Asteraceae; and *Cyathea*, Cyatheaceae (Ospina-González and Valencia unpublished data). The trees are about 10 - 15 m high and several are covered by epiphytes (e.g. mosses, orchids, and bromeliads) and by a parasitic plant (*Gaiadendrum punctatum*, Loranthaceae). The higher section of the study area (between 3,300 and 3,400 m) is a Páramo with "Frailejones" (*Espeletia hartwegiana*, Asteraceae), grasses, bambues (*Chusquea*, *Calamagrostis*, *Neurolepis*, Poaceae), and puyas (*Puya trianae*); mixed with small patches of elfin forest composed of bushes and small trees (up to 8 m high) (*Diplostegium*, Asteraceae; *Miconia*, *Brachyotum*, *Tibouchina*, Melastomataceae) (Ospina-González and Valencia unpublished data).

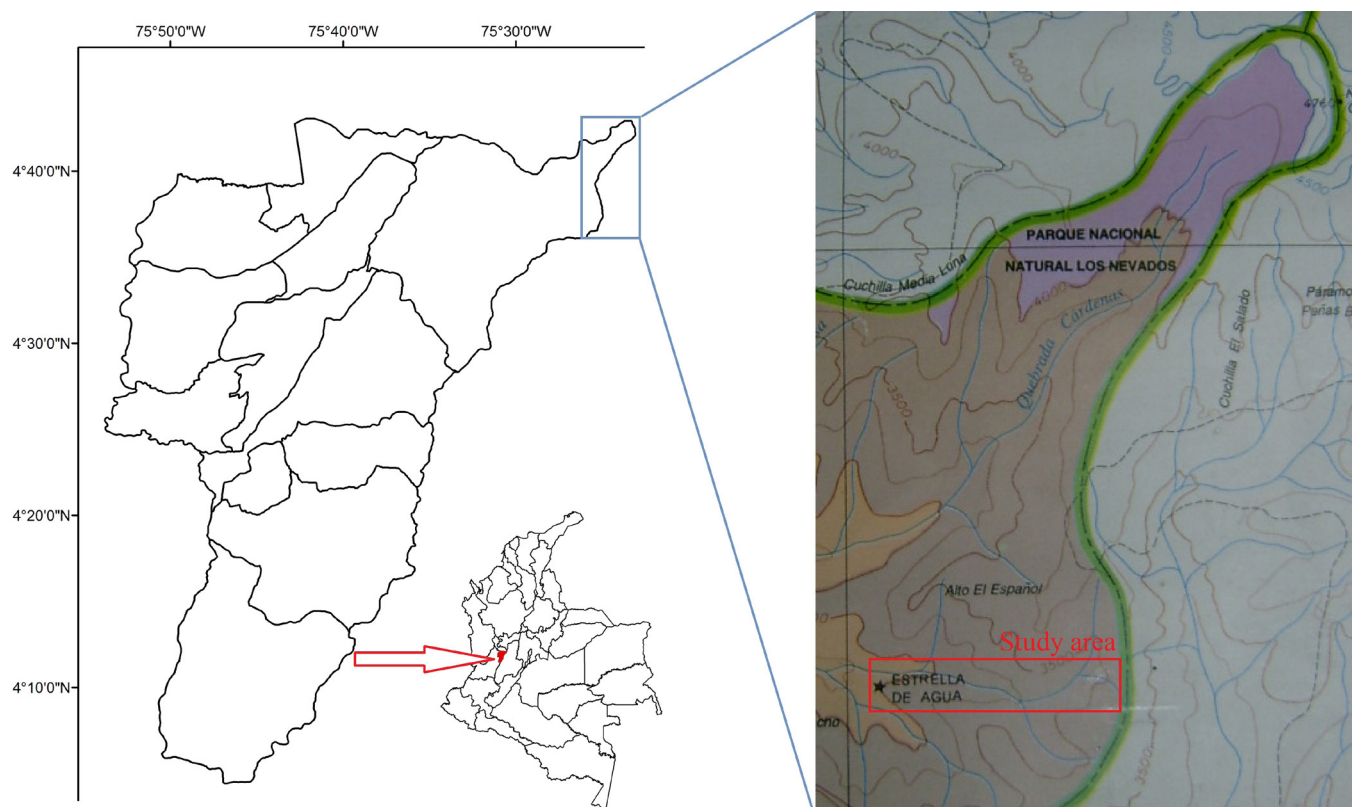


FIGURE 1. Finca Estrella de Agua – Páramo de Frontino section (3,100 – 3,400 m), Salento, Quindío, Central Andes of Colombia, where birds were surveyed between 2005 and 2008. Source: Instituto Geográfico Agustín Codazzi 1998. Scale - 1: 10000.



FIGURE 2. Two main vegetation types in the Páramo de Frontino, Salento, Quindío, Colombia: Páramo (the open landscape where “Frailejones”, *Espeletia hartwegiana*, presence is evident) surrounded by elfin and Montane Forest.

Data collection

The study area was visited three times, four days long every visit, between September and November 2005. Several posterior short visits were conducted by OHMG, between 2006 and 2008. We made visual and aural recordings while walking along a narrow path of 6 km in length that crossed the study area. In every visit we sampled two kilometers long sections, and every section was visited twice at day: one at 06:00 h - 10:00 h, and other at 14:00 h - 18:00 h. We did not obtain nocturnal records. In total we completed 96 hours of field observations (64 hours in the cloud forest and 32 hours in the páramo). Additionally, we set up a total length of 30 m of mist nets

between 06:00 h and 17:00 h each day, for a total of 330 mist net hours. As a surrogate for the species frequency we report the number of records (occasions in which we recorded one species) for each species on each habitat (Table 1). The nomenclature and classification follows the South American Checklist Committee (Remsen *et al.* 2009) while the conservation status and endemism was assigned following Renjifo *et al.* (2000; 2002).

RESULTS AND DISCUSSION

We recorded a total of 92 bird species, belonging to 28 families (Table 1). Five species were detected only through mist netting, and 26 were recorded during the subsequent visits to the area. These results indicate the importance of *ad libitum* observations in order to thoroughly document the species richness of a zone (*e.g.* O’Dea *et al.* 2004).

The list includes three species presently categorized of conservation concern (vulnerable): the Gray-breasted Mountain-toucan *Andigena hypoglaucha* (Gould, 1833), the Rufous-fronted Parakeet *Bolborhynchus ferrugineifrons* (Lawrence, 1880), and the Masked Mountain-tanager *Buthraupis wetmorei* (Moore, 1934) (Figure 3D); the latter record also represents an important range extension for the species that was published elsewhere (Arbeláez-Cortés and Baena-Tovar 2006). Three Colombian endemics and semi-endemics were also recorded: the Black-thighed Puffleg *Eriocnemis derbyi* (DeLattre and Bourcier, 1846) (Figure 3A), the Golden-breasted Puffleg *E. mosquera* (DeLattre and Bourcier, 1846), and the Golden-fronted Redstart *Myioborus ornatus* (Boissonneau, 1840).

We also document important altitudinal range extensions (that cover an increment of more than 300 m of elevation), for the following species: the Green-and-

black Fruiteater *Pipreola riefferii* (Boissonneau, 1840), the Andean Pygmy-owl *Glaucidium jardinii* (Bonaparte, 1855) (Figure 3B), the Pearled Treerunner *Margarornissquamiger* (d'Orbigny and Lafresnaye, 1838), and the Barred Becard *Pachyramphus versicolor* (Hartlaub, 1843). These species were only known for Colombia from altitudes up to 2,700, 2,800, 3,000, and 2,400 m, respectively (Hilty and Brown 1986), and were recorded in this study at 3,100, 3,200, 3,350, and 3,200 m, respectively. Three of these species were recorded via mist net captures (*P. riefferii*, *G. jardinii* and *M. squamiger*), while *P. versicolor* was observed in a bird mixed species flock together with some species of tanagers (e.g. *Buthraupis*, *Anisognathus*, and *Hemispingus*).

Another set of noteworthy records were those of the Purple-backed Thornbill *Ramphomicron microrhynchum* (Boissonneau, 1839), the Ocellated Tapaculo *Acropternis orthonyx* (Lafresnaye, 1843), the Black-backed Bush-

tanager *Urothraupis stolzmanni* (Taczanowski and Berlepsch, 1885) (Figure 3E), and the Chestnut-breasted Chlorophonia *Chlorophonia pyrrhophrys* (Sclater, 1851). All of these are species with scarce records, scattered populations, or “leapfrog” distributional ranges along the Andes (Hilty and Brown 1986; Fjeldså and Krabbe 1990, Ridgely and Tudor 1989; 1994; Restall et al. 2006).

It is worth mentioning that in our study area we observed indirect evidence of the presence of some endangered Andean mammals like the Andean Bear (*Tremarctos ornatus*) by signs of feeding (claw marks in *Puya* sp.) and the Mountain Tapir (*Tapirus pinchaque*) by the non-visual record of one individual that run away through dense vegetation. The presence of both species in the area was confirmed by local people. These observations are evidence of the health of the area explored and add value to the conservation importance of this region.



FIGURE 3. Noteworthy bird species recorded in the Finca Estrella de Agua – Páramo de Frontino section (3,100 – 3,400 m), Salento, Quindío, Central Andes of Colombia. A, *Eriocnemis derbyi*, a Colombian semiendemic species; B, *Buthraupis wetmorei*, a vulnerable species; C, an individual of *Glaucidium jardinii* that represents an altitudinal range extension; D, *Scytalopus spillmanni*, a very secretive species of Andean highland forests; E, *Urothraupis stolzmanni*, a species with scarce records in the region.

TABLE 1. Bird species recorded at Finca Estrella de Agua – Páramo de Frontino section (3,100 – 3,400 m), Salento, Quindío, Central Andes of Colombia. The habitat (Cloud Forest or Páramo) where each species was recorded is indicated. The total number of records for each species are presented as a surrogate of their frequency in the area. The letter “X” indicates species recorded by OHMG only during the additional visits to the area (only presence/absence data is available for these species). Means by which species have been recorded is informed (Type of record: O = observed, H= heard, C = captured with mist-net).

FAMILY/SPECIES	FOREST	PÁRAMO	TYPE OF RECORD
CRACIDAE			
<i>Chamaepetes goudotii</i> (Lesson, 1828)	1		O
<i>Penelope montagnii</i> (Bonaparte, 1856)	12		O,H
ACCIPITRIDAE			
<i>Accipiter ventralis</i> (Sclater, 1866)	1		C
<i>Geranoaetus melanoleucus</i> (Vieillot, 1819)		X	
<i>Buteo polyosoma</i> (Quoy and Gaimard, 1824)		X	
CHARADRIIDAE			
<i>Vanellus resplendens</i> (Tschudi, 1843)		X	
SCOLOPACIDAE			
<i>Gallinago nobilis</i> (Sclater, 1856)		X	
COLUMBIDAE			
<i>Patagioenas fasciata</i> (Say, 1823)		1	
PSITTACIDAE			
<i>Bolborhynchus ferrugineifrons</i> (Lawrence, 1880)		1	O
<i>Amazona mercenaria</i> (Tschudi, 1844)		1	O
STRIGIDAE			
<i>Ciccaba albitarsis</i> (Bonaparte, 1850)	X		
<i>Glaucidium jardiinii</i> (Bonaparte, 1855)	6		H,C
CAPRIMULGIDAE			
<i>Caprimulgus longirostris</i> (Bonaparte, 1825)		X	
APODIDAE			
<i>Streptoprocne zonaris</i> (Shaw, 1796)		1	O
TROCHILIDAE			
<i>Helianthus exortis</i> (Fraser, 1840)	8		O
<i>Ramphomicron microrhynchum</i> (Simon, 1921)		1	O
<i>Chalcostigma herrani</i> (DeLattre and Bourcier, 1846)		7	O,C
<i>Oxypogon guerini</i> (Boissonneau, 1840)		X	
<i>Metallura tyrianthina</i> (Loddiges, 1832)	7	1	O,C
<i>Eriocnemis derbyi</i> (DeLattre and Bourcier, 1846)	1	2	O,C
<i>Eriocnemis mosquera</i> (DeLattre and Bourcier, 1846)	13	4	O,C
<i>Coeligena torquata</i> (Boissonneau, 1840)	9		O
<i>Coeligena lutetiae</i> (DeLattre and Bourcier, 1846)	1		O
<i>Pterophanes cyanopterus</i> (Fraser, 1839)	X		
TROGONIDAE			
<i>Trogon personatus</i> (Gould, 1842)	12	1	O
RAMPHASTIDAE			
<i>Andigena hypoglaucha</i> (Gould, 1833)	3		H
PICIDAE			
<i>Veniliornis nigriceps</i> (d'Orbigni, 1840)	1		C
<i>Colaptes rivoli</i> (Boissonneau, 1840)	4		O
<i>Campephilus pollens</i> (Bonaparte, 1845)	1		O
FURNARIIDAE			
<i>Schizoeaca fuliginosa</i> (Lafresnaye, 1843)	X		
<i>Synallaxis unirufa</i> (Lafresnaye, 1843)	X		
<i>Hellmayrea gularis</i> (Lafresnaye, 1843)	3		O
<i>Margarornis squamiger</i> (d'Orbigni and Lafresnaye, 1838)	28	3	O,C

TABLE 1. CONTINUED.

<i>Pseudocolaptes boissonneautii</i> (Lafresnaye, 1840)	7		O,C
GRALLARIDAE			
<i>Grallaria squamigera</i> (Prevost and Des Murs, 1846)	9		O,H
<i>Grallaria nuchalis</i> (Sclater, 1859)	8		H
<i>Grallaria rufula</i> (Lafresnaye, 1843)	7		O
RHINOCRYPTIDAE			
<i>Scytalopus spillmanni</i> (Stresemann, 1937)	10	?	C,H
<i>Scytalopus canus</i> (Chapman, 1915)		X	
<i>Acropternis orthonyx</i> (Lafresnaye, 1843)	1		O
TYRANNIDAE			
<i>Phyllomyias nigrocapillus</i> (Lafresnaye, 1845)	X		
<i>Mecocerculus stictopterus</i> (Sclater, 1858)	17	1	O
<i>Mecocerculus leucophrys</i> (d'Orbigni and Lafresnaye, 1837)	14	3	O,C
<i>Anairetes agilis</i> (Sclater, 1856)	X		
<i>Pseudotriccus ruficeps</i> (Lafresnaye, 1843)	4		O,H
<i>Myiotheretes striaticollis</i> (Sclater, 1853)		X	
<i>Myiotheretes fumigatus</i> (Boissonneau, 1840)	X		
<i>Ochthoeca diadema</i> (Hartlaub, 1843)		X	
<i>Ochthoeca frontalis</i> (Lafresnaye, 1847)	2	1	O,C
<i>Ochthoeca rufipectoralis</i> (d'Orbigni and Lafresnaye, 1837)	X		
<i>Ochthoeca cinnamomeiventris</i> (Lafresnaye, 1843)	9		O,H
<i>Ochthoeca fumicolor</i> (Sclater, 1856)		2	O,C
COTINGIDAE			
<i>Ampelion rubrocristatus</i> (d'Orbigni and Lafresnaye, 1837)		6	O,C
<i>Pipreola riefferii</i> (Boissonneau, 1840)	16		C,H
<i>Pipreola arcuata</i> (Lafresnaye, 1843)	X		
TITYRIDAE			
<i>Pachyrhamphus versicolor</i> (Hartlaub, 1843)	X		
CORVIDAE			
<i>Cyanolyca armillata</i> (Gray, 1845)	3		O
HIRUNDINIDAE			
<i>Orochelidon murina</i> (Cassin, 1853)		2	O
TROGLODYTIDAE			
<i>Cinnycerthia unirufa</i> (Lafresnaye, 1840)	1		O
<i>Troglodytes solstitialis</i> (Sclater, 1859)	23		O,H
<i>Cistothorus platensis</i> (Latham, 1790)		20	O,C,H
<i>Henicorhina leucophrys</i> (Tschudi, 1844)	4		H
TURDIDAE			
<i>Turdus fuscater</i> (d'Orbigni and Lafresnaye, 1837)	35	4	O,H
THRAUPIDAE			
<i>Sericossypha albocristata</i> (Lafresnaye, 1843)	X	X	
<i>Hemispingus atropileus</i> (Lafresnaye, 1842)	X		
<i>Hemispingus superciliaris</i> (Lafresnaye, 1840)	12		O
<i>Hemispingus verticalis</i> (Lafresnaye, 1840)	8		O
<i>Buthraupis montana</i> (d'Orbigni and Lafresnaye, 1837)	16		O,C,H
<i>Buthraupis eximia</i> (Boissonneau, 1840)	26		O
<i>Buthraupis wetmorei</i> (Moore, 1934)	2		C
<i>Anisognathus lacrymosus</i> (Du Bus, 1847)	33		O
<i>Anisognathus igniventris</i> (d'Orbigni and Lafresnaye, 1837)	90	5	O,C,H
<i>Dubusia taeniata</i> (Boissonneau, 1840)	X		
<i>Iridosornis rufivertex</i> (Lafresnaye, 1842)	10	1	O

TABLE 1. CONTINUED.

<i>Tangara vassorii</i> (Boissenneau, 1840)	74		O,H
<i>Conirostrum sitticolor</i> (Lafresnaye, 1840)	19		O
<i>Diglossa lafresnayii</i> (Boissenneau, 1840)	7	7	O,C
<i>Diglossa humeralis</i> (Fraser, 1840)		1	C
<i>Diglossa cyanea</i> (Lafresnaye, 1840)	13	4	O,C
<i>Urothraupis stolzmanni</i> (Taczanowski and Berlepsch, 1885)	1	3	O,C
EMBERIZIDAE			
<i>Haplospiza rustica</i> (Tschudi, 1844)		X	
<i>Catamenia homochroa</i> (Sclater, 1858)		X	
<i>Arremon torquatus</i> (d'Orbigni and Lafresnaye, 1837)	1		O
<i>Atlapetes pallidinucha</i> (Boissenneau, 1840)	4	2	O,C
<i>Atlapetes schistaceus</i> (Boissenneau, 1840)	3		O
PARULIDAE			
<i>Dendroica fusca</i> (Muller, 1776)	X		
<i>Myioborus ornatus</i> (Boissenneau, 1840)	31		O,C,H
<i>Basileuterus luteoviridis</i> (Bonaparte, 1845)	2		O
ICTERIDAE			
<i>Cacicus chrysonotus</i> (d'Orbigni and Lafresnaye, 1838)	1		O
FRINGILLIDAE			
<i>Carduelis spinescens</i> (Bonaparte, 1850)		19	O,C
<i>Carduelis magellanica</i> (Vieillot, 1805)		X	
<i>Chlorophonia pyrrhophrys</i> (Sclater, 1851)	1		O

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LITERATURE CITED

- Arbeláez-Cortés, E. and O. Baena-Tovar. 2006. Primer registro del Azulejo de Wetmore (*Buthraupis wetmorei*, Thraupinae) para el Quindío, Andes Centrales de Colombia. *Ornitología Colombiana* (4): 78-81.
- Chapman, F.M. 1917. The distribution of bird-life in Colombia: a contribution to a biological survey of South America. *Bulletin of The American Museum of Natural History* (36): 1-729.
- Cuervo, A.M., F.G. Stiles, C. D. Cadena, J. L. Toro and G. A. Londoño. 2003. New and noteworthy bird records from the northern sector of the Western Andes of Colombia. *Bulletin of the British Ornithologist's Club* 123(1): 7-23.
- Cuervo, A. M., P. C. Pulgarín, Diego Calderón-F, J. M. Ochoa-Quintero, C. A. Delgado-V, A. Palacio, J. M. Botero and W. A. Múnera. 2008a. Avifauna of the northern cordillera central of the Andes, Colombia. *Ornitología Neotropical* 19(4): 495-515.
- Cuervo, A.M., P.C. Pulgarín and D. Calderón. 2008b. New distributional bird data from the Cordillera Central of the Colombian Andes, with implications for the biogeography of northwestern South America. *Condor* 110(3): 526-537.
- Cuervo, A. M., C. D. Cadena, N. Krabbe and L. M. Renjifo. 2005. *Scytalopus stilesi*, a new species of tapaculo (Rhynocryptidae) from the Cordillera Central of Colombia. *Auk* 122(2): 445-463.
- Donegan, T., J. E. Avendaño-C, B. Huertas and P. Flórez. 2009. Avifauna de San Pedro de los Milagros, Antioquia: una comparación entre colecciones antiguas y evaluaciones rápidas. *Boletín Científico del Museo de Historia Natural de la Universidad de Caldas* 13(1): 63-72.
- Fjeldsø, J. and N. Krabbe. 1990. *Birds of the high Andes*. Copenhagen: University of Copenhagen and Apollo Books. 876 p.
- Hilty, S.L. and W.L. Brown 1986. *A Guide to the Birds of Colombia*. Princeton: Princeton University Press. 836 p.
- Kattan, G.H. 2002. Fragmentación: Patrones y mecanismos de extinción de especies; p. 561-590. In M.R. Guariguata and G.H. Kattan (ed.). *Ecología y conservación de bosques neotropicales*. Costa Rica: Editorial LUR.
- Kessler, M. and S.K. Herzog. 1998. Conservation status in Bolivia of timberline habitats, elfin forest and their birds. *Cotinga* 10(1): 50-54.
- Krabbe, N., P. Flórez, G. Suárez, J. Castaño, J.D. Arango and A. Duque. 2006. The birds of Páramo de Frontino, Western Andes of Colombia. *Ornitología Colombiana* (4): 39-50.
- O'Dea, N., J.E.M. Watson and R.J. Whittaker. 2004. Rapid assessment in conservation research: a critique of avifaunal assessment techniques illustrated by Ecuadorian and Madagascar case study data. *Diversity and Distributions* 10(1): 55-63.
- Marín-Gómez, O.H. 2005. Avifauna del campus de la Universidad del Quindío. *Boletín SAO* 15(2): 42-60.
- Marín-Gómez, O.H. 2007. Visitas de "Aves insectívoras" al guamo, *Inga edulis* (Mimosoideae) en el departamento del Quindío, Colombia. *Boletín SAO* 17(1): 39-46.
- Remsen, J.V.Jr., A. Jaramillo, M. Nores, J.F. Pacheco, M.B. Robbins, T.S. Schulenberg, F.G. Stiles, J.M.C. da Silva, D.F. Stotz and K.J. Zimmer. 2009. *A classification of the bird species of South America*. American Ornithologists' Union. Electronic Database accessible at <http://www.museum.lsu.edu/~Remsen/SACCBaseline.html>. Captured on 15 September 2009.
- Renjifo, L.M. 1991. Discovery of the masked saltator in Colombia, with notes on its ecology and behavior. *Wilson Bulletin* 103(4): 685-690.
- Renjifo, L.M. 1994. First records of the bay-vented cotinga *Doliornis sclateri* in Colombia. *Bulletin of the British Ornithologist's Club* 114(2): 101-103.
- Renjifo, L.M. 1999. Composition changes in a subandean avifauna after long-term forest fragmentation. *Conservation Biology* 13(5): 1124-1139.
- Renjifo, L.M. 2001. Effect of natural and anthropogenic landscape matrices on the abundance of subandean bird species. *Ecological Applications* 11(1): 14-31.
- Renjifo, L.M., A.M. Franco, H. Álvarez-L, M. Álvarez, R. Borja, J.E. Botero, S. Córdoba, S. De La Zerda, G. Didier, F. Estela, G. Kattan, E. Londoño, C. Márquez, M.I. Montenegro, C. Murcia, J.V. Rodríguez, C. Samper and W.H. Weber. 2000. *Estrategia nacional para la conservación de las aves de Colombia*. Bogotá: Instituto Alexander von Humboldt. 35 p.

- Renjifo, L.M., A.M. Franco, J.D. Maya, G.H. Kattan, and B. López-Lanús. 2002. *Libro rojo de Aves de Colombia*. Serie libros rojos de especies amenazadas de Colombia. Bogotá: Instituto de Investigación de Recursos Biológicos Alexander von Humboldt y Ministerio del Medio Ambiente. 562 p.
- Restall, R., C. Rodner and M. Lentino. 2006. *Birds of Northern South America: an identification guide. Volume 1*. New Heaven: Yale University Press. 880 p.
- Ridgely, R. S. and G. Tudor. 1989. *The Birds of South America: Volume I: The Oscine Passerines*. Austin: University of Texas Press. 596 p.
- Ridgely, R. S. and G. Tudor. 1994. *The Birds of South America: Volume II: The Suboscine Passerines*. Austin: University of Texas Press. 814 p.
- Rodríguez, Q. 2003. Estudio de la comunidad aviaria en la Reserva Natural Semillas de Agua páramo de Los Valles, Cajamarca, Tolima. *Boletín Aleteo* 9 (Abril 2003): 1-15.
- Stiles, F.G., A.V. Ayala and M. Girón. 1992. Polinización de las flores de *Brachyotum* (Melastomataceae) por dos especies de *Diglossa* (Emberizidae). *Caldasia* 17(1): 47-54.
- Stiles, F.G. and L. Roselli. 1998. Inventario de las aves de un bosque altoandino: comparación de dos métodos. *Caldasia* 20(1): 29-43.

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