



Reproductive events of birds from Southern Ecuador

Ibeth P. Alarcón, Paul Molina Abril, María Cristina Ríos, Adrian Orihuela-Torres, Agustín Carrasco, Daniel Pacheco, Edison Juca, Ruth Arias, Carlos I. Espinosa, Leonardo Ordóñez-Delgado, Héctor Cadena-Ortiz & Boris A. Tinoco

To cite this article: Ibeth P. Alarcón, Paul Molina Abril, María Cristina Ríos, Adrian Orihuela-Torres, Agustín Carrasco, Daniel Pacheco, Edison Juca, Ruth Arias, Carlos I. Espinosa, Leonardo Ordóñez-Delgado, Héctor Cadena-Ortiz & Boris A. Tinoco (2023) Reproductive events of birds from Southern Ecuador, *Neotropical Biodiversity*, 9:1, 93-114, DOI: [10.1080/23766808.2023.2237229](https://doi.org/10.1080/23766808.2023.2237229)

To link to this article: <https://doi.org/10.1080/23766808.2023.2237229>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



[View supplementary material](#)



Published online: 27 Jul 2023.



[Submit your article to this journal](#)








[View related articles](#)



[View Crossmark data](#)

Reproductive events of birds from Southern Ecuador

Ibeth P. Alarcón ^{a,b}, Paul Molina Abril^a, María Cristina Ríos ^{b,c}, Adrian Orihuela-Torres^{d,e}, Agustín Carrasco^f, Daniel Pacheco^f, Edison Juca^f, Ruth Arias^g, Carlos I. Espinosa^d, Leonardo Ordóñez-Delgado ^{d,h}, Héctor Cadena-Ortiz ^{b,c} and Boris A. Tinoco ^a

^aEscuela de Biología, Universidad Del Azuay, Cuenca, Ecuador; ^bPajareando Ando Ecuador (Colectivo de Observadores de Aves), Ecuador; ^cDepartment of Ornithology, Instituto Nacional de Biodiversidad (INABIO), Quito, Ecuador; ^dLaboratorio de Ecología Tropical Y Servicios Ecosistémicos (EcoSs-Lab), Departamento de Ciencias Biológicas, Universidad Técnica Particular de Loja, Loja, Ecuador; ^eDepartamento de Biología Aplicada, Universidad Miguel Hernández, Elche, España; ^fIndependent Researcher; ^gHerbario Azuay, Universidad Del Azuay, Cuenca, Ecuador; ^hPrograma de Doctorado en Conservación de Recursos Naturales, Escuela Internacional de Doctorado, Universidad Rey Juan Carlos, Madrid, Spain

ABSTRACT

Understanding the reproductive biology of birds is crucial for comprehending their natural history and implementing effective conservation practices. However, there is limited information available on the reproductive behavior of many bird species in Southern Ecuador. This manuscript contributes to the knowledge of the reproductive biology of 127 bird species from the region, providing detailed information on five species whose reproductive traits were previously undocumented (*Urochroa leucura*, *Agriornis albicauda*, *Turdus maranonicus*, *Spinus olivaceus*, and *Stilpnia viridicollis*), as well as reproductive data on 12 species for which information was scarce (*Heliangelus viola*, *Chalcostigma stanleyi*, *Eriocnemis luciani*, *Coeligena iris*, *Megascops koepckeae*, *Conopophaga castaneiceps*, *Sclerurus obscurior*, *Leptasthenura andicola*, *Ochthoeca fumicolor*, *Geospizopsis unicolor*, *Catamenia inornata*, and *Sporophila castaneiventris*). Furthermore, we include additional information on the reproductive biology of 110 species that have already been documented. This manuscript provides the most up-to-date inventory of the reproductive behavior of bird species in Southern Ecuador, which can aid in the development of better conservation strategies in the region.

ARTICLE HISTORY

Received 14 June 2021
Accepted 10 July 2023

KEYWORDS

breeding biology;
reproduction; chicks;
hatching; nests

Introduction

Documenting the reproductive biology of birds is important for understanding their natural history, population dynamics, and evolutionary processes [1–4]. This information is also valuable for making informed management decisions in conservation [1]. For instance, studying the breeding biology of a species can aid to identify the factors that may be impacting reproductive success, such as habitat loss [5]. Nonetheless, the reproductive biology of many Neotropical birds remains largely unknown [3], including Ecuador, where there has been a recent increase in publications on the subject [6–10]. Despite these efforts, knowledge gaps still exist in certain regions, particularly in the southern area of the country [2], which is home to a high concentration of endemic and threatened species [11–16]. Therefore, there is a pressing need to fill these gaps to better understand and conserve Ecuadorian birds.

The reproductive biology of birds in Southern Ecuador is known for few descriptions of reproductive events in certain localities [9, 17–21], and for a low number of species [6–8, 21–33]. In this manuscript, we present information about the reproductive

biology of 127 species of birds that inhabit this region. In particular, we provide (1) detailed observations for five species for which reproduction was previously undocumented, (2) complementary information for 12 species for which reproductive information is scarce, and (3) further details of reproductive events for 110 better-documented species.

Methods

From 2007 to 2021, we collected information on bird reproductive events for multiple species as part of fieldwork activities performed by the authors in six provinces of Southern Ecuador (El Oro, Cañar, Azuay, Loja, Morona Santiago, and Zamora Chinchipe). When a breeding event was noted (adults carrying nest material, nest-building, copulating, laying eggs, incubating, eggs hatching, brooding, or fledglings with parental care), we recorded detailed descriptions of the reproductive behavior [34–36]. All observations were opportunistic. Furthermore, from May 2019 to April 2020, we conducted a search for records of bird reproduction documented on the social media group Pajareando Ando Ecuador hosted on

CONTACT Ibeth P. Alarcón  ibeth_alarcon@yahoo.com

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/23766808.2023.2237229>.

© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

Facebook, which is primarily composed of birdwatchers. These records were verified through photographs.

Our inventory of reproductive events included descriptions of location, habitat, nests, eggs, chicks, and parental care. Locations were assigned to natural regions following the classification from BioWeb [37]. Nesting materials were identified through direct observations, photographs, or by collecting

abandoned nests, and categorized as: plant, animal matter, and others. In the collected nests, materials coming from the incubation chamber was independently identified from those of outer lining. We used a digital caliper and a scale to measure and weigh nests, eggs, and chicks when possible. We present all measurements in millimeters (mm), except for the height of the nests from the ground, which we present in meters (m) and weights in grams (g). The development of the chicks was documented with photographs. We used binoculars and telescopes to obtain reproductive data when nests were out of reach. Since our observations were opportunistic, the amount of information collected for each species varied.

Finally, we carried out a bibliographic review of the reproductive biology of all the species to determine if there was any previously published information. The Macaulay Library at the Cornell Lab of Ornithology [38] and Google Scholar Internet search engine were used to search that information, employing common and scientific names of each bird species, and adding the keywords “nestling”, “reproduction” and “breeding”. We followed the taxonomy of the South American Classification Committee [39].

Results & discussion

We document 287 reproductive events for 127 species of birds, recorded between 2007 and 2021. Our inventory focuses on seven natural regions, with most of the breeding events recorded in the Andean shrub (93), Eastern Montane (79), and Paramo (42) (Supplementary Figure S1). We present data for 13 species that are distributed only in Ecuador and Peru, e.g. *Coeligena iris* and *Cranioleuca antisiensis* [15]; and for *Oreotrochilus chimborazo*, which is restricted to Ecuador and Colombia. Six species are threatened in Ecuador: *Spizaetus isidori* is Critically Endangered (CR), *Agriornis albicauda*, *Conirostrum binghami*, and *Xenodacnis parina* are Endangered (EN), and *Chalcostigma stanleyi* and *Penelope barbata* are Vulnerable (VU) [16]. In addition, four species are globally threatened: *Spizaetus isidori* is Endangered (EN), *Agriornis albicauda* is Vulnerable (VU), and *Conirostrum binghami* and *Penelope barbata* are Near Threatened (NT) [40].

Below, we provide comprehensive reproductive information for 17 species. Among these, 5 species

had no prior documentation available, while 12 had limited information previously published. The remaining 110 species have already some information published, and for these we present a summary with new and updated data.

Species with no previous breeding records

Urochroa leucura Lawrence, 1864 White-tailed Hillstar

Type of breeding event

A nest found during incubation.

Date

It was found on 20 September and visited again on 27 September 2018.

Location

Altitude of 1523 m a.s.l. Limon Indanza, Morona Santiago province. Eastern Montane natural region.

Habitat around the nest

River edge.

Nest location

On the bank of the river, where it was attached to a rock from the side (Figure 1a). The nest was constructed over the base of a former nest indicated by two distinct outer coverings.

Nest shape

Low cup.

Nest materials

Outer lining and incubation chamber included mosses, roots, and spiderwebs.

Clutch size

Two.

Eggs shape and color

Ovoid and white (Figure 1b).

Other observations

When we returned, on 27 September 2018, the nest had been destroyed due to the detachment of the rock that supported it.

Agriornis albicauda Sclater, 1860 White-tailed Shrike-tyrant

Type of breeding event

A nest was found with brooding chicks.

Date

It was found on 5 October, and monitored on 9, 13, and 21 October 2019.

Location

Altitude of 2769 m a.s.l. El Tablon, Cañar province. Andean Shrub natural region.

Habitat around the nest

Shrub and arboreal remnants and grasslands.

Nest location

At a fork of a tree branch (*Pinus patula*).

Nest shape

A platform-shaped.

Nest measurements

Nest was 3 m above the ground.



Figure 1. (a-b) Nest and eggs of White-tailed Hillstar *Urochroa leucura*, 20 September 2018, Limón Indanza, Morona Santiago. (c) Juvenile of Koeppcke's Screech-owl *Megascops koepckeae* feeding on a frog *Pristimantis* sp., 23 April 2019, Loja. (d) Nest and chick of Chestnut-crowned Gnateater *Conopophaga castaneiceps*, 12 December 2018, Tundayme, Zamora Chinchipe. (e) Nest and chick of Andean Tit-Spinetail *Leptasthenura andicola*, 6 August 2020, Cajas National Park, Azuay. (f) Nest and chick of Marañon Thrush *Turdus maranonicus*, 23 February 2016, Zamora Chinchipe. (g) Nest of Olivaceous Siskin *Spinus olivaceus*, 15 February 2016, Palanda, Zamora Chinchipe. (h) Adult carrying nest material of Plain-colored Seedeater *Catamenia inornata*, 27 March 2019, Moras, Loja. (i) Nest and chicks of Silver-backed Tanager *Tangara viridicollis*, 14 April 2016, Zumba, Zamora Chinchipe. Photos AC (A, H), PMA (B), DP (C), MCR (D), IPA (E), LOD (F, I), AOT (G).

Nest materials

Outer lining contained dry twigs (the majority greater than 3 mm in diameter), and *Pinus patula* needles; also, some moss was observed at the border of the nest. While the incubation chamber contained mammalian hair, dry twigs, small pieces of plastic, grass (Poaceae), and moss.

Chicks

Two.

Chick development

On 5 October 2019 chicks with closed eyes, the gapes and bill tips were yellow, nessoptiles gray covered the body, and the tails edge were white. After four days, pin feathers covered the body of the chicks, and with nessoptiles were present in their napes and lower backs. Bills had gray upper mandibles and yellow gapes (Figure 2a, b). After eight days, the chicks had pin feathers around their bills, eyes, and wings, and the rest of the body was covered with gray plumage. Some

pin feathers of the tail were emerging, revealing black feathers at the center and white feathers at the edges. Bills showed black mandibles and yellow tips (Figure 2c). After 16 days, we observed two fledglings perched on the branch of a pine tree, ~30 m away from the nest (Figure 2d), where they remained for several hours, sometimes making calls (<https://macaulaylibrary.org/asset/198645791>) while waiting for the adults. The plumage of the fledglings was similar to that of adults, but they retained the lower mandible and yellow gapes, with a belly and back showing a lighter coloration.

Adult behavior

We studied the nest attendance by the parents using a camera trap that was placed on 9 October for 4 hours, from 6:00 to 10:00. We detected an average feeding frequency of both adults of 1.75 (± 0.5 SD) events per hour. Overall, we recorded 15 feeding events, that included *Stenocercus* sp. and *Pholidobolus* sp. lizards as prey (<https://macaulaylibrary.org/asset/201932161>). We observed the adults fed the chicks several days after they left the nest.



Figure 2. Nest of White-tailed Shrike-tyrant *Agriornis albicauda*, El Tablón hill, Cañar. (a) ~9th day from hatching, adult individual delivering a lizard (*Pholidobolus* cf. *macbrydei*/cf. *prefrontalis*) to chick, 6 October 2019. (b) Adult individual delivering a lizard (*Stenocercus* cf. *festae*) to chick, 6 October 2019. (c) ~13th day, 10 October 2019. (d) ~19th day, 16 October 2019. Photos DP (A, B), PMA (C-D).

Previously published information

An individual with widened gonads and courtship observations during June in northern Ecuador [38].

***Turdus maranonicus* Taczanowski, 1880
Marañon Thrush****Type of breeding event**

Two nests were found with brooding chicks.

Date

Both nests on 23 February 2016.

Location

Altitude of 1290 m a.s.l. Palanda, Zamora Chinchipe province. Eastern Foothill natural region.

Habitat around the nest

Coffee agroforestry system.

Nest location

One nest was located on the base of a cut trunk belonging to a Porotón tree (*Erythrina edulis*), with sprouts covering the nest. The other nest was attached to the side of a trunk of an unidentified dead tree.

Nest shape

Robust low cups.

Nest measurements (n = 2)

Internal diameter 85 and 80 mm, external diameter 120 and 135 mm, cup depth 65 and 60 mm, nest height 112 and 110 mm. The height of the nest above ground is 1 and 2 m. The two nests were ~100 m apart from each other.

Nest materials (n = 2)

Outer lining of both nests contained fine dark brown roots. While the incubation chamber contained moss and some clay lining used externally at their bases (Figure 1f).

Chicks

One recently hatched individual was found in each nest. The eyes of the chicks were closed and their skins were orange with a fine line of nessesopiles on the head, nape, back, and wings. The bills still had egg

tooths and were predominantly orange with the gaps and white tips (Figure 1f).

***Spinus olivaceus* Berlepsch & Stolzmann, 1894
Olivaceous Siskin****Type of breeding event**

A nest was found with brooding chicks.

Date

15 February 2016

Location

Altitude of 1401 m a.s.l. Palanda, Zamora Chinchipe province. Eastern Foothill natural region.

Habitat around the nest

Grasslands.

Nest location

~8 m above the ground at the top of a dead tree of unidentified species.

Nest shape

Cavity.

Chicks

Two fully feathered chicks, visible when they stretched their heads begging for food upon arrival of the parents (Figure 1g).

Adult behavior

The chicks were attended multiple times by both adults.

***Stilpnia viridicollis* (Taczanowski, 1884)
Silver-backed Tanager****Type of breeding event**

A nest was found with brooding chicks.

Date

14 April 2016

Location

Altitude of 1788 m a.s.l. Zumba, Zamora Chinchipe province. Eastern Montane natural region.

Habitat around the nest

Coffee agroforestry system.

Nest location

Supported by the forked branch of a coffee plant.

Nest shape

High cup.

Nest measurements

Internal diameter 60 mm, external diameter 90 mm, cup depth 30 mm, and nest height 30 mm. Height of the nest above ground 1.5 m.

Nest materials

Outer lining contained moss, lichens, and small branches. While the incubation chamber contained fine roots.

Chicks

Two chicks with pink bills, white gaps, pink skin, and gray nessoptiles on the head, back, and wings, with pin feathers in the wings and flanks (Figure 1i).

Species with scarce reproductive information

Heliangelus viola (Gould, 1853) Purple-throated Sunangel

Type of breeding event

19 nest in total, one found during nest construction, 12 nests were found during incubation, five nests were found with brooding chicks, one had fledglings with parental care.

Date

Nests were found on 7, 19, and 20 November 2018; 7, 17, 24, 30 January; 3 February; 2 March; 17, 22, 24, 30 May 2019; 5 August; 24 January 2021.

Location

Altitudes between 2195 and 3992 m a.s.l. One record was in the Colina El Calvario, Cañar province, two records were in Moras and Jimbura, Loja province; and 16 records were in Turupamba, Tutupali Chico, Victoria del Portete, Checa, Y de Labrado, Comuna Balcón del Azuay, Soldados, Llaviucu – Parque Nacional Cajas, in Azuay province. Andean Shrub, eastern foothill, eastern montane, and western montane natural regions.

Habitat around the nest

One record was in grasslands and scattered trees, two records were next to riparian vegetation, and 16 records were surrounded by shrubs and tree remnants.

Nest location

One nest was hanging on a plastic thread, one nest was supported by roots of an unidentified orchid in a *Clethra* sp. tree, and 17 were located in the upper portions of embankment walls of tertiary roads (Figure 3a).

Nest shape

One nest was a high cup and the remaining 18 nests were low cups. Two nests were reused, clearly differentiated by the presence of fern clothing, one on top of the other. One of the reused nests was previously used by *Coeligena iris*.

Nest measurements

Internal diameter 30 mm ($n = 1$), external diameter mm 46.2 and 70 mm ($n = 2$), cup depth 23 mm ($n = 1$), nest height 55.5 and 70 mm ($n = 2$), dry weight 6.1 g ($n = 1$). Height of nests from the ground 1.5 ($n = 2$), 1.8, 2, and 5 m ($n = 5$).

Nest materials ($n = 16$)

Outers lining of all the nests contained mosses and lichens, and occasionally dry leaves, branches, and spiderwebs ($n = 4$). While the incubation chambers contained a softer vegetative material, brown in color, called indumentum of *Athyrium* sp. (Athyriaceae), and some nests had white seeds of unknown species ($n = 5$).

Clutch size

Eight nests had two eggs each (Figure 3b), and one nest contained three eggs (Figure 3d).

Eggs shape and color

Ovoid and white (Figure 3a).

Eggs measurements

One egg 15 × 10 mm.

Chicks

One nest contained two recently hatched chicks covered in scattered eggshell remains. Two nests had two hatchlings that were only a few days old; these presented beige nessoptiles on their backs. The last nest contained two fully feathered chicks with short, straight bills; the upper mandible was darker than the lower one, with black on the tips of the bill; nostrils were yellow and the gaps also presented a beige malar band and white post-eye patches; traces of nessoptiles were still present on their backs, feathers were primarily green, with



Figure 3. Nests of Purple-throated Sunangel *Heliangelus viola*. Nest 1: 17 May 2019, Balcón del Azuay, (a) Nest location and shape, (b) Nest with 2 eggs, (c) Chicks with full plumage development, 19 June 2019. Nest 2: 30 January 2019, Soldados, Azuay, (d) Nest with 3 eggs. Photos IPA (A-C), PMA (D).

black rectrices present along with purple throats (Figure 3c). We also observed a fledgling perched on a branch next to a nest while an adult came to feed it.

Adult behavior

Only the female was observed taking part in parental care.

Nesting phenology

We cannot estimate incubation or hatching periods for this species, but 34 days elapsed in one nest from the first observation, when the adult incubated the eggs, to the last observation when the chicks were fully feathered and possibly ready to leave the nest.

Previously published information and discussion

There is a study indicating reproductive dates [38], and other that includes descriptions of nests, eggs, and parental care, taken from two nests found in June in Peru [41]. Our findings show that the reproductive season of the species is year-round, expanding beyond the previously reported October to January period [38].

Additionally, our observations highlight the variability in the location and support of its nests. While the two nests found in Peru were in small holes in the rocks of an ancient wall [41], our nests were either hanging on a plastic thread in abandoned buildings or supported by roots in trees or embankments. Typically, the embankments exhibited protrusions caused by erosion, which revealed small overhangs and plant root systems suitable for nest construction.

In terms of egg-laying behavior, it is typical for hummingbirds to lay two eggs per nest. However, our observation includes a clutch of three, which is a rare occurrence. Records of up to five eggs have been documented in some species e.g. *Glaucis hirsutus*, *Threnetes ruckeri*; these records are rare, and perhaps the result of clutches laid by two or more females in the same nest [42].

Chalcostigma stanleyi (Bourcier, 1851) Blue-mantled Thornbill

Type of breeding event

Five nests in total, three nests found during incubation, and two nest was found with brooding chicks.

Date

These were found on 22 March; 3, 8 May; and 21 July 2019. All nests were monitored only once, except one, which was monitored 11 times, on 3, 23, and 31 May; 7, 10, 16, 27 June; 6, 13, and 21 July 2019.

Location

Altitudes between 3881 and 3906 m a.s.l. Three nests were in Cajas National Park, and two were on the Cuenca – Molleturo road, in Azuay province. Paramo natural region.

Habitat around the nest

Native shrub remnants.

Nest location

Under a road embankment.

Nest shape

High cups. Supported by roots and rocks. Two nests were reused possibly by the same adults after we observed the failure of a first attempt.

Nest measurements (n = 2)

Internal diameter 41.1 and 32.2 mm, external diameter 82.5 and 80 mm, cup depth 45 and 21.3 mm, nest height 96.8 and 70.6 mm, dry weight 12 g (n = 1). Height of nests from the ground 1.8, 2, and 2.1 m (n = 3).

Nest materials

Outer lining of all the nests contained mosses, lichens, dry branches, and fern pubescence. While the incubation chamber contained mammalian fur, white unidentified plant pubescence, and feathers.

Clutch size

Three nests had two eggs.

Eggs shape and color

Ovoid and white (Figure 4a).

Eggs measurements

Two eggs in one nest 10.3 × 15 mm, weighing 0.43 g; and 10.6 × 15.7 mm, 0.53 g.

Chick development (n = 1)

On 23 May 2019 hatchlings were born with closed eyes, light brown nessoptiles on the back, pink skin, and yellow bills (Figure 4b). After eight days, the eyes of the chicks remained closed, while pin feathers were developing on their backs and tails, and their bills showed a more intense yellow color (Figure 4c). After 15 days, the chicks had emergent pin feathers and showed gray beards and black bill tips. After 18 days, chicks still retain nessoptiles on their backs, and pin feathers in wings and tails, the

gaps and bill bases still yellow. After 24 days, chicks still retained nessoptiles on their tails. After 35 days, we observed that chicks had dark plumage, black and blue on the back, black and green on the chest, white post-eye patches, and yellow bills with black tips. After 40 days, we observed fledglings perching on branches close to the ground (Figure 4d). After 44 days, fledglings continued close to the nest and occasionally emitted small whistles while being fed by the adult female (<https://www.xeno-canto.org/480705>). After 51 days, one fledgling was seen feeding on flowers of *Gynoxys* sp. (Asteraceae), near the nest (Figure 4e). After 59 days (19 after leaving the nest), the fledgling showed plumage coloration similar to that of an adult, still lacking iridescence, with a cream mustache, beard, and throat, the gaps maintained some yellow.

Adult behavior

Only the female was observed participating in parental care.

Nesting phenology (n = 1)

An incubation period of 19 days, from the laying of eggs to the hatching of the first egg. The chicks remained in the nest for more than 24 days.

Previously published information and discussion

There is information on clutch size, egg color, and parental care in Bolivia [38], and also 13 records of breeding events in Papallacta, northern Ecuador, between July and November [43]; but these did not include details. The coloration of the eggs, clutch size, and parental care were similar to previous reports [38].

Eriocnemis luciani (Bourcier, 1847) Sapphire-vented Puffleg

Type of breeding event

Three nests in total, one nest found during incubation, and two nests were found with brooding chicks.

Date

These were found on 14 June 2011, 30 May, and 4 December 2019.

Location

Altitudes between 3003 and 3250 m a.s.l. One nest was in Laviucu, Cajas National Park and two nests were in Checa; in Azuay province. Eastern Montane and Eastern Montane natural regions.

Habitat around the nest

Shrub and arboreal remnants and grasslands.



Figure 4. Nests of Blue-mantled Thornbill *Chalcostigma stanleyi*, Cajas National Park, Azuay. Nest 1: (a) Eggs, 22 March 2019. Nest 2: (b) 2nd day from the hatching of the first egg, 8 May 2019, (c) 8th day, 14 May 2019, (d) Fledgling fed by an adult female, 10 June 2019. Nest 3: (e) Juvenile feeding on *Gynoxys* sp., 22 June 2019. Photos PMA.

Nest location

One nest supported by several roots in the upper portion of an embankment wall of a tertiary road (Figure 5c). Two other nests were recorded in forked branches of *Barnadesia arborea* and *Chusquea* sp. respectively (Figure 5a).

Nest shape

Low cups.

Nest measurements ($n = 2$)

Internal diameter 27.9 and 39.3 mm, external diameter 62.8 and 63.4 mm, cup depth 28 and 36 mm, nest height 55 and 78 mm. The height of nests from the ground was 2 and 2.5 m.

Nest materials ($n = 2$)

Outers lining of all the nests contained mosses, and one nest had dry leaves, branches, and spiderwebs. While the incubation chambers contained fern scales and soft white structures ($n = 1$).

Clutch size

One nest had two eggs.

Eggs shape and color

Ovoid and white (Figure 5b).

Chicks

Two nests with two chicks. The two chicks in one of the nests were fully feathered, with iridescent green coloration on the heads and backs, traces of golden nesoptyles on the lower backs, white post eye patches, gray tails, and wings feathers; bills with black upper mandibles, and beige lower mandibles, and lighter malar bands (Figure 5d).

Previously published information and discussion

There are descriptions of the nest, eggs, and parental care of this species, in Pichincha-Ecuador, in February [38,44]. Schuchmann [44] suggested that this species might choose covered sites for nesting to protect the nest. However, the nest we found in branches of *Chusquea* sp. was completely exposed. In addition, fern scales and white soft structures have not been previously described in the incubation chambers for this species.



Figure 5. Nests of Sapphire-vented Puffleg *Eriocnemis luciani*, Checa, Azuay. Nest 1: 30 May 2019, (a) Nest at a fork. (b) Eggs. Nest 2: 4 December 2019, (c) Nest on an embankment, (d) Chicks with full plumage development. Photos IPA.

***Coeligena iris* (Gould, 1854) Rainbow Starfrontlet**

Type of breeding event

Seven in total, an individual carrying nest material, one nest found during laying eggs, and four nests found during incubation.

Date

Nests were found on 8 February 2016; 21 September and 3 November 2018; 8 February, 10 June, and 19 December 2019; 22 January 2020. All nests were monitored only once, except one, which was monitored six times, on 3, 18 November; 1, 6, 12, and 15 December 2019.

Location

Altitudes between 3068 and 3228 m a.s.l. Two records in Tarqui, Laviuvu – Cajas National Park, and one record in Victoria del Portete, Turupamba, Nero, Cuenca – Molleturo road; in Azuay province. Eastern Montane natural region.

Habitat around the nest

Shrub and forest native and exotic remnants.

Nest location

One nest was embedded in several dry branches in the upper portions of embankment walls of tertiary roads. One nest was supported on its lateral part by plant stems (*Gynoxys* sp.). Four nests were supported on their lateral part by plastic threads, and electrical wires, inside abandoned buildings.

Nest shape

High cups.

Nest measurements (n = 4)

Internal diameter ranged from 28.8 to 35 mm, external diameter ranged from 47.7 to 70 mm, cup depth ranged from 12 to 20.5 mm, nest height ranged from 65.4 to 187 mm, dry weight 11.8 and 16.8 g ($n = 2$). The height of nests from the ground ranged from 1 to 6 ($n = 5$). Additionally, two nests in the same building were separated by ~50 m.

Nest materials (n = 4)

Outer lining contained mosses, while the incubation chamber showed brown fern scales. In the incubation chamber of one nest, we identified remains of fertilized

Poaceae flowers, and in another nest Bromeliaceae seeds.

Clutch size

Two nests had one egg, and two nests had two eggs.

Eggs shape and color

Ovoid and white (Figure 6a).

Eggs measurements

Three eggs in three nests, 10.2×7 mm, 12.2×8 mm, 15.4×9.7 mm; the last egg weighed 1.3 g.

Chick development ($n = 1$)

On 18 November 2018 recently hatched chicks had wet nessoptiles on their backs and were covered by scattered eggshell remains (Figure 6b). After 13 days, pin feathers were beginning to cover their bodies, with lower backs already developing dark brown plumage. The pin feathers in the malar zone were lighter in color; their bills were relatively small, with black tips and yellow gaps (Figure 6c). After 18 days, all the pin feathers were developing mature brown plumage, except

the malar band which showed a beige coloration and white post-eye patches. Traces of nessoptiles remained on the lower back, and the bills appeared longer and darker (Figure 6d). After 24 days, the chicks presented brown plumage on their wings and bellies, and the brown plumage on their heads and tails was noticeably darker compared with the rest of their bodies. The bills appeared fully grown, tips and upper mandibles were black, while lower mandibles and gaps were beige (Figure 6e). After 27 days, the nest was abandoned.

Adult behavior

Only the female was observed taking part in parental care.

Nesting phenology

The chicks remained in the nest for more than 24 days.

Other observations

We saw an adult repeatedly return to a mossy rock from which it collected moss possibly for nest-building.



Figure 6. Nest of Rainbow Starfrontlet *Coeligena iris*, Cajas National Park, Azuay. (a) Eggs, 3 November 2018. (b) Chicks with a few hours old, 18 November 2018. (c) 13th day from hatching, 1 December 2018. (d) 18th day, 6 December 2018. (e) 24th day, chicks with full plumage development, 12 December de 2018. Photos IPA.

Previously published information and discussion

Reproductive periods and descriptions of nests and eggs had been previously published [26,38]. One of the records includes two nests found in Llaviucu, Cajas National Park, our study area, in February and April [26]. Based on our observation, we found records of reproductive activity between November and February, and between June and September, suggesting that this species could breed year-round in Azuay, which aligns with previous records [26].

During our observation, we discovered a new nest location in which the nest was embedded in several dry branches in the upper portions of embankment walls. The materials used for construction were consistent with previous reports [26,38]. We also observed reddish plant material in the incubation chambers. This coloration may serve as camouflage for adult individuals since it resembles the plumage of their dorsum, wings, and tail [26].

In regards to clutch size, Ortiz-Crespo [26] also documented two eggs per nest. Therefore, our observations of nests containing only one egg may have been observed during egg-laying.

Megascops koepckeae Hekstra, 1982 Koepcke's Screech-owl

Type of breeding event

Two fledglings with parental care.

Date

23 April 2019.

Location

Altitude of 2131 m a.s.l. Universidad Técnica Particular de Loja, Loja province. Andean Shrub natural region.

Habitat around the nest

Shrub.

Fledglings

Two fledglings maintained nessoptiles all over the body. They had a barred plumage pattern, gray with white colors, with brown on the chest; the edges of the facial disc were black, the eyebrows white and the eyes yellow.

Other observations

Fledglings were perched on the tree branches of a *Podocarpus* sp., at a height between 3 and 4 m from the ground. During nestling provisioning, we identified two prey types: a scorpion *Teuthraustes* sp. (Chactidae), and a frog *Pristimantis* sp. (Strabomantidae) (Figure 1c).

Previously published information and discussions

There are breeding occurrences and descriptions of a nest in March in Peru [38, 45], one chick recorded in February 2014, and another one in December 2015 in Loja, Ecuador [46]. Based on previous local records and our data, we can suggest a local reproductive season from December to April.

Conopophaga castaneiceps Sclater, 1857 Chestnut-crowned Gnateater

Type of breeding event

A nest was found with brooding chicks.

Date

12 December 2019.

Location

Altitude of 1681 m a.s.l. Tundayme, Zamora Chinchipe province. Eastern montane natural region.

Habitat around the nest

Forest remnants

Nest location

The nest was located 50 cm above the ground. It was supported by epiphytic plants and roots.

Nest shape

Low robust cup, ovoid outer and circular incubation chamber

Nest measurements

External diameter 120.9 mm, internal diameter 55.8 mm, and height 50.8 mm.

Nest materials

Outer lining was mainly comprised of leaves and stem bark. While the incubation chamber contained thin fibers.

Chicks

Two chicks with bodies primarily covered in black plumage with brown tips; pin feathers were just beginning to develop on the backs and necks. The bills were dark with thickened yellow gapes (Figure 1d).

Adult behavior

Biparental care.

Previously published information and discussions

Previous reproductive knowledge of this species comes from observations in Colombia, with a nest found in February, and reproductive activities of adults between March and June [38, 47–49, Lizarazo-B and Londoño in prep.]. Hilty [47] describes a nest of this species, with similar characteristics to our observations, although he describes a distinctly ovoid inner

edge (60 × 40 mm) and with an outer lining fully covered by abundant vegetation. In addition, biparental care was previously reported [47].

Sclerurus obscurior Harter, 1901 South American Leaf-tosser

Type of breeding event

A nest found during incubation.

Date

It was found on 5 May 2019, and monitored on 10, 13, 18, 21, and 22 May 2019.

Location

Altitude of 1203 m a.s.l. Tundayme, Zamora Chinchipe province. Eastern Foothill natural region.

Habitat around the nest

Forest native remnant.

Nest location

It was inserted between the soil and the roots of a fallen tree (Figure 7a).

Nest shape

Cavity with access tunnel.

Nest measurements

Diameter of the entrance 64.5 mm; the height of nests from the ground 1.3 m.

Nest materials

The incubation chamber had abundant dry branches and clay walls.

Clutch size

Two.

Eggs shape and color

Ovoid and white, slightly stained with yellow spots from the clay material surrounding the nest (Figure 7b).

Eggs measurements

Two eggs were measured and weighed the same day they were found: 24.1 × 19.7 mm and 4.6 g; and 21.1 × 20 mm and 4.9 g; seven days later the eggs weighed 4.1 and 4.3 g.

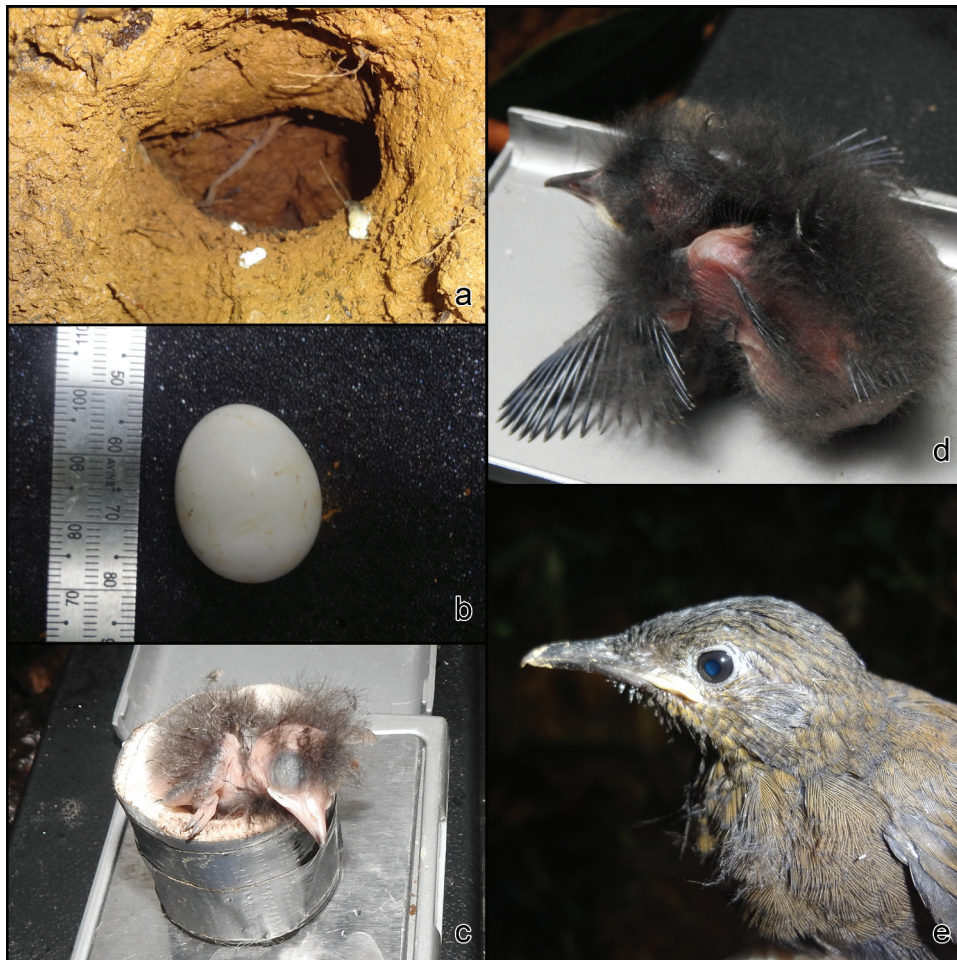


Figure 7. Nest of Tawny-throated Leaf-tosser *Sclerurus mexicanus*. (a) Nest entrance, 29 May 2019. (b) Egg, 5 May 2019. (c) Chick with a few hours old, 15 May 2019. (d) 5th day from hatching, 20 May 2019. (e) 13th day, chicks with full plumage development, 28 May 2019. Photos MCR.

Chick development

On 8 May 2019 the nest contained two chicks that had recently hatched. The hatchlings had closed eyes, sand-colored skin, and black nessoptiles on their heads, napes, wings, and backs; the bill presented a sandy color, with lighter gaps, and black-tip (Figure 7c). After two days, they had begun to open their eyes; they had abundant nessoptiles and pin feathers growing on the wings. The bills were black with sand-colored gaps. After five days, the chicks retained the nessoptiles on their heads, wing coverts, and backs; the flight feathers, flanks, and tail were already covered with pin feathers. Rumps and the secondary feathers 7, 8, and 9 had also begun to develop. The bills were completely black and the gaps remained sand-colored (Figure 7d). After 10 days, the pin feathers had emerged on most of the body, the backs and throats were covered in brown plumage, black wing coverts, and wing ropes were still growing, revealing black pin feathers. The heads also had pin feathers. The nessoptiles remained on the crown, nape, wings, lower back, and tail. The bill was long, black, with sand-colored gaps. After 13 days, the chicks showed fully developed plumage with brown coloration; wing feathers had black endings. Their feet and legs were black. The bill was long and black, with sand-colored gaps (Figure 7e). After 14 days, we did not find the chicks in the nest, and we observed feces around the entrance to the cavity (Figure 7a), suggesting that the chicks left the nest on their own.

Adult behavior

Only the female was observed taking part in parental care.

Nesting phenology

The chicks remained in the nest for more than 13 days.

Previously published information and discussions

Reproductive events for this species have been reported from Costa Rica, México, French Guiana, and Colombia [38, 48, 49], and northern Ecuador [50, 51]. The characteristics of the nest were similar to the previous descriptions [38, 50]. Previous records of this species also indicate clutch sizes of two, and immaculate eggs [38, 52, 53].

Leptasthenura andicola Sclater, 1870 Andean Tit-Spintail

Type of breeding event

Two nests, one was found during incubation, and the other with brooding chicks.

Date

6 August and 12 March 2021.

Location

Altitude of 3539 and 4132 m a.s.l. Cajas National Park, in Azuay province and Cerro de Arcos, in El Oro province. Paramo natural region.

Habitat around the nest

Polylepis forest and grassland.

Nest location

One nest was inside a crack in a *Polylepis* sp. tree and the other was inside a rock.

Nest shape

Cavity.

Nest measurements (n = 1)

External diameter 40 mm, nest height 71 mm. The measures were taken in the larger areas as they varied according to the contour of the crack. Height of nests from the ground is 1.1 m.

Nest materials (n = 1)

Included feathers, thin branches, straws (Poaceae), and pubescent *Puya* sp.

Chicks

One nest contained two chicks with gray nessoptiles on their heads, pin feathers on wings and throat; black colored eyes, yellow bills, inside and out, and black tips (Figure 1e).

Adult behavior

We recorded both adults carrying food for chicks and entering the cavities.

Previously published information and discussion

There are reports about individuals with reproductive conditions and a nest in September, in Colombia [38, 48, 54]; and some nests in northern Ecuador, between August to December [43]. Previously recorded nests were mostly found inside cavities but were reported as ball-shaped, sometimes complete, with entrances at the top or on the side [43, 54, 55]. This species takes advantage for natural cavities to nest-building.

Ochthoeca fumicolor Sclater, 1856 Brown-backed Chat-tyrant

Type of breeding event

Three in total, an individual carrying nest material, one nest found during incubation, and one nest was found with brooding chicks.

Date

There were found on 15 October 2018, 10 November, and 1 December 2019. One nest was monitored 4 times, on 3, 14, and 21 November 2018.

Location

Altitudes between 3205 and 3939 m a.s.l. Cuenca – Molleturo road in Azuay province, and Cerro de Arcos and Guanazan, in El Oro province. Paramo natural region.

Habitat around the nest

Paramo grassland.

Nest location

One nest was in the middle of a set of spikes of a Poaceae plant and the other nest was on the edge of a riverbank.

Nest shape

Low cups.

Nest measurements (n = 1)

Internal diameter 68.5 mm, external diameter 130.3 mm, cup depth 76.2 mm, nest height 110 mm, and dry weight 51 g. Height of nests from the ground is 34 cm.

Nest materials (n = 1)

Outer lining was mainly comprised of dry branches, with moss on the edges. While the incubation chamber contained pubescence of *Puya* sp.

Clutch size

One nest had two eggs.

Eggs shape and color

Ovoid and white, with irregularly scattered brown spots, more abundant on one egg (Figure 8a).

Eggs measurements

One nest with two eggs, 20.1 × 15.6 mm and 2.6 g; and 20.5 × 15.9 mm and 2.6 g.

Chick development (n = 1)

On 3 November 2018 the chicks had pink skin, yellow bills and legs, lighter gaps, and abundant gray nessoptiles on heads, wings, and backs (Figure 8b). After 11 days, the chicks presented pin feathers with a brown coloration that covered all the body and wings; they also retained nessoptiles at the nape and back; the bills were pale yellow with lighter gaps (Figure 8c). After 18 days, the chicks were fully feathered, with gray heads and a thick light brown superciliary band, their backs and wing coverts were brown, the tail and flight feathers were gray with light brown edges, and there were pin feathers on the alula. They had a gray throat, reddish-brown chest and flanks, white belly, and lower tail coverts;

the lower mandibles were darker pink in the center, but pale yellow on the gaps (Figure 8d, e). On day 18, the two chicks weighed 19.6 and 20.5 g.

Adult behavior

We assume biparental care because two adults arrived at the nest, where one delivered an insect to the chicks and the other waited near the nest, sometimes singing. On one occasion we observed an adult defended its territory, preventing other birds from approaching the nesting area, while the other individual remained inside the nest. Additionally, we recorded an adult collecting pubescence from *Puya hamata*, suggesting that it was constructing a nest (<https://macaulaylibrary.org/asset/195143531>).

Nesting phenology

The chicks remained in the nest for more than 18 days.

Previously published information and discussion

In Colombia, reproductive events for the species occurred between February and December, in Peru, there are records in November; in Bolivia in January [38] and Venezuela in March [56], and in northern Ecuador, there is a record in October [57]. However, there is no published information on chick development and adult behavior. Our records and previous show variations in the location of the nests, but all were surrounded by vegetation, e.g. the nest described in Ecuador [57] was located at the edge of a path, surrounded by vegetation (creeper plant), in Venezuela, one nest was surrounded by vegetation, and the other was in a cavity formed in an *Espeletia* sp [56]. While the characteristics and measurements of the eggs coincide with descriptions made by Kiff et al. [57].

Geospizopsis unicolor (Lafresnaye & D'Orbigny, 1837) Plumbeous Sierra-finch

Type of breeding event

Two nests were found during incubation.

Date

3 and 10 May 2019. The second nest was monitored on 8, 14, and 19 May 2019.

Location

Altitude of 3940 m a.s.l. Cuenca – Molleturo road, in Azuay province. Paramo natural region.

Habitat around the nest

Native shrub remnants.



Figure 8. Nest of Brown-backed Chat-tyrant *Ochthoeca fumicolor*, Cajas National Park, Azuay. (a) Eggs, 26 October 2018. (b) Chick with a few days old, 26 October 2018. (c) 11th day from hatching, 6 November 2018. (d) 18th day, two chicks in the nest, 13 November 2018. (e) 18th day, chick with the leg of an insect in its bill, 13 November 2018. Photos PMA.

Nest location

One nest has placed on top of a clump of a Poaceae, and the other was at the fork of a *Polylepis* sp. tree.

Nest shape

Low cups.

Nest measurements (n = 1)

Internal diameter 75 mm, external diameter 190 mm, cup depth 45 mm, nest height 100.7 mm.

Nest materials (n = 1)

Outer lining contained dry twigs, moss, and straw (Poaceae). The incubation chamber also contained moss and straw black, and white mammalian hair, and white pubescence.

Clutch size

Two nests with two eggs.

Eggs shape and color

Three eggs were pyriform and turquoise blue with dark-colored spots, and more numerous at the widest

pole (Figure 9a). One egg pyriform with dark brown spots (Figure 9e).

Eggs measurements

Two eggs in one nest with equal measures, 28 × 18 mm.

Chick development (n = 1)

On 8 May 2019 the nest contained an egg and a chick. The chick had yellow skin on the lateral parts and pink on the dorsal part, with abundant gray nessoptiles on the head, back, and wings (Figure 9b). ~6 days after hatching, the pin feathers began to develop in the head, wings, flanks, and back. The bill was dark brown in the center, while the gaps and the tip were white (Figure 9c). After ~11 days, the pin feathers began to emerge in the back, revealing a gray plumage with some sections of brown color. The bills were black with white gaps (Figure 9d).

Other observations

One of the nests had two remarkably different eggs in size and coloration, one egg was smaller with dark brown spots (Figure 9e), an anomaly called “dwarfism” [58].



Figure 9. Nests of Plumbeous Sierra-finch *Geospizopsis unicolor*, next to Cajas National Park, Azuay. Nest 1: (a) Nest with two eggs, 3 May 2019. (b) Hatching day, 8 May 2019. (c) 6th day, 14 May 2019. (d) 11th day, 19 May 2019. Nest 2: (e) Nest with two eggs, one with dwarfism. Photos PMA.

Nesting phenology

The chicks remained in the nest for more than 11 days.

Previously published information and discussion

In Chile, a reproductive season is noted between November and January, in Argentina between January and March, in Peru fledglings were observed between February and July, in Colombia males were recorded as being reproductively active between July and October [38]. For Ecuador, reproductive events reported in the north, including Papallacta, Micacocha, and Cotopaxi, between August and December [43]. Variation in the location of the nests of this species has been documented previously [43], as it was found by us. In addition, previous descriptions indicate similar coloration and egg measurements, and a clutch size of 2 to 3 eggs [38, 42]. However, we must also highlight the record with dwarfism, as it is possibly the first published report with this anomaly for this species. There are different theories about the cause of dwarfism, including the age of the laying birds, a temporary injury, or an infection in the female reproductive system; these eggs are infertile because they have little or no yolk [58], but we could not confirm the

viability of the anomalous egg as the nest was depredated five days after our first observation.

Catamenia inornata (Lafresnaye, 1847) Plain-colored Seedeater

Type of breeding event

Three in total, two couples were building their nest, and one record was of fledglings with parental care.

Date

27 March 2019, 28 October 2019, and 5 October 2020.

Location

Altitudes between 3015 and 3327 m a.s.l. Moras, in Loja province; leonan – Bulan, in Cañar province; and Checa, in Azuay province. Eastern Montana and western Montana natural regions.

Habitat around the nest

native shrub and forest remnants.

Nest location (n = 1)

It was supported by a clump of Poaceae.

Nest shape (n = 1)

Low cup.

Nest measurements (n = 1)

Internal diameter 52.5 mm, external diameter 113 mm, cup depth 53.4 mm, nest height 86 mm. It was located 20 and 10 cm above the ground. These measures were taken during nest-building.

Nest materials (n = 1)

Outer lining contained leaves of straw (Poaceae) (Figure 1h). While the incubation chamber also contained leaves of straw (Poaceae) and some dry leaves.

Adult behavior

Two adults were arriving with nest materials.

Previously published information and discussion

Several previous breeding records from Argentina and Colombia [38, 59–61]. Eggs and chicks of this species have been documented in Argentina between December to February, while in Colombia, it possibly reproduces throughout the year [38]. These are possibly the first records published for Ecuador. The variation in dates between the reproductive events reported in this document could reinforce the idea that this species reproduces throughout the year. Nests in Argentina were also found close to the ground and surrounded by abundant support from plants [59, 60].

***Sporophila castaneiventris* Cabanis, 1849
Chestnut-bellied Seedeater****Type of breeding event**

Four nests, three nests found during incubation, and one nest was found with brooding chicks.

Date

These were found on 21 March, 3 April, 27, and 30 December 2019. We monitored two nests, the first was on 21 March, 2, 5, 8, and 11 April 2019; and the second was on 27 December 2019, 2, and 4 January 2020.

Location

Altitudes between 817 and 978 m a.s.l. Tundayme, in Zamora Chinchipe province. Eastern Foothill natural region.

Habitat around the nest

Gardens and grasslands.

Nest location

On branches of ornamental plants.

Nest shape

Low cups.

Nest measurements (n = 4)

Internal diameter ranged from 32.3 to 61.5 mm, external diameter ranged from 61.4 to 81 mm, cup depth ranged from 32 to 40 mm, and nest height ranged from 37.1 to 39.1 mm. Height of nests from the ground ranged from 0.3 to 2.1 m.

Nest materials (n = 4)

These were constructed with thin dry leaves of Poaceae both in the outer lining and the incubation chamber.

Clutch size

Two nests had two eggs each, and one nest had three eggs.

Eggs shape and color

Pyriform and white with brown spots, more abundant, and larger towards the wide pole (Figure 10a).

Eggs measurements

One egg 16.9 × 12.8 mm and weight 1.45 g.

Chick development (n = 2)

On 27 December 2019, we saw the hatching of eggs from one nest. One chick had already hatched and the other was breaking the eggshell. The chicks had their eyes closed, with white natal plumage on their head, wings, back, thighs, and belly. The bill was yellow with white gaps, and an evident egg tooth (Figure 10b). After six days the hatching day, the chick remained with the eyes closed and brown nessoptiles all over the body, except on the wings, which already had pin feathers, as well as on the lower back and around the thighs, which had shorter pin feathers. The bill was gray with yellow gaps and tips (Figure 10c). After eight days, the chicks opened their eyes. They retained the nessoptiles on the head, with pin feathers starting to emerge, revealing light brown plumage. The bill was gray, with white gaps. We were unable to continue monitoring the development of the chicks.

On 2 April 2019, we found another nest with two close-eyed chicks, with white nessoptiles and pin feathers on the wings. After three days, the chicks retained brown nessoptiles on the head and started producing pin feathers on the wings and back, showing light brown plumage. The bill was gray, with white gaps. Characteristics are very similar to those recorded in the previous nests. After six days, the chicks showed a highly developed plumage, brown in color, with a darker tone in the dorsal zone (Figure 10d), very similar to that of adult females. The head still retained nessoptiles and abundant pin feathers. The bill was brown, with



Figure 10. Nests of Chestnut-bellied Seedeater *Sporophila castaneiventris*, Tundayme, Zamora Chinchipe. Nest 1: 24 March 2019. (a) Eggs. Nest 2: 5 January 2020. (b) Chick just hatching. (c) 6th day, 10 January 2020. Nest 3: 2 January 2020. (d) the developing chick looks similar to an adult female. Photos MCR.

a yellow gap and tip. After nine days, the nest was abandoned.

Adult behavior

Only the female was observed taking part in parental care.

Nesting phenology

Based on the characteristics of the chicks, we suggest that the hatching and rearing period in the nest for this species could be between ten and 12 days.

Previously published information and discussions

There are nest and egg descriptions for this species from Colombia between June and July [62]. These are possibly the first records published for Ecuador. The shape and location of nests from Colombia are similar, but nesting materials included dry branches and soft material on the edges [62]. Clutch size also was similar in Colombia, but eggs were reported as white with brown spots, lilac, and with black lines [62].

Overview of reproductive data for species with prior published information about reproduction

Altogether we reported 230 reproductive events for 110 species (Supplementary Table S1).

Type of breeding event

We report adults carrying nest-material $n = 25$, nest-building $n = 18$, laying eggs $n = 1$, incubating $n = 60$, brooding $n = 62$, fledglings with parental care $n = 38$, and nests monitored more than once $n = 14$

Nests location

We found nests in the forest (canopy, understory layer, and shrub) $n = 97$, on slopes and buildings $n = 61$, on the ground $n = 11$, and in riparian vegetation $n = 2$.

Nest shape

We identified four nest shapes: cups $n = 103$, simple $n = 27$, cavities $n = 20$, and closed $n = 19$.

Nest measurements

We took measurements of 57 nests of 41 species. In 91 nests of 46 species.

Nest materials

We found differences between the materials used for the construction of the external part and those of the incubation chamber, the latter being softer.

Clutch size

Most recorded nests had a clutch size of two eggs per nest ($n = 49$), five nests had one egg, three nests had three eggs, and three nests had four eggs; the last corresponded to the species: *Vanellus resplendens*, *Sayornis nigricans*, *Zonotrichia capensis*.

Egg shape and color

We recorded pyriform ($n = 29$) and ovoid ($n = 23$) eggs. The predominant color of the eggs was white ($n = 42$), some with spots or dots.

Eggs measurements

We measured 19 eggs, corresponding to 15 nests of 12 species.

Chicks

We recorded nests with one to six nestlings. Nests with two chicks were the most common ($n = 57$) and belonged to 36 species. One species that had six nestlings was *Crotophaga sulcirostris* this species has colonial nesting, so it is possible that more than one adult took care of this nest.

Chick development

We measured and recorded the plumage development of nestlings from 14 nests, corresponding to 12 species.

Nesting phenology

We present data on the duration of different breeding faces, including adult nest-building, copulating, laying eggs, incubating, brooding, and fledglings with parental care.

Adult behavior

We recorded 58 nests of 15 species where the female is the sole provider of parental care, and 49 nests of 33 species with biparental care.

Conclusions

Although there has been a recent increase in the descriptions of several aspects of the reproductive biology of birds inhabiting Ecuador, there are still many species for which information is either lacking or scarce. This manuscript aims to expand of the knowledge about reproductive biology of 127 birds

in Southern Ecuador, some of which have limited distributions and/or threatened conservation status. For some of these, we present the first available information about their reproduction. The knowledge gained from this study helps to better understand the natural history of the species and their ecological requirements in these unique area of Southern Ecuador.

The information provided in this manuscript can serve as a valuable baseline for future ecological research. For instance, our findings can be used to differentiate certain nesting patterns among individuals of the same species, such as the nests of *Leptasthenura andicola*, *Ochthoeca fumicolor*, and *Geospizopsis unicolor* the we discovered in sites that had not been documented before [1,43,54,56]. Additionally, it could be used to explore nesting patterns within a region. For instance, most clutch sizes in our records were of two eggs ($n = 69$), a common pattern for Neotropical birds [63]. In addition, we document interesting ecological interactions among species, as the event of nest parasitism of *Zonotrichia capensis* by *Molothrus bonariensis* [64].

We want to highlight the ability of various species of birds to reproduce in human-altered environments, such as houses or bridges (e.g. *Coeligena iris* and *Sayornis nigricans*), edges of secondary roads (e.g. *Heliangelus viola* and *Metallura tyrianthina*), and on introduced plant species (e.g. *Agriornis albicauda* and *Sporophila castaneiventris*). With the current rates of human modification of natural habitats, the ability of certain species to reproduce in human environments could be crucial in maintaining their populations.

We encourage to continue studying and publishing about the breeding biology of birds in neotropical regions, as that knowledge is key for understating the ecological and evolutionary factors that originate and maintain this biodiversity hotspot [3].

Acknowledgments

We thank Luis Curillo, Jonathan Aguirre, Victoria Argudo, Bernarda Vásquez, Omar Landázuri, Fabián Castillo, Berenice Vallejo, Gabriela Aguilar, Alejandro Trelles, Diego Cárdenas, Fabricio Peñaranda and Jorge Luna for sharing their nesting records. To Amanda Quezada for identifying the lizards. To Jake Hutton, Diana Székely and Ian J Ausprey for their valuable comments on the manuscript. We appreciate the detailed feedback from reviewers at Neotropical Biodiversity. AOT, LOD, CIE, BAT and IPA collaborated in the construction of this article while they were part of the project "Respuestas espacio temporales de las comunidades de aves a gradientes altitudinales y de perturbación en tres ecosistemas del Sur del Ecuador", financed by the Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT).

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Ibeth P. Alarcón  <http://orcid.org/0000-0003-2820-8535>
 María Cristina Ríos  <http://orcid.org/0000-0002-7807-0194>
 Leonardo Ordóñez-Delgado  <http://orcid.org/0000-0002-4593-1728>
 Héctor Cadena-Ortiz  <http://orcid.org/0000-0003-4653-2072>
 Boris A. Tinoco  <http://orcid.org/0000-0003-1054-8945>

Author contributions

IPA designed the research, compiled the data files and wrote the first draft of the manuscript; HCO, CIE, LOD and BAT revised the structure of the table to collect the data; HCO, LOD, PMA and MCR wrote or edited some of the species accounts; RA disaggregated and identified the nest materials; PMA made the plates; HCO, MCR, LOD, BAT and IPA edited the final version of manuscript; all authors contributed data and comments to the article.

References

- [1] Knowlton JL. Breeding records of birds from the Tumbesian Region of Ecuador. *Ornitol Neotrop.* 2010;21:109–129.
- [2] Greeney HF. Anidación de la avifauna ecuatoriana: dónde estamos y hacia dónde vamos. In: Cisneros-Heredia D, Freile J Guevara E ed., *Resúmenes de la IV Reunión Ecuatoriana de Ornitología*. Maldonado, Ecuador: Archivos Académicos USFQ, Quito; 2015. 2014 Aug 21–24. p. 9. doi: 10.18272/archivosacademicos.vi3.1471
- [3] Xiao H, Yigang H, Zedong L, et al. How much do we know about the breeding biology of bird species in the world? *J Avian Biol.* 2017;48(4):513–518. doi: 10.1111/jav.00934
- [4] Both C, Artemyev AV, Blaauw B, et al. Large-scale geographical variation confirms that climate change causes birds to lay earlier. *Proc Royal Soc B.* 2004;271(1549):1657–1662. doi: 10.1098/rspb.2004.2770
- [5] Oppel S, Schaefer HM, Schmidt V, et al. Cowbird parasitism of Pale-headed Brush-finch *Atlapetes pallidiceps*: implications for conservation and management. *Bird Conserv Int.* 2004;14(2):63–75. doi: 10.1017/S0959270904000103
- [6] Greeney HF. The nest and eggs of Black-capped Sparrow *Arremon abeillei abeillei* (Passerellidae) in southwestern Ecuador. *Rev Ecuatoriana Orn.* 2018;3(3):32–42. doi: 10.18272/reo.v0i3.1059
- [7] Molina AP, Carrasco UA, Iñiguez VX, et al. Primera descripción sobre la anidación del Dacnis Andino Norteño (*Xenodacnis petersi*) en Ecuador. *Ornitol Neotrop.* 2019;30:79–83. doi: 10.58843/ornneo.v30i0.394
- [8] Molina AP, Ordóñez-Delgado L. Aportes al conocimiento de la biología reproductiva del Pinchaflor Satinado (*Diglossa lafresnayii*). *Ornitol Neotrop.* 2019;30:193–195. doi: 10.58843/ornneo.v30i0.449
- [9] Greeney HF, Angulo PF, Dobbs RC, et al. Notes on the breeding biology of the Tumbesian avifauna in southwest Ecuador and northwest Peru. *Rev Ecuatoriana Orn.* 2020;6(6):1–54. doi: 10.18272/reo.vi6.1146
- [10] Molina AP, Alarcón IP, Curillo L, et al. Anidación del Colacintillo Coliverde *Lesbia nuna* (Apodiformes: Trochilidae) en Azuay, Ecuador. *Rev Ecuatoriana Orn.* 2021;7(2):53–60. doi: 10.18272/reo.v7i2.1917
- [11] Best BJ, Kessler M. *Biodiversity and Conservation in Tumbesian Ecuador and Peru*. Cambridge (UK): BirdLife Internacional; 1995.
- [12] Rahbek C, Bloch H, Køie PM, et al. The avifauna of the Podocarpus National Park – the “Andean jewel in the crown” of Ecuador’s protected areas. *Ornitol Neotrop.* 1995;6:113–120.
- [13] Ridgely RS, Greenfield PJ. *Birds of Ecuador. Volume 1, Status, distribution, and taxonomy*. Ithaca (NY): Cornell University Press; 2001.
- [14] Freile JF, Santander T, coordinadores. *Áreas de importancia para la Conservación de las Aves en Ecuador*. Quito (EC): Aves & Conservación, BirdLife International, Conservación Internacional y Ministerio del Ambiente; 2005.
- [15] Freile JF, Restall R. *Birds of Ecuador*. Londres (UK): Helm Field Guides; 2018.
- [16] Freile JF, Santander GT, Carrasco L, et al. *Lista Roja de las Aves del Ecuador continental*. Quito (EC): Ministerio del Ambiente, Aves y Conservación, Comité Ecuatoriano de Registros Ornitológicos, Fundación Charles Darwin, Universidad del Azuay, Red Aves Ecuador y Universidad San Francisco de Quito; 2019.
- [17] Best BJ, Clarke CT. *The threatened birds of the Sozoranga region southwest Ecuador*. Cambridge (UK): International Council for Bird Preservation, University of East Anglia; 1991.
- [18] Best BJ, Clarke CT, Checker M, et al. Distributional records, natural history notes, and conservation of some poorly known birds from southwestern Ecuador and northwestern Peru. *Bull Br Ornithol Club.* 1993;113:234–255.
- [19] Best BJ, Checker M, Thewlis RM, et al. New bird breeding data from southwestern Ecuador. *Ornitol Neotrop.* 1996;7:69–73.
- [20] Cisneros-Heredia DF. Notes on breeding, behavior and distribution of some birds in Ecuador. *Bull Br Ornithol Club.* 2006;126(2):153–164.
- [21] Greeney HF, Juiña ME, Harris JBC, et al. Observations on the breeding biology of birds in south-east Ecuador. *Bull Br Ornithol Club.* 2010;130(1):61–68.
- [22] Schulenberg TS, Gill FB. First description of the nest of the Olive Finch, *Lysurus castaneiceps*. *Condor.* 1987;89(3):673–674. doi: 10.2307/1368661
- [23] Robbins MB, Ridgely RS, Cardiff SW. Voice, plumage and natural history of Anthony’s Nightjar (*Caprimulgus anthonyi*). *Condor.* 1994;96(1):224–228. doi: 10.2307/1369085
- [24] Rasmussen JF, Rahbek C, Poulsen BO, et al. Distributional records and natural history notes on threatened and little known birds of southern Ecuador. *Bull Br Ornithol Club.* 1996;116(1):26–46.
- [25] López LB, Lowen JC. Observations of breeding activity in El Oro Parakeet *Pyrrhura orcesi*. *Cotinga.* 1999;11:46–47.
- [26] Ortiz-Crespo F. The nest of the Rainbow Star-frontlet, *Coeligena iris*. *Bull Br Ornithol Club.* 2000;120(4):205–208.
- [27] Oppel S, Schaefer HM, Schmidt V. Description of the nest, eggs, and breeding behavior of the endangered Pale-headed Brush-Finch (*Atlapetes pallidiceps*) in Ecuador. *Wilson Bull.* 2003;115(4):360–366. doi: 10.1676/03-020
- [28] Greeney HF, Rombough CJF. First nest of the Chusquea Tapaculo (*Scytalopus parkeri*) in Southern Ecuador. *Ornitol Neotrop.* 2005;16:439–440.

- [29] Greeney HF, Sherman N, Lynch R, et al. The nest and eggs of Maroon-chested Ground-dove *Claravis monde-toura* in south-east Ecuador. *Cotinga*. 2007;28:71–73.
- [30] Greeney HF, Zyskowski K. Incubation behavior of the White-browed Spinetail (*Hellmayrea gularis*) in Southeastern Ecuador. *Ornitol Neotrop*. 2008; 19:451–456.
- [31] Juiña ME, Harris JBC, Greeney HF. Description of the nest and parental care of the Chestnut-naped Antpitta (*Grallaria nuchalis*) from Southern Ecuador. *Ornitol Neotrop*. 2009;20:305–310.
- [32] Greeney HF. The nest, eggs, and nesting success of the Ecuadorian Thrush (*Turdus maculirostris*) in southwest Ecuador. *Ornitol Colomb*. 2010;10:38–42.
- [33] Ordóñez-Delgado L. Primera descripción del nido del Pinchaflor Satinado (*Diglossa lafresnayii*) en el Parque Nacional Podocarpus, Andes del Sur de Ecuador. *Ornitol Neotrop*. 2016;27:121–124. doi: 10.58843/orn neo.v27i0.89
- [34] Barta Z, Székely T. The optimal shape of avian eggs. *Funct Ecol*. 1997;11(5):656–662. doi: 10.1046/j.1365-2435.1997.00136.x
- [35] Simon JE, Pacheco S. On the standardization of nest descriptions of neotropical birds. *Rev Bras Ornitol*. 2005;13(2):143–154.
- [36] Cadena-Ortiz H. Sugerencias para la toma de datos en eventos de biología reproductiva de aves. *Av Cienc Ing*. 2018;10(1):24–35. doi: 10.18272/aci.v10i1.297
- [37] Regiones naturales del Ecuador [Internet]. Quito (EC): BIOWEB, Pontificia Universidad Católica del Ecuador; [updated 2019 Jan 31 cited 2021 Apr 1]. Available from: <https://bioweb.bio/faunaweb/amphibiaweb/RegionesNaturales>
- [38] Birds of the World [Internet]. New York (US): Cornell Lab Of Ornithology's Macaulay Library; [updated 2020 cited 2020 Sep 23]. Available from: <https://www.macaulaylibrary.org/>
- [39] A classification of the bird species of South America [Internet]. Philadelphia: South American Classification Committee, American Ornithologists' Union; [updated 2021 cited 2021 Feb 2]. Available from: <https://www.museum.lsu.edu/~Remsen/SACCWordFiles/SACCBaseline01.html>
- [40] The IUCN Red List of Threatened Species. [Internet]. United Kingdom (UK): International Union for Conservation of Nature IUCN; [updated 2021 cited 2022 Feb 6]. Available from: <https://www.iucnredlist.org>
- [41] Rivas ME. Registro de anidación del Ángel-del-Sol de Garganta Púrpura (*Heliangelus viola*) en el Complejo Arqueológico de Aypate, Ayabaca, Piura – Perú. *Bol UNOP*. 2014;9(1):5–10.
- [42] Ortiz-Crespo FI. Los colibríes historia natural de unas aves casi sobrenaturales. 2nd ed. Quito (EC): Imprenta Mariscal; 2011.
- [43] Greeney HF, Martin PR, Gelis RA, et al. Notes on the breeding of high-Andean birds in northern Ecuador. *Bull Br Ornithol Club*. 2011;131(1):24–31.
- [44] Schuchmann KL. A nest of the Sapphire-vented Puffleg *Eriocnemis luciani*. *Bull Br Ornithol Club*. 1988;108(1):13–14.
- [45] Fjeldså J, Baiker J, Engblom G, et al. Reappraisal of Koepcke's Screech Owl *Megascops koepckeae* and description of a new subspecies. *Bull Br Ornithol Club*. 2012;132(3):180–193.
- [46] Ordóñez-Delgado L, Freile J. First records of Koepcke's Screech-Owl *Megascops koepckeae* (Aves: Strigidae) in Ecuador. *Rev Ecu Ornitol*. 2019;5:25–29. doi: 10.18272/reo.vi5.1193
- [47] Hilty SL. Notes on a nest and behavior of the chestnut-crowned gnatcatcher. *Condor*. 1975;77(4):513–514. doi: 10.2307/1366112
- [48] Hilty SL, Brown WL. A guide to the birds of Colombia. New Jersey (US): Princeton University Press; 1986.
- [49] Greeney HF. Antpittas and Gnatcatchers. United Kingdom (UK): Helm Identification Guide Series; 2018.
- [50] Greeney HF, Gelis RA, White R. Notes on breeding birds from an Ecuadorian lowland forest. *Bull Br Ornithol Club*. 2004;124(1):28–37.
- [51] Solano-Ugalde A, Arcos-Torres A, Greeney HF. Additional breeding records for selected avian species in northwest Ecuador. *Bol SAO*. 2007;17(1):17–25.
- [52] Rowley JS. Breeding records of land birds in Oaxaca, Mexico. 1984;2(3); California (US): Western Foundation of Vertebrate Zoology.
- [53] Londoño GA. Parque Nacional del Manu, Cusco, Perú. Anidación de Aves en un Gradiente Altitudinal. *Rapid Color Guide*. 2014;514(1):1–36. Chicago (US); The Field Museum.
- [54] Coludito Frailejonero (*Leptasthenura andicola*) [Internet]. Cali (CO): Wiki Aves Colombia, Universidad ICESI; [cited 2020 Jul 10]. Available from: <https://n9.cl/z1bra>
- [55] Zyskowski K, Prum RO. Phylogenetic analysis of the nest architecture of Neotropical Ovenbirds (Furnariidae). *Auk*. 1999;116(4):891–911. doi: 10.2307/4089670.
- [56] Vuilleumier F, Ewert DE. The distribution of birds in Venezuelan páramos. *Bull Am Mus Nat Hist*. 1978;162(2):49–90.
- [57] Kiff LF, Marin AM, Sibley FC, et al. Notes on the nests and eggs of some Ecuadorian birds. *Bull Br Ornithol Club*. 1989;109(1):25–31.
- [58] Hernández F, Arredondo JA, Hernández F, et al. Abnormal eggs and incubation behavior in Northern Bobwhite. *Wilson J Ornitol*. 2006;118(1):114–116. doi: 10.1676/05-016.1
- [59] Salvador SA, Narosky S. Nuevos nidos de aves argentinas. *Muscisaxicola rufivertex*, *Catamenia inornata*, *Sicalis olivascens* y *Carduelis crassirostris*. *Hornero*. 1983;12(2):134–137. doi: 10.56178/eh.v12i2.1207
- [60] Salvador SA. Reproducción de aves andinas del Noroeste Argentino. *Hist Nat*. 2015;5(1):49–76.
- [61] De La Peña MR. Nidos y reproducción de las Aves Argentinas. Número 8. Santa Fe (AR): Ediciones biológica, serie naturaleza, conservación y sociedad; 2013.
- [62] Espiguelo Ventricastaño (*Sporophila castaneiventris*) [Internet]. Cali (CO): Wiki Aves Colombia, Universidad ICESI; [cited 2020 Jul 10]. Available from: <https://n9.cl/foa4>.
- [63] Skutch AF. Clutch size, nesting success, and predation on nests of Neotropical birds, reviewed. *Ornithol Monogr*. 1985;36(36):575–594. doi: 10.2307/40168306
- [64] Medrano-Vizcaíno P, Bedoya J, Cadena-Ortiz H. Dynamics of the distribution and hosts of *Molothrus bonariensis* (Passeriformes: Icteridae) in Ecuador. *Caldasia*. 2020;42(1):38–49. doi: 10.15446/caldasia.v42n1.78891