

TAXONOMY AND BIOGEOGRAPHY OF THE MONTE YELLOW-FINCH (*SICALIS MENDOZAE*): UNDERSTANDING THE ENDEMIC AVIFAUNA OF ARGENTINA'S MONTE DESERT

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Abstract. The poorly known *Pseudochloris mendozae* Sharpe, 1888, has usually been considered a subspecies of the widespread Greenish Yellow-Finch (*Sicalis olivascens*) of the Andes of Peru, Bolivia, northern Chile, and northwest Argentina. In this work, we present data on morphology, vocalizations, ecology, and distribution supporting the recognition of the Monte Yellow-Finch (*Sicalis mendozae*) (Sharpe 1888) as a full species. *S. mendozae* is 10% smaller in size (with no overlap in wing or bill measurements), and its average weight is 80% that of *S. olivascens*. In comparison with *S. olivascens*, breeding males of *S. mendozae* are considerably brighter, lack any olive tinge on the throat and breast, lack any dorsal mottling or streaking, and have a brighter olive rump. In fresh plumage nonbreeding males are similar to four other *Sicalis* species, differing subtly. Female *S. mendozae* is closest in appearance to the allopatric Patagonian Yellow-Finch (*S. lebruni*), differing chiefly by its olive rump. The song, complex song, and calls of *S. mendozae* are diagnostic, though it also imitates some other birds. *S. mendozae* is endemic to the arid Monte Desert of western Argentina from western Tucumán south to Mendoza, and is parapatric with *S. olivascens* of high Andean steppes. Contrary to literature reports, *S. mendozae* is nonmigratory but may move altitudinally, descending to lower altitudes during winter. We propose the recognition of the Monte Desert as a new Endemic Bird Area, based on the overlap of the geographic ranges of several bird species.

Key words: Andes, endemic bird area, Monte Desert, *Pseudochloris*, *Sicalis mendozae*, *Sicalis olivascens*, speciation, species limits.

Taxonomía y Biogeografía de *Sicalis mendozae*: Entendiendo la Avifauna Endémica del Desierto del Monte en Argentina

Resumen. El poco conocido *Pseudochloris mendozae* Sharpe, 1888, ha sido habitualmente considerado como una subespecie del ampliamente distribuido *Sicalis olivascens* de los Andes de Perú, Bolivia, norte de Chile y noroeste de Argentina. En este trabajo presentamos datos de morfología, vocalizaciones, ecología y distribución que apoyan el reconocimiento de *Sicalis mendozae* (Sharpe 1888) como una especie plena. *S. mendozae* es un 10% más chico (sin superposición en medidas de ala y pico) y pesa en promedio un 80% del peso de *S. olivascens*. En comparación con *S. olivascens*, los machos de *S. mendozae* en plumaje reproductivo son considerablemente más brillantes, carecen de tonos olivas en la garganta y pecho, carecen de moteado o estriado dorsal y exhiben una rabadilla oliva más notable. Los machos en plumaje fresco no-reproductivo son similares a otras cuatro especies de *Sicalis* en este plumaje y discutimos diferencias sutiles entre todas ellas. La hembra de *S. mendozae* es más similar a la del alopatric *S. lebruni* pero difiere de ésta principalmente por poseer la rabadilla oliva. El canto, canto complejo y llamados de *S. mendozae* son diagnósticos; además, puede imitar otras especies de aves con las que cohabita. *S. mendozae* es endémico del Desierto del Monte en el oeste de Argentina, desde el oeste de Tucumán hasta el sur de Mendoza y es parapatric con el habitante de estepas altoandinas *S. olivascens*. Contrariamente a lo que dice la literatura, *S. mendozae* no es migratorio y a lo sumo podría realizar movimientos altitudinales, descendiendo en altura en invierno. Proponemos el reconocimiento del Desierto del Monte como una nueva área de endemismo en aves, basados en la superposición de los rangos geográficos de varias especies de aves.

INTRODUCTION

In an inhospitable sub-Andean scrub desert of South America, perched atop a boulder in a barren landscape, a yellow-finch delivers its complex song. From a distance, the bird will

most likely remain an unidentified *Sicalis* yellow-finch to the uninitiated listener, but it will be confidently identified by the naturalist who understands the secret language of birds. Upon close examination, the bird will show some greenish dorsal shades, a gray facial marking, a unique yellow ventral tone,

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while its bill shape and wing length will provide morphological clues to its identity. Given their surprising similarities, and usual lack of strikingly distinctive features, most scientific names of the species of *Sicalis* refer to the yellow or yellowish ventral colors: *lutea*, *auriventris*, *citrina*, *luteocephala*, *luteola*, *flaveola*, *olivascens*, and it is perhaps understandable that they have had little appeal for biological study.

The *Sicalis* yellow-finches constitute a diverse group of neotropical emberizid finches, well known for their perplexing field identification and extremely confusing taxonomic history (Reichenow 1917, Hellmayr 1938, Paynter and Storer 1970, Ridgely and Tudor 1989). Although most species inhabit the Andes, a few are widespread in the lowlands (Paynter and Storer 1970, Fjeldså and Krabbe 1990). The composition of *Sicalis* and its number of species varies notably from author to author: 10 by Hellmayr (1938), 11 by Paynter and Storer (1970), 11 by Meyer de Schauensee (1970), 13 by Sibley and Monroe (1990), 12 by Remsen et al. (2010). Three former genera, *Pseudochloris*, *Pseudosicalis*, and *Gnathospiza*, are now included within *Sicalis* (Hellmayr 1932, 1938, Paynter and Storer 1970). Paynter and Storer (1970: 122) summarized the status quo: “The species limits within *Sicalis* are poorly understood. Many forms have limited and disjunct distributions and most taxa are morphologically very similar, making it difficult to employ these two key taxonomic characters in separating the species. Voice, and probably behavior, appear distinctive but until a comparative study has been done there is little hope of improving the following arrangement, which closely follows that of Hellmayr, 1938.”

The poorly known *Pseudochloris mendozae* Sharpe, 1888, is perhaps the most often confused taxon among the *Sicalis* yellow-finches with regard to its identification and taxonomy. Here we reinstate this taxon to species level, as *Sicalis mendozae*, on the basis of its distinctive vocalizations, plumage, morphology, habitat, and distribution pattern. The recognition of this species leads us to discuss the biogeography and evolutionary differentiation of the avifauna of the arid Monte Desert of Argentina, proposing the existence of a hitherto unrecognized area of endemism.

METHODS

We examined photographs of the type specimens of *Emberiza olivascens* d’Orbigny and Lafresnaye, 1837 (= *Sicalis o. olivascens*) and of *Pseudochloris mendozae* Sharpe, 1888 (= *Sicalis mendozae*) (Appendix 1 online, dx.doi.org/10.1525/cond.2012.110052). We examined and measured 39 specimens of *Sicalis o. olivascens*, 30 of *S. mendozae*, and studied plumage and structural features of specimens of these species and of other Andean and Patagonian species of *Sicalis*

deposited at various museums (Appendix 1). We measured bill length (exposed culmen) to the nearest 0.05 mm with digital calipers and wing chord and tail length with a metal ruler to the nearest 0.5 mm. We calculated average weights on the basis of data from the literature, specimen labels, and field data kindly provided by P. Blendinger. We used additional distributional information from specimens held at the BM(NH) (British Museum [of Natural History], Tring), FMNH (Field Museum of Natural History, Chicago), LSU (Louisiana State University, Baton Rouge), and YPM (Yale Peabody Museum, New Haven).

We studied *Sicalis mendozae* in the field in Argentina as follows: 9 February 1997 at Reserva Natural Divisadero Largo, 29 December 2007, 4 January 2008, 2 April 2009, 10 and 24 May 2009, 18 January 2010, 3 February 2010, and 31 July 2010 at Cajón del Atuel (Mendoza), 4 March 1998, 27–30 May, and 20–22 November 2010 at Parque Nacional Sierra de las Quijadas (San Luis), 14 November 1991 at La Tranca, 26–27 November 2010 in the region between Parque Nacional El Leoncito and Talacasto (San Juan), and 24–26 January 2009 at Hualfin (Catamarca). For each field observation we took notes on behavior, habitat, plumage, and the color, shape, and size of the bill. We recorded vocalizations with a Sennheiser ME-62 microphone in a Telinga Universal parabola and Marantz PMD-222, PMD-661, and Sony TCD5-ProII recorders, with a Sennheiser ME-67 microphone and a Sony TCM 5000 tape recorder, and with a Panasonic RQ-L30 tape recorder and a nonprofessional microphone of unknown brand. Recordings made by J. I. Areta are deposited at the Macaulay Library of Natural Sounds (Cornell Lab of Ornithology), and those made by M. Pearman are deposited in the British Library (National Sound Archive). To determine qualitative differences in the vocalizations of *S. mendozae* from those of other Andean species of *Sicalis*, we examined our recordings aurally and then visually with the aid of spectrograms generated with Syrinx 2.6h (www.syrinxpc.com, John Burt). During the breeding season, we experimented with the responses of *S. olivascens* and *S. mendozae* to each species’ songs. Each experiment consisted of playing two songs in alternation to territorial males, one song twice and another song once (i.e., conspecific-heterospecific-conspecific or heterospecific-conspecific-heterospecific). We performed five playback experiments on *S. olivascens* with voices of *S. olivascens* and *S. mendozae* in Putre, extreme northern Chile (November 2011) and five on *S. mendozae* with voices of *S. mendozae* and *S. olivascens* in Parque Nacional Sierra de las Quijadas (November 2010).

We examined 107 recordings of most currently recognized Andean species of *Sicalis*, including recordings of 35 individuals of all currently recognized subspecies of *S. olivascens* (nominate *olivascens*, *chloris*, and *salvini*) and

of 22 individuals of *S. mendozae* (Appendix 2 online, dx.doi.org/10.1525/cond.2012.110052).

RESULTS AND DISCUSSION

TAXONOMIC HISTORY

The complex taxonomic history of *Sicalis mendozae* deserves full description (see Table 1). Sharpe (1888:788) described *Pseudochloris mendozae* as a distinct species on the basis of two adult specimens at the BM(NH), a male in the Sclater collection and a female in the Salvin and Godman collection, from Mendoza, Argentina. The brief description consists only of “Adult male. Similar to *P. auriventris* but smaller, and having no bright yellow over the eye. Total length 4·6 inches, culmen 0·45, wing 3·05, tail 1·9, tarsus 0·75.” According to Hellmayr (1932, 1938), Sharpe (1888) misidentified another specimen of *mendozae* (“spec. a”), also in the Salvin and Godman collection, from “Pampas Argentinas,” a term traditionally used by Leybold (1873) for Mendoza province, as *S. lutea*. Burmeister (1860: 257) described two specimens that he assigned incorrectly to *Sycalis chloropsis* (a new, incorrect, name for the composite *Crithagra chloropsis* Bonaparte, 1850) as follows: “Mendoza; frequent.—Somewhat big, greenish in color; dorsal plumage of a single color. Without darker shaft stripes. Young birds entirely brownish gray, with only half of the belly yellowish” (our translation). He added that “*Sycalis chloropsis* Bon. is perhaps identical to *Emberiza luteocephala* D’Orb.,” that “*Sycalis chloropsis* represents in Mendoza the *S. luteiventris* (the Chipiú, number 132 of Azara)” (Burmeister 1861, vol. 1: 313 in 2008 translation), and thus erroneously mentioning two less closely related species while providing the description, “It inhabits Mendoza and Catamarca up to Bolivia. Fairly larger than the preceding species [*S. luteiventris*], the bill is thicker, of a bluish-horn color. The plumage of the old birds is greenish yellow in the dorsum, without dark central shafts; the remiges and the tail are cinnamon gray, with yellow borders. Lower body parts of a live orangish yellow. The chicks have a chestnut gray dorsum, and the belly of a pallid yellow; the chest is fairly gray. The first three remiges have exactly the same length. The little feet have short toes, and the claws being especially short”

(1861, vol. 2: 489, 457–458 in 2008 translation). It is worth noting that Burmeister misspelled the *Crithagra chloropsis* of Bonaparte as *Chritagra chloropsis* (1861, vol. 2: 489, 457–458 in 2008 translation). Hellmayr (1938), upon examining the specimens attributed to *S. chloropsis*, found them to be *mendozae*, and reidentified the young bird of Burmeister as a female. Dabbene (1910) explicitly excluded *S. mendozae* from his list, since he considered Sharpe’s species of dubious validity. Nevertheless, he referred to the specimens of Burmeister as *S. lutea*, and this was copied by Reed (1916). Just four years later, Dabbene (1914) changed his mind and treated, for the first time and without comment or explanation, *mendozae* as *Pseudochloris aureoventris mendozae*, which was followed by Sanzin (1918) as *Pseudochloris auriventris mendozae*. Finally, Hellmayr (1932:95), who probably examined more skins of *Sicalis* than had any other researcher, chose to treat *mendozae* as a subspecies of *Sicalis olivascens*, the treatment followed by all subsequent authors without question. He justified his position as follows “*S. o. mendozae* (Sharpe), from the Andes west of Mendoza, is very similar to *S. o. sordida*, but much smaller, while the males appear to be of a somewhat brighter, more yellowish coloration. Six specimens measure as follows: wing 76–78; tail 51–53; bill 10 mm.” Later he wrote, “*Sicalis olivascens mendozae* (Sharpe): Similar in coloration to *S. o. sordida*, but considerably smaller. Wing, 76–78, (female) 76–77; tail, 51–53; bill 10.... This little-known form, which has been recorded only from the vicinity of the city of Mendoza, is merely a smaller edition of *S. o. sordida*, its coloration being exactly the same. The female bears some likeness to that of *S. lebruni*, and sometimes just as little yellow beneath; it is, however, slightly smaller and much darker, less grayish, on the upper parts.” (Hellmayr 1938: 317).

In taxonomic works, *Sicalis mendozae* has been repeatedly misidentified, especially as *Sicalis lutea* (Sclater 1872, Sclater and Hudson 1888, Sharpe 1888, Gosse 1899, Wetmore 1926, A. Wetmore in Hellmayr 1932). For example, Philip Lutley Sclater in Sclater and Hudson (1888: 69) wrote under *Sycalis lutea* “In my revision of the genus published in 1872, I referred the specimens (upon some of which Prof. Burmeister based his species *S. chloropsis*) to *S. uropygialis*. I now find that this was an error, and that they really belong to *S. lutea*”.

TABLE 1. History of the classification of the *olivascens* group of *Sicalis* by the main works treating the complex. See text for citations of original descriptions and details.

Taxon	Sclater 1872	Hellmayr 1938	Paynter 1970	Fjeldsá and Krabbe 1990
<i>olivascens</i>	<i>S. o. olivascens</i>	<i>S. o. olivascens</i>	<i>S. o. olivascens</i>	<i>S. o. olivascens</i>
<i>berlepschi</i>	—	<i>S. o. berlepschi</i>		
<i>sordida</i>	—	<i>S. o. sordida</i>		
<i>chloris</i>	<i>S. lutea</i>	<i>S. o. chloris</i>	<i>S. o. chloris</i>	<i>S. o. chloris</i>
<i>salvini</i>	—	<i>S. o. salvini</i>	<i>S. o. salvini</i>	<i>S. o. salvini</i>
<i>mendozae</i>	“ <i>S. uropygialis</i> ”	<i>S. o. mendozae</i>	<i>S. o. mendozae</i>	<i>S. o. mendozae</i>
<i>lebruni</i>	—	<i>S. lebruni</i>	<i>S. o. lebruni</i>	<i>S. lebruni</i>

In yet another confusing publication, Chubb (1919) described *Pseudochloris aureiventris incae* on the basis of specimens of *S. auriventris* collected by Gosse in Aconcagua (Mendoza) and incorrectly stated that these were the birds that Gosse (1899) referred to as *Sycalis lutea*; they were actually *Sicalis mendozae* that Gosse found in Luján de Cuyo (Mendoza). The holotype, held in the BM(NH) is clearly a male *S. auriventris* and was collected at Puente del Inca, Aconcagua, Mendoza, a locality where this species is abundant (pers. obs.).

The taxonomy of *Sicalis olivascens* is not free from similar controversies (see Table 1). *Sicalis olivascens* was originally described as *Emberiza olivascens* d'Orbigny and Lafresnaye, 1837, from La Paz, Bolivia. Bonaparte (1850) described *Crithagra chloropsis* on the basis of specimens of both *S. olivascens* and *S. lutea*. Thus the diagnosis is a composite of characters, invalidating the name (see Hellmayr 1938: 309). Two taxa that were subsequently described as species, *Sycalis chloris* Cabanis in Tschudi (1846) and *Pseudochloris salvini* Chubb (1919), were finally allocated as subspecies of *Sicalis olivascens* by Zimmer (1930), while two other subspecies, *Pseudochloris olivascens berlepschi* Ménégau (1909) and *Pseudochloris olivascens sordida* Chapman (1919), were transferred to *Sicalis* by Hellmayr (1932, 1938). Chubb (1923) described *Pseudochloris stewarti*, but later Hellmayr (1938) considered it “an absolute synonym of *Sicalis olivascens sordida*.” Paynter and Storer (1970) subsumed *berlepschi* and *sordida* within nominate *olivascens*, and this was followed by Fjeldså and Krabbe (1990). *Sicalis lebruni* has also been considered as a subspecies of *S. olivascens* (Paynter and Storer 1970) or usually as a valid species (Hellmayr 1932, 1938, Fjeldså and Krabbe 1990 and all modern sources).

MORPHOLOGY

Sicalis mendozae has the bill, wing, and tail significantly shorter than those of *S. olivascens* (Table 2, Hellmayr 1932, 1938). *S. olivascens* is ~10% larger than *S. mendozae* in all linear measurements, with no overlap in bill length and wing length and virtually no overlap in tail length. *Sicalis mendozae* is also smaller and lighter than *S. lebruni*, but both have similar

sized bills (Table 2). Consistent bill-shape differences within *Sicalis* were already noticed by d'Orbigny and Lafresnaye (1837: 74–75), who mentioned the “rostrum forte, altum, corneum, culmine arcuato” of *S. lutea* and the “rostrum paulo longiore, recto, conico” of *S. olivascens*. The bill of *S. mendozae* is not shaped as strikingly as that of *S. lutea* or *S. olivascens*: it is smaller, of medium height, with a modest curvature to the culmen. *Sicalis auriventris* in comparison has a bill longer than that of the congeners with an almost straight culmen.

The average weight of *Sicalis mendozae* is only 80% of that of *S. olivascens* (Table 2, see also Navas and Bó 2000). The weights reported under “*Pseudochloris aureiventris Mendozae*” (sic) in Fiora (1934: 361) for five birds from Capilla Punta Corral (Jujuy, 3600 m above sea level) averaged 24.5 g and seem to be based on misidentified males of the larger *S. auriventris* and come from outside of the distributional and altitudinal range of *S. mendozae*. Moreover, Fiora reported an average weight of 22.8 g for six males of “*Sicalis olivascens sordida*” (sic) from Santa Ana (Jujuy, 3250 m above sea level), consistent with data from El Infiernillo (Tucumán, 3000 m above sea level, Salvador 1990). Thus, given the smaller measurements of *S. mendozae* in comparison to *S. olivascens* it seems safe to conclude that the heavy birds incorrectly assigned by Fiora (1934) to *S. mendozae* are either *S. olivascens* or *S. lutea*. The assignment of an average weight of 55 g to *S. auriventris* by Dunning (2008) clearly represents confusion with the weight given by Fiora (1934:362) for the Black-backed Grosbeak (*Pheucticus auriventris*), since Navas and Bó (2000) reported an average weight of 26.4 g for 30 males (range 22–31.6 g) and of 27.1 g for 8 females (range 22.2–29.2 g) of *S. auriventris*.

FIELD DIAGNOSIS

Over much of its range *S. mendozae* is syntopic only with the very different *S. flaveola*, over less of its range with *S. luteola*, yet neither of these species presents any kind of identification confusion. Field identification of *S. mendozae* might conceivably prove difficult close to its upper elevational limit where it might overlap or occur in close proximity to *S. auriventris* and to *S. olivascens*.

TABLE 2. Measurements of bill length, wing chord, and tail length (mm) and weights of the Monte Yellow-Finch (*Sicalis mendozae*), Greenish Yellow-Finch (*S. olivascens*), and Patagonian Yellow-Finch (*S. lebruni*) according to data from specimens listed in Appendix 1 (dx.doi.org/10.1525/cond.2012.110052). Values are means \pm SD (*n*) [range], depending upon availability. The measurements support the status of the smaller *S. mendozae* as full species. Its averages \pm SD do not overlap with those of *S. olivascens*.

	<i>S. mendozae</i>	<i>S. olivascens</i>	<i>S. lebruni</i>
Bill length	10.02 \pm 0.31 (20) [9.34–10.47]	11.22 \pm 0.38 (30) [10.6–11.86]	10.16 \pm 0.28 (12) [9.50–10.63]
Wing chord	75 \pm 2.22 (20) [71–79.5]	82.23 \pm 2.41 (32) [78.5–88]	80.81 \pm 1.60 (13) [78–83.5]
Tail length	48.98 \pm 2.04 (20) [45.5–53]	52.45 \pm 2.54 (31) [48.5–60]	50.65 \pm 1.34 (13) [48–53]
Weight	18.14 \pm 0.80 (29) [16.5–19.8]	22.8 (6) [20.4–24.2]	25.3 (4) [23.1–26.6]

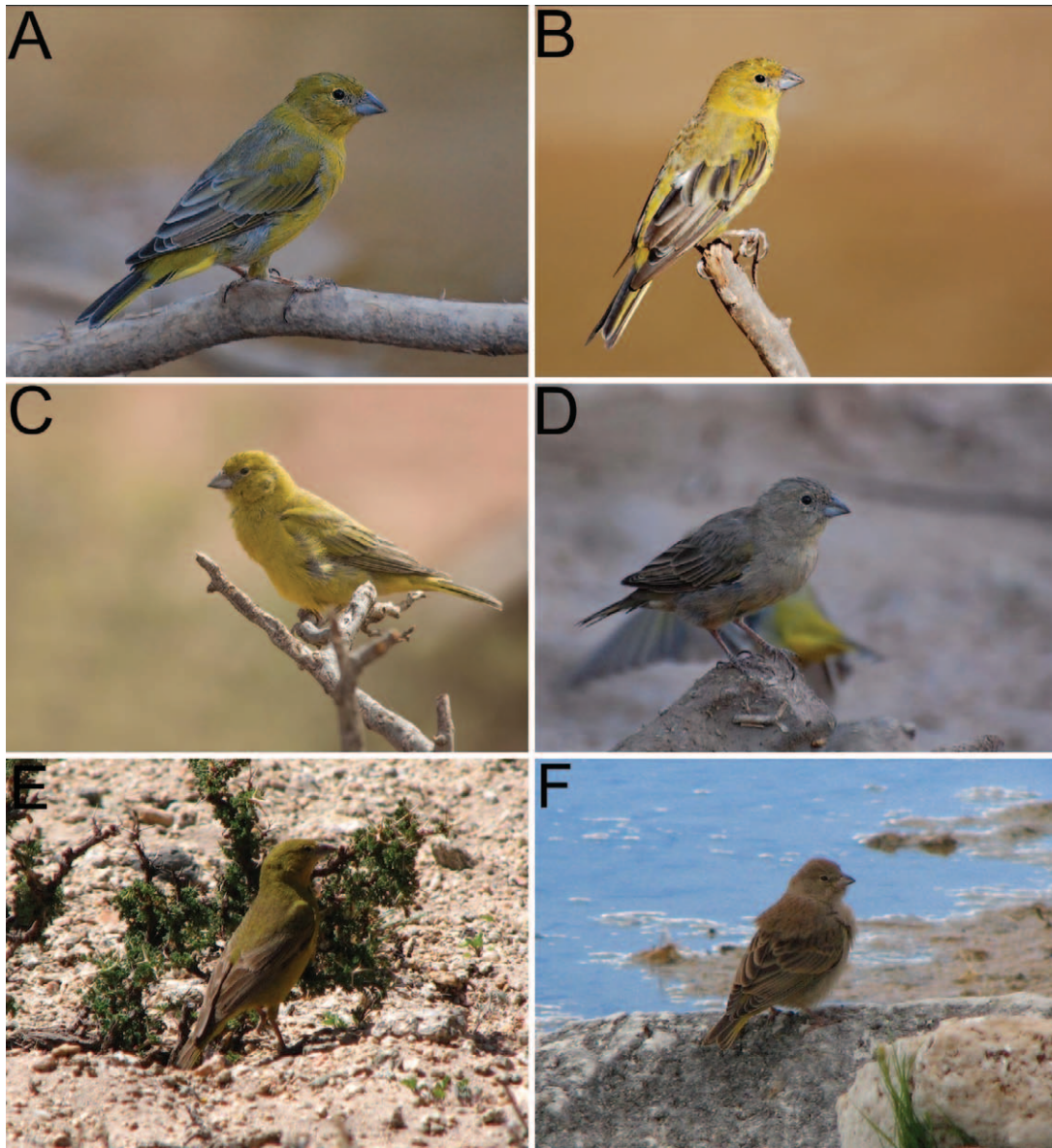


FIGURE 1. Monte Yellow-Finch (*Sicalis mendozae*): (A) Male in fresh plumage (May, Retamito, San Juan, Argentina, Francisco Lucero), (B) Male in half-worn plumage (March, Retamito, San Juan, Argentina, Francisco Lucero), (C) Male in worn (full breeding) plumage (January, Parque Nacional Sierra de las Quijadas, San Luis, Argentina, Diego Oscar), (D) female (March, Retamito, San Juan, Argentina, Francisco Lucero). Greenish Yellow-Finch (*S. olivascens*): (E) Male in worn (full breeding) plumage (January, Cuesta de Randolpho, Catamarca, Argentina, Juan I. Areta), (F) juvenile (January, Laguna Alumbreira, Catamarca, Argentina, Juan I. Areta).

The male of *S. mendozae* is one of the brightest colored *Sicalis* finches. The intensity of its yellow ventral pigmentation is perhaps second only to that of *S. lutea*, and it lacks the olive tinge on the throat and breast of *S. olivascens*. In breeding (worn) plumage, the head is a golden yellow a little duller than that of the underparts. The lores, visible at close range, are always gray (Fig. 1A–C), a feature also of *S. olivascens* although harder to see in that species because of its duller, more olive face

(Fig. 1E). The unmarked back of *S. mendozae* is washed a fairly intense yellow-olive and it does not contrast strongly with the crown, as it does in *S. auriventris*, which has a rich cadmium-yellow crown and face. Importantly, as highlighted by Burmeister (1860, 1861), *S. olivascens* shows brown shaft streaks on its back or brownish feather centers when worn, which create a streaked or mottled effect, respectively. A mottled effect to an olive back can also be seen in fresh male *S. auriventris*,

while this feature is absent in *S. mendozae*. The rump of *S. mendozae* is brighter olive than the back, as is the case in *S. olivascens*, although the contrast is stronger in *S. mendozae*, while *S. auriventris* has a more yellow rump.

In winter (fresh) plumage, the back of *S. mendozae* is light gray, the typical yellow-olive dorsal color of males appearing only once the bloom is worn (Fig 1A–C). The gray dorsal bloom of fresh plumage is not well known but can also be found in *S. auriventris*, *S. olivascens*, *S. lebruni*, and *S. lutea*, all of which subsequently show the typical dorsal pattern when the plumage becomes worn (pers. obs., see also Peters 1923). The outer webs of the secondaries and wing coverts of males show broad white or pinkish borders that disappear with wear, these feathers becoming more acuminate and unicolored. The tail of both *S. mendozae* and *S. lebruni* is fairly well notched, recalling somewhat the tail shape of *Sporagra* (*Carduelis*) *sis-kins*. This winter plumage is very similar to that of *S. lebruni*, although there is far less gray on the flanks and the bases of the primaries are fringed yellow or olive in *S. mendozae*, not gray as in *S. lebruni*. This plumage also resembles the equivalent in *S. olivascens*, although that species has only narrow gray fringes to the outer webs of the tertials, not the entire web as in *S. mendozae*. It is also noteworthy that *S. mendozae*, *S. olivascens*, *S. lebruni*, and *S. auriventris* all commonly show some gray on the ear-coverts in this nonbreeding dress.

Turning to the identification of females, *S. mendozae* (Fig. 1D) is much closer in plumage to *S. auriventris* than it is to *S. olivascens*, while it bears an even closer resemblance to the allopatric *S. lebruni*. The female has an intense sulfur-yellow patch covering the upper belly or center of the abdomen that may reach the throat. This pattern is completely dissimilar from that of *S. olivascens*, which instead shows dull yellow indiscriminately mixed with brown from the throat to the undertail coverts. While females of *S. mendozae* have an unmarked dorsum and rounded short bills, females of *S. olivascens* show a dark mottled dorsum and a somewhat longer conical bill (Burmeister 1860, 1861). The yellow fringes at the base of the outer three rectrices are brighter in *S. mendozae* than in *S. olivascens*. The possibly sympatric *S. auriventris* is a much larger and more bulky species with more extensive yellow on the belly, a notably long primary extension (which prompted Chubb [1921] to propose the monotypic genus *Pseudosicalis* for it), and a relatively long, sharp bill with a straight culmen. There is little difference between the sexes of the allopatric *S. lutea*, in which the female is a slightly duller version of the male, and apart from the contrasting yellow rump, differs by its well-marked yellow-fringed primaries and secondaries, white-fringed black tertials, and arched culmen of its massive bill. Thus there is no confusion with female *S. lutea*. Females of *S. mendozae* most closely resemble those of *S. lebruni* (Hellmayr 1932) and are best distinguished by their olive rump, which is brown in *S. lebruni*. Additionally female *S. mendozae* tends to show little or no olive on the lesser wing coverts, whereas this is usually prominent in female *S. lebruni*.

DISTRIBUTION AND MOVEMENTS

The distribution of *S. mendozae* extends along the eastern foothills of the Andes and lowland scrub deserts from central Mendoza (Hellmayr 1938) north through San Juan (Camperi and Darrieu 2004), La Rioja (Esteban 1953), Catamarca (Burmeister 1861, Esteban 1953, but see Darrieu and Camperi 2002), and at least occasionally to Tucumán (Olrog 1979). The species is also present in the extra-Andean Sierra de las Quijadas, San Luis (Nellar 1993) (Fig. 2). Flocks of about 20–30 individuals of presumed *S. mendozae* observed in western Córdoba during autumn and winter in low Chaco forest and peri-saline shrublands were always drinking from natural and artificial water sources at mid-day or in the early afternoon (Miatello 2009); these may be individuals commuting daily from nearby breeding locations (Fig. 2). Two other purported records, far to the south in northern and central western Neuquén (10 February 1993 at Volcán Tromen and 4 March 1994 at Area Natural Protegida Copahue, see Chebez et al. 1993 and Veiga et al. 2005) lack any description, come from altitudes higher and habitats (high Andean grasslands) different from those of *S. mendozae* elsewhere (Fig. 2) and could well have been based on misidentified *S. auriventris*, which is common at both localities (pers. obs.).

The altitudinal distribution of *S. mendozae* ranges from 900 to 2100 m above sea level in the Andes and from 600 to at least 770 m above sea level in the Sierra de las Quijadas, according to our data. In contrast, in Argentina and elsewhere, *S. olivascens* ranges from 2250 to 4500 m above sea level (Fjeldså and Krabbe 1990). In parts of Tucumán, Catamarca, La Rioja, and Mendoza, *S. mendozae* and *S. olivascens* may be parapatric, with *S. mendozae* occurring at lower altitudes, *S. olivascens* at higher altitudes (Esteban 1953, Fig. 2). For example, specimens from Colalao del Valle (1815 m above sea level), Tucumán, include what appear to be very worn examples of *S. mendozae* and *S. olivascens* (presumably collected at elevations higher than were the previous specimens). The holotype of *Pseudochloris stewarti* (see above), collected at an unspecified altitude in Gualfin (Hualfin), Catamarca, is also noteworthy since *S. mendozae* is the only *Sicalis* species that occurs at low altitude in Hualfin today (this study), while the remaining individuals of the type series were collected at nearby localities. This indicates that Hualfin may well be a potential zone of overlap of *S. mendozae* and *S. olivascens*. A specimen initially identified as *S. lutea* (USNM 227967, Potrerillos, Mendoza, Wetmore 1926) agrees in measurements and bill shape with those of *S. mendozae*. Thus Wetmore's later re-identification of this specimen (published in Hellmayr 1932) seems correct, and there is no evidence of the occurrence of *S. lutea* within the known distribution of *S. mendozae*. For the present, we consider *S. mendozae* to be endemic to Argentina.

Seasonal movements of *S. mendozae* to the north outside of the breeding season have been reported by Olrog (1979: 272), who gave the distribution and habitat of *S. mendozae* as "Dry shrubby creeks from southern La Rioja to Mendoza;

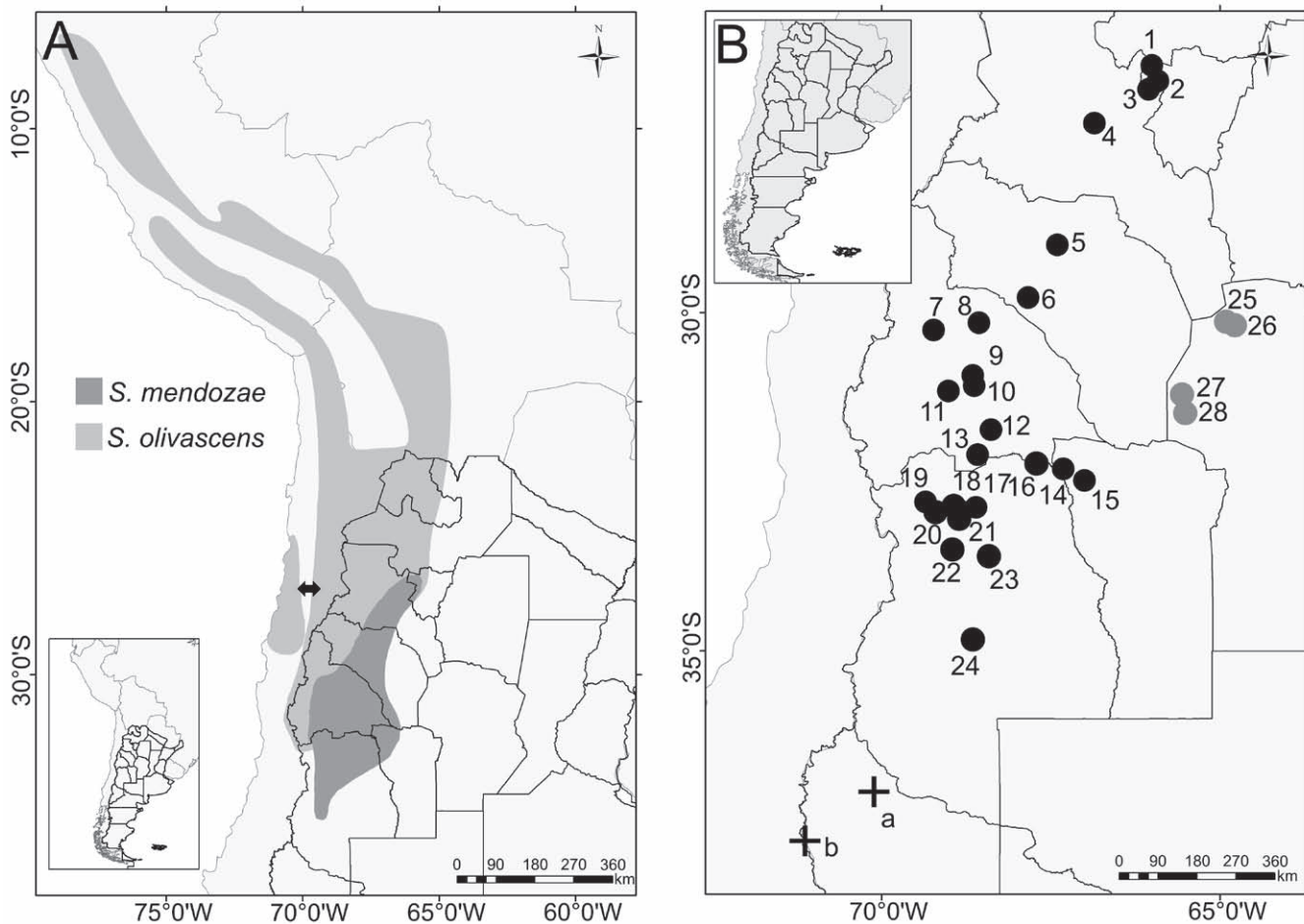


FIGURE 2. (A) Approximate distributions of the Monte Yellow-Finch (*Sicalis mendozae*) and Greenish Yellow-Finch (*S. olivascens*) showing their parapatry (modified from Ridgely et al. 2007). (B) Known localities of *S. mendozae* in Argentina. Black circles and numbers, localities with confirmed records of *S. mendozae*; gray circles, localities with presumed records; crosses and letters, wrongly cited localities. TUCUMÁN: 1, Colalao del Valle (26° 21' S, 66° 00' W) [Jul]; 2, Amaicha del Valle (26° 35' S, 65° 55' W) [Dec]. CATAMARCA: 3, Santa María (26° 42' S, 66° 03' W) [Mar]; 4, Hualfin (27° 12' S, 66° 51' W) [Jan]. LA RIOJA: 5, Guandacol (29° 00' S, 67° 29' W) [May]; 6, Parque Nacional Talampaya (29° 47' S, 67° 50' W) [Jan/Dec]. SAN JUAN: 7, Pismanta/Arroyo del Agua Negra (30° 16' S, 69° 14' W) [Jan, Dec]; 8, La Ciénaga (30° 09' S, 68° 34' W) [Dec]; 9, El Balde (30° 56' S, 68° 39' W) [Sep/Dec]; 10, Talacasto (31° 05' S, 68° 38' W) [Jan, Dec]; 11, Quebrada de las Burras (31° 10' S, 69° 01' W) [Nov]; 12, Retamito (32° 06' S, 68° 35' W) [Mar]; 13, Parque Nacional El Leoncito (31° 48' S, 69° 21' W) [Jan/Dec]; 14, La Tranca (32° 19' S, 67° 19' W) [Nov]. SAN LUIS: 15, Parque Nacional Sierra de las Quijadas (32° 29' S, 67° 00' W) [Jan/Dec]. MENDOZA: 16, Tres Cruces (32° 14' S, 67° 43' W) [Apr]; 17, Mendoza (32° 54' S, 68° 53' W) [Mar]; 18, Laguna del Vitorón (32° 53' S, 68° 36' W) [Jan/Dec]; 19, Potrerillos (32° 57' S, 69° 12' W) [Mar]; 20, Divisadero Largo (32° 52' S, 68° 56' W) [Feb]; 21, Luján de Cuyo (33° 03' S, 68° 51' W) [Jun/Jul]; 22, Río Tunuyán (33° 30' S, 68° 57' W) [Nov]; 23, Estancia La Madrugada (Campo Vizcacheras) (33° 40' S, 68° 25' W) [Aug]; 24, Cajón del Atuel (34° 50' S, 68° 39' W) [Jan/Mar]. CÓRDOBA: 25, El Molino (30° 08' S, 64° 58' W) [Jun]; 26, Árbol Blanco (30° 10' S, 64° 40' W) [May]; 27, Punta del Árbol (31° 12' S, 65° 42' W) [Jul]; 28, Oeste de La Patria (31° 25' S, 65° 40' W) [Jul]. NEUQUÉN: a, Área Natural Protegida Tromen (37° 05' S, 70° 07' W) [Feb]; b, Área Natural Protegida Copahue (37° 49' S, 71° 08' W) [Mar].

during autumn migrates to Catamarca, Tucumán and Salta.” This might have influenced Fjeldså and Krabbe (1990: 655), who described distributions as spanning “Apurímac (ssp?) and Cuzco, se Peru, through w Bol. to n La Rioja, Arg. (*olivascens*), San Juan and s. La Rioja to Mendoza and San Luis, in winter n. to Salta (*mendozae*).” The references to seasonal movements of *S. mendozae* lack solid documentation and may stem from misidentifications (e.g., two MACN specimens

of *S. olivascens* from Lara, Tucumán, in the Museo Argentino de Ciencias Naturales, Buenos Aires, and two specimens from Maymará, Jujuy, in the Naturhistorisches Museum, Vienna, that were wrongly labeled as *S. mendozae*). A singing male *S. mendozae* (tape-recorded), and a group of ~20 males, females, and juveniles found during early January in Hualfin, Catamarca, close to the northern distributional limit of *S. mendozae*, provides evidence of breeding in the area, contra

Olrog (1979). Likewise, Gosse (1899) reported flocks of the species (under *Sycalis lutea*) during the winter months of June and July near Luján, Mendoza, while Contreras and Fernández (1980) reported *S. mendozae* during the cold months in the Laguna del Viborón, Mendoza, and Miatello (2009) reported it at low altitude during winter in eastern and northern Córdoba. Blendinger (2005) considered it resident at El Balde, San Juan, and Nellar (1993) reported several birds collected outside the breeding season (late August) at Potrero de la Aguada, San Luis. Our records in May and November at Sierra de las Quijadas demonstrate that the species is resident in that area as well. At El Balde, and on the outskirts of the city of Mendoza, *S. mendozae* is common during winter but scarcer during the breeding season (P. Blendinger, in litt.), while the lack of records in a well-surveyed locality, Reserva Ñacuñán, in the lowland Monte desert of Mendoza, suggests that the species is not a marked altitudinal migrant (Marone 1992, Marone et al. 1997). In sum, the available information indicates that *S. mendozae* is resident in its restricted distribution, engaging in only local seasonal movements of wintering flocks, with perhaps a minor altitudinal component at some localities (descending in winter).

Sicalis olivascens appears to be a year-round resident in most of its range (Johnson 1967; this work); downslope winter movements have been mapped only in Chile (Fig. 2, Jaramillo 2003).

HABITAT

We found *S. mendozae* in arid shrubby areas, preferably close to creeks or canyons in wind-blown and wind-eroded sedimentary mountains always within the phytogeographic region of the Monte Desert (Cabrera 1971). Likewise, Blendinger (2005) considered it (under *S. olivascens*) a valley species, not present on the Monte plains. The Monte Desert can be divided in two ecoregions characterized by geomorphologic features: the Monte de Sierras y Bolsones (mountains and valleys), extending from the north to southern San Juan, and the Monte de Llanuras y Mesetas (plains and table-top mountains), extending from southern San Juan to Chubut (Burkart et al. 1999). The aridity and floristic composition is fairly homogeneous throughout this region. The climate is warm and dry with great daily and seasonal temperature fluctuations, with a mean annual temperature ranging from -10 to 18 °C. Rainfall is concentrated in the summer and increases markedly from west to east, regularly ranging from 80 to 300 mm and strongly conditioned by local relief (see Pol et al. 2005, Abraham et al. 2009 for more information).

In Catamarca province, we recorded *S. mendozae* in very open shrubbery rarely exceeding 1.5 m in height, with isolated shrubs or small groups of five or six shrubs widely separated on bare soil during the dry season that might be occupied by ephemeral plants during the rainy season. The dominant shrub is the nondeciduous creosote *Larrea cuneifolia*, which

is accompanied at low density by *L. divaricata*, *Cercidium praecox*, *Cassia aphylla*, *Prosopis flexuosa* saplings, and isolated *Bulnesia retama* bushes. In Mendoza province, we found *S. mendozae* in the ecological subdivision of the Monte Desert known as Huayquerías, which extends through the center of the province. The dominant large shrubs in this area are *Zucagnia punta*, *L. cuneifolia*, *Prosopidiastrum globosum*, *Bougainvillea spinosa*, *Ephedra ochreatea*, *Condalia microphylla*, *Gochnatia glutinosa*, *Schinus polygamus*, small *P. flexuosa* trees, and cacti such as *Denmozna rhodocanta* and *Trichocereus candicans*. The highest shrubs rarely surpass 2 m, and are sparsely separated at 2 to 6 m apart. Other small shrubs and plants include *Junella scoparia*, *Senna aphylla*, *Bredemeyera microphylla*, *Salvia gillesi*, *Buddleia mendozensis*, *Hysterionica jasionoides*, *Euphorbia collina*, and *Hyalis argentea*. In San Luis province, we recorded *S. mendozae* only in the extra-Andean Sierra de las Quijadas. The deep canyons it occupied are characterized by *Z. punctata*, *Senecio subulatus*, *Ramorinoa girolae*, *Cyclolepis genistoides*, *Capparis atamisquea*, *Atriplex lithophila*, *Eryngium paniculatum*, several cacti like *Cereus aethiops*, *Trichocereus candicans*, *Opuntia sulphurea*, *Echinopsis leucantha* and *Pyrrhocactus* sp., and stunted *P. flexuosa*, while flatter areas were dominated by *L. cuneifolia*, *L. divaricata*, and *Mimozyanthus carinatus*. In San Juan province, we recorded pairs feeding in extremely dry areas dominated by a sparse shrubland of *L. cuneifolia* growing on flat ground covered by a mosaic of small rocks and accompanied by the cactus *Tunilla corrugata* and an unidentified grass in higher areas, while vegetation in the creek was dominated by *L. divaricata* with sparse *S. polygamus*, *Proustia cuneifolia*, and *Lycium chilense* shrubs.

We found *Sicalis olivascens* in sparse high Andean shrublands, along creeks, and in canyons, essentially in the puna zone and nearby high-altitude environs as reported in the literature (Hellmayr 1938, Fjeldså and Krabbe 1990, Jaramillo 2003, Schulenberg et al. 2007).

BREEDING

There are few data on breeding of *S. mendozae*. Only de la Peña (1983, 1987) reported, under *S. olivascens mendozae*, nests found 60 km west of Talacasto, San Juan. He reported "several nests," found on 15 January 1982 on the slope of a mountain, which were shallow cups made of straw, lined with hair and wool, and built in cavities. One nest had a diameter of 8 cm and a depth of 1.5 cm and was built 30 cm inside a tunnel ~10 cm wide. F. Lucero (in litt.) found several birds nesting in holes in a bank in a dry shrubby environment on 6 March 2010 at Retamito, San Juan. Navas and Bó (2000) mentioned enlarged gonads in males and females collected in December in San Juan province, with an egg formed in the oviduct of a female. Apparently, the eggs have not been formally described. A male with a protruding cloaca netted on 6 December 1996 at El Balde was evidently in breeding condition (Blendinger

2005; P. Blendinger, in litt.), but no nests were found in the area. During late November 2010, in Quebrada de las Burras and Parque Nacional Sierra de las Quijadas, we found foraging and roosting flocks in which pairs could be easily identified, but there was no evidence of breeding.

Breeding of *S. lebruni* has been reported in Paso Córdoba (Río Negro, Argentina) on the basis of an observation of adults with fledglings (Llanos et al. 2011; F. Llanos, in litt.). Given its intermediate geographical position between the known breeding ranges of *S. mendozae* and *S. lebruni*, and the habitat apparently adequate for *S. mendozae*, Paso Córdoba should be prospected further (see Vocalizations below).

VOCALIZATIONS

The song of *S. mendozae* consists of a succession of rhythmic, harsh, metallic, and fast-rolling series of ascending and descending syllables. The number, temporal pattern, and quality of these syllables vary (Figs. 3A–C). We obtained strong evidence of vocal learning in *S. mendozae* when we tape-recorded an adult male singing a complex song in which the more common and simple song was interspersed. The complex song contained faster-version renderings of the songs of the Andean Swift (*Aeronautes andecolus*), Rufous-banded Miner (*Geositta rufipennis hoyi*), Saffron Finch (*Sicalis flaveola*), House Wren (*Troglodytes aedon*), a mockingbird (*Mimus patagonicus* or *M. triurus*), Rufous-collared Sparrow (*Zonotrichia capensis*), Golden-billed Saltator (*Saltator aurantiirostris*), Cinnamon Warbling-Finch (*Pooispiza ornata*), Carbonated Sierra-Finch (*Phrygilus carbonarius*), and calls of Steinbach's Canastero (*Pseudasthenes steinbachi*) and of the southern subspecies of the Chiguanco Thrush (*Turdus chiguanco anthracinus*) (Fig. 3D–E). The imitations followed each other in fast succession, giving the song a fast pace and a musical sound. The complex imitations were usually introduced only once in a bout, while the simple notes were repeated several times. In both cases, the imitations mirrored the patterns of song production of the mimicked species. Importantly, *Pseudasthenes steinbachi*, *M. triurus*, *Pooispiza ornata* and *Phrygilus carbonarius* are all endemic breeders of the Monte Desert (see Cabrera and Willink 1980, Areta et al. 2011), the imitation of *Z. capensis* was of the local dialect, and we noted no bird vocalizations from outside the area among the imitations of *S. mendozae* (see Distribution and Movements above). All males of *S. mendozae* sang from exposed rocks on the sides of deep canyons or from cavities on rock walls. We recorded several calls of *S. mendozae* from Mendoza and San Luis, a *tweep* call heard more often in flight (Fig. 3F–H), described by Wetmore (1926:404) as a “musical call note, a pleasant *tweep tweep* that suggested familiar notes of other flocking finches of the *Carpodacus* or *Astragalinus* type,” a short *tick* uttered continually by members of a pair and flocks while

perched (Fig. 3I, K), and a high-pitched warble uttered usually when the bird is excited (Fig. 3J). Some other less frequent calls include metallic upsweeping notes (Fig. 3F, H) and unstructured soft notes (Fig. 3G).

The sounds of *S. olivascens* differ strikingly from those of *S. mendozae*. The song of *S. olivascens* consists of several consecutive series each consisting of three or four rapid, harsh, and dry trilled notes, with each series following the previous in rapid succession, and the entire phrase typically ending with a distinctive final note (Fig. 4A–C). Presumably, *S. olivascens* can also imitate other birds, or at least sing a more complex and unstructured song (Fig. 4D). Calls include several note types (Fig. 4E).

The pattern and quality of songs of male *S. olivascens chlo-ris* from Putre, extreme northern Chile, and of male *S. o. olivascens* at the Cuesta de Randolpho, Catamarca, Argentina, more than 1000 km apart in a straight line, are strikingly similar. In contrast, the voices of *S. olivascens* from Cuesta de Randolpho and *S. mendozae* from Hualfin, just ~50 km apart in Catamarca province, differ radically. Hence, despite wide opportunity for significant geographic variation in voice, we found conservatism over a large geographic area in *S. olivascens* and an abrupt appearance of *S. mendozae* vocalizations. The sounds of *S. mendozae* remain diagnosable along the ~900 km that separate Hualfin from Cajón del Atuel (Mendoza, Argentina).

The song of *S. lebruni* is a series of syncopated clicking notes (Fig. 5A). That species also has a large repertoire of calls, with an unstructured series of notes (Fig. 5B), a *tweep* (Fig. 5C) and ticking (Fig. 5D) calls that we presume homologous to those of *S. mendozae*, and a high-pitched warble (Fig. 5E). Aurally, the simple songs of *S. mendozae* distantly resemble those of *S. uropygialis* and *S. auriventris*. The song of *S. auriventris* spans a wider frequency range, has a more metallic, ringing quality, and is more varied with longer phrases (Fig. 6A), while the song of *S. uropygialis* is more varied, jumbled, and musical (Fig. 6B). Both species sing long complex songs (see Fig. 6C for *S. auriventris* and Fig. 6D for *S. uropygialis*). Calls of *S. luteocephala* resemble (and we presume are homologous to) the *tweep* and ticking of *S. mendozae* and *S. lebruni*, while *S. auriventris* and *S. uropygialis* have contact calls that vaguely resemble the *tweep* calls of these species (not illustrated). Moreover, all Andean–Patagonian species of *Sicalis* have a large repertoire of a series of high-pitched, unstructured, and extremely variable calls (not illustrated).

In all reciprocal playback experiments on *S. olivascens* and *S. mendozae*, males responded aggressively to conspecific vocalizations, approaching the sound's source and singing, while ignoring heterospecific vocalizations, regardless of the order of playback. Additionally, two different males of *S. mendozae* recorded at Cajón del Atuel on 29 December 2007 answered to playback of their own voices

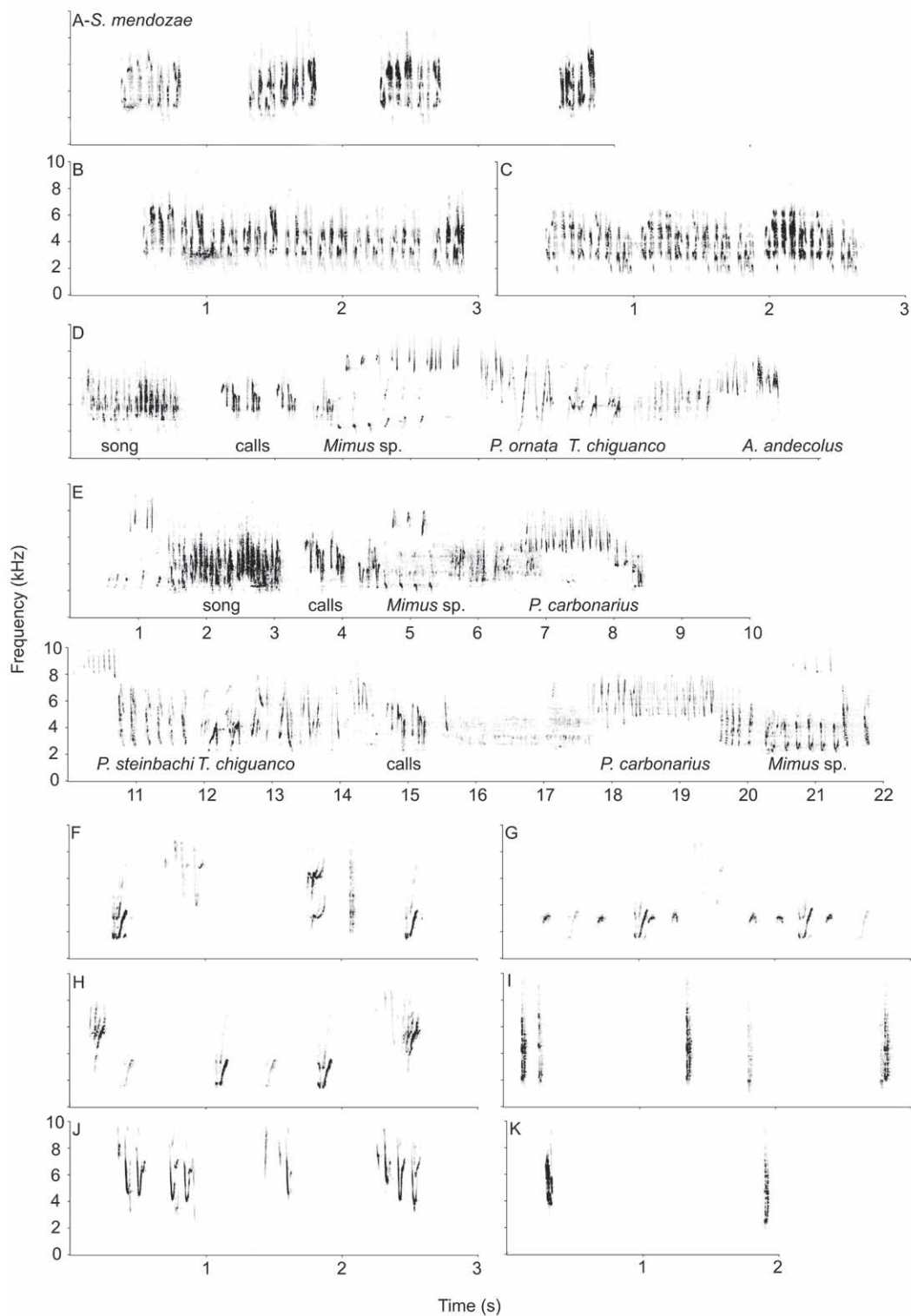


FIGURE 3. Spectrograms of vocalizations of the Monte Yellow-Finch (*Sicalis mendozae*), with mimicry labeled with the species mimicked. (A) Song (Cajón del Atuel, Mendoza, Argentina, JIA); (B) song (Cajón del Atuel, JIA); (C) song (Cajón del Atuel, JIA); (D) long song (Cajón del Atuel, RA); (E) long song (Cajón del Atuel, RA); (F) call (Parque Nacional [PN] Sierra de las Quijadas, San Luis, Argentina, JIA); (G) Call (PN Sierra de las Quijadas, JIA); (H) call (PN Sierra de las Quijadas, JIA); (I) call (PN Sierra de las Quijadas, JIA); (J) call (PN Sierra de las Quijadas, JIA); (K) call (PN Sierra de las Quijadas, JIA).

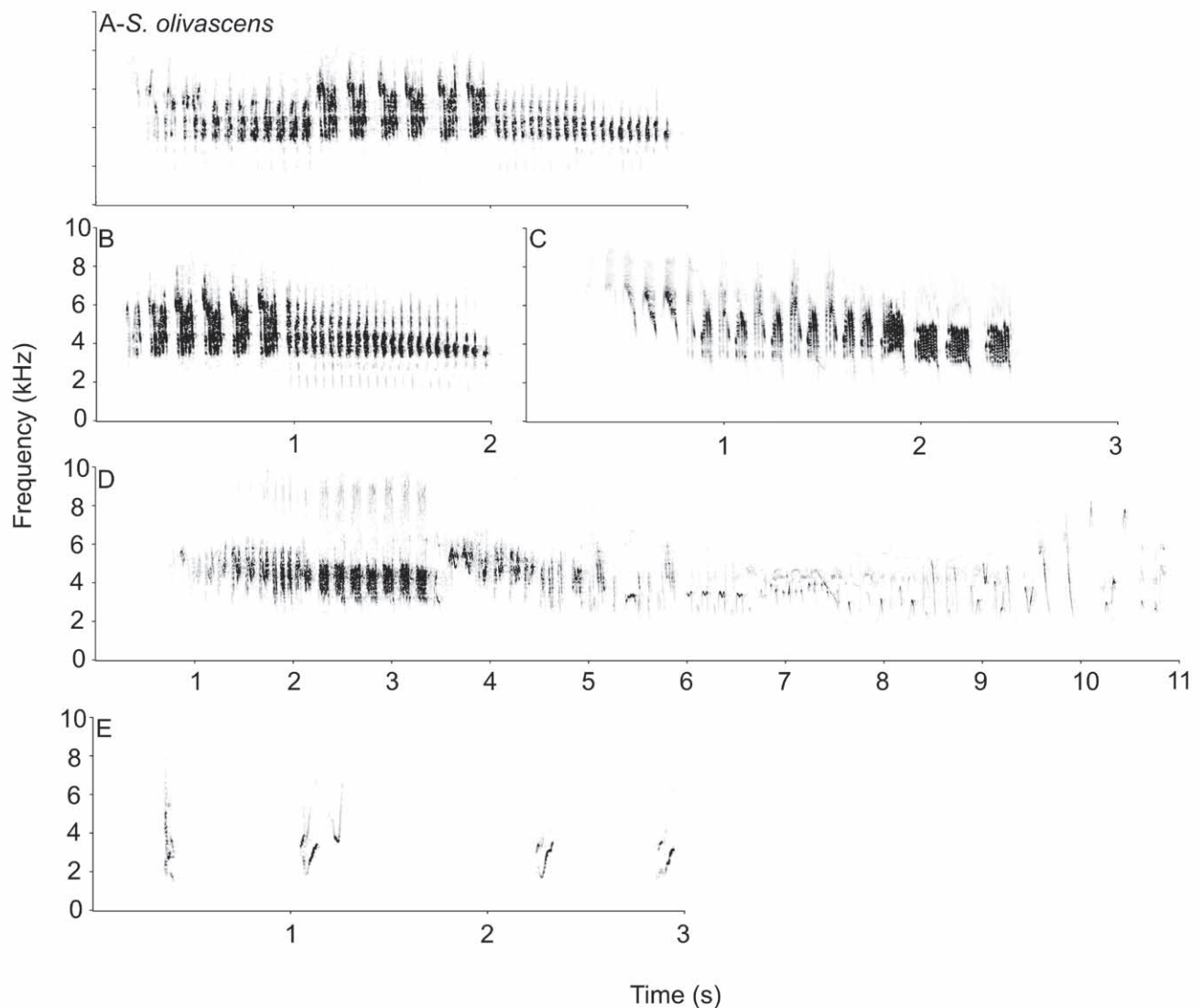


FIGURE 4. Spectrograms of vocalizations of the Greenish Yellow-Finch (*Sicalis olivascens*). (A) Song (Putre, I Región, Chile, JIA); (B) song (Putre, I Región, Chile, JIA); (C) song (Yavi, Jujuy, Argentina, Nick Athanas, XC-13003); (D) long song (Yavi, Jujuy, Argentina, Carlos Ferrari); (E) calls (Aconquija, Tucumán, Argentina, Juan Mazar Barnett, XC-15436); (E) calls (Aconquija, Tucumán, Argentina, Juan Mazar Barnett, XC-15436).

by approaching the sound source but quit vocalizing and remained silent, perched on boulders. One of them flew more than 80 m across a deep canyon to approach its own vocalization, but both birds ignored the voices of *S. olivascens*, *S. lebruni*, and *S. uropygialis* of Straneck (1990a,b), which we used in playback trials. Likewise, two different wintering groups of *S. lebruni* found in what appeared to be good habitat for *S. mendozae* in Paso Córdoba (May 2011, Río Negro province, Argentina) ignored songs and calls of *S. mendozae* and responded strongly to calls of *S. lebruni* from Santa Cruz province, approaching the sounds' source and uttering very similar calls (see Breeding above).

BEHAVIORAL OBSERVATIONS

Sicalis mendozae gathers in small flocks after the breeding season is over; Gosse (1899) reported groups of 10–20 birds during June and July at Luján de Cuyo, Wetmore (1926) reported little flocks and family groups at Potrerillos, Mendoza, in March, and Contreras collected three specimens at Estancia La Madrugada, 90 km southeast of the city of Mendoza, from a flock of 30 birds (see above for our record in Catamarca). At least during winter and close to the onset of breeding, the species roosts communally, groups of up to 40 individuals gathering in the myriad of crevices, cracks, and holes in the wind-protected sandstone banks of Parque Nacional Sierra de

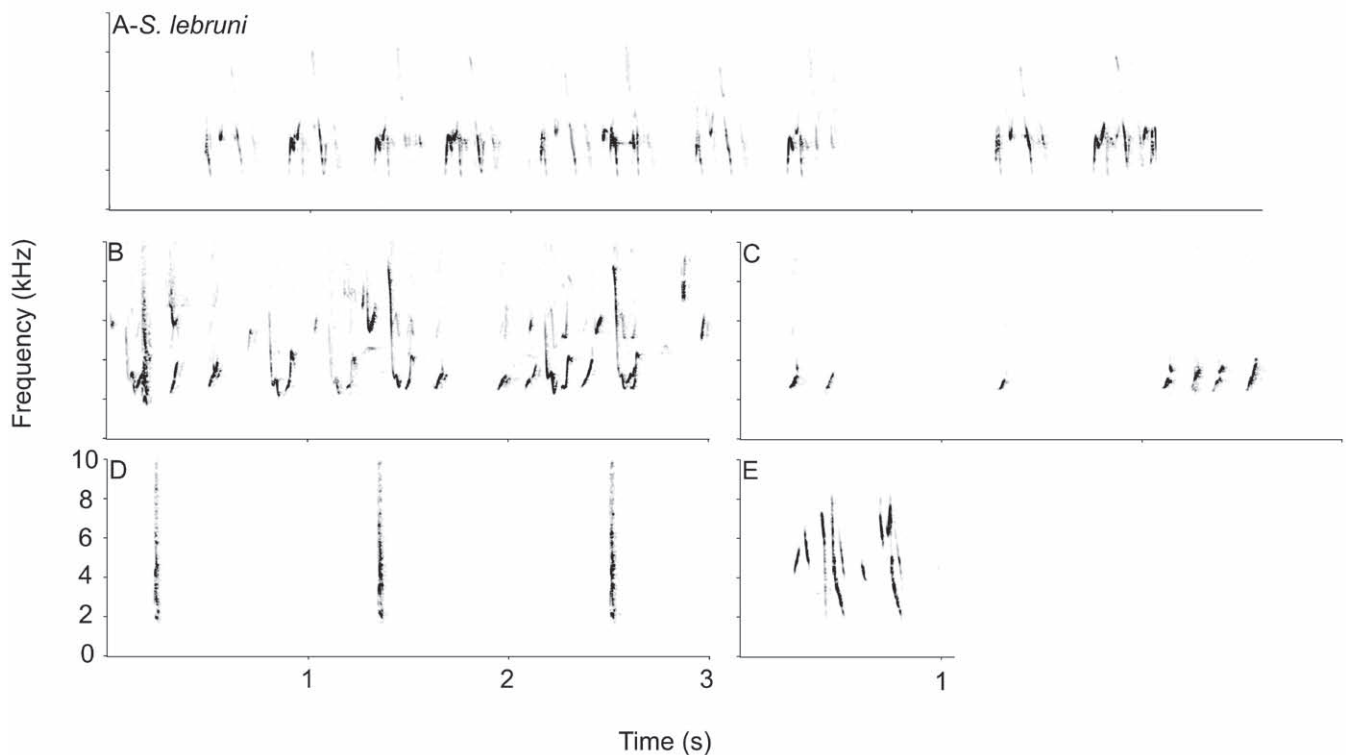


FIGURE 5. Spectrograms of vocalizations of the Patagonian Yellow-Finch (*Sicalis lebruni*). (A) Song (Bosque Petrificado, Chubut, Argentina, Roberto Straneck, Straneck 1990a); (B) calls (Estancia Buitreras, Santa Cruz, Argentina, Santiago Imberti); (C) calls (Estancia Buitreras, Santiago Imberti), (D) calls (Estancia Buitreras, Santiago Imberti); (E) calls (Laguna Verde, XII Región, Chile, Alvaro Jaramillo, XC-60232).

las Quijadas. The noisy groups keep in contact through their contact calls at dusk and dawn and leave the roost to forage far away from it, returning only at sunset. Heavy storms may drive them away momentarily from their preferred mountainous terrain into lower flat areas (Wetmore 1926). We observed *S. mendozae* feeding on seeds fallen on the ground, and Wetmore (1926) also reported it fluttering to pull seeds off grass stalks. Flocks of paired birds flying high in the Quebrada de las Burras indicate that *S. mendozae* may fly long distances to its food sources. Like other desert birds, they occasionally congregate at ephemeral water sources to drink communally (J. Contreras, specimen label data; F. Lucero, in litt.; Miatello 2009). During winter, P. Blendinger (in litt.) reports *S. mendozae* to be one of the most granivorous birds in the Monte desert at El Balde, San Juan, with 99.5% of its food consisting of seeds (especially *Chloe* sp. and *Aristida* sp.), only 0.5% of arthropods. We have not witnessed any epigamic display in this species.

At the Cuesta de Randolpho, Catamarca, on 26 January 2009 a male *S. olivascens* on the ground was fluttering its wings toward a female, occasionally hopping to follow her and display at very close distance (~5–10 cm). It held the vibrating wings half open from the sides of the body and the

tail cocked. This occurred amid a group of eight birds (four males and four females, plus probably two young birds). The birds were observed foraging on seeds of *Adesmia* cf. *schickendanzii* and on flowers of an unidentified species, introducing their heads into the orange belt of *Cajophora* cf. *coronata* flowers, removing sand and small stones with their beaks to get seeds from the ground, and taking small insects from the foliage of several shrubs. A male *S. olivascens* found at Corral Blanco, Catamarca, on 27 January 2009 was singing continuously from a rock ledge. This male and a female were going in and out of a nest-hole ~15 m high in a cliff, feeding nestlings. At Laguna Alumbreira, Catamarca, 28 January 2009, *S. olivascens* was very common on the solidified lava flows of Volcán Antofagasta. Several young birds were begging for food with a harsh voice consisting of a series of “trrrriiiii-trrrriiiii-trrrriiiii...” The young birds had browner backs and wing edgings but already showed the dorsal streaking of adult birds. Many birds were drinking the relatively fresh water of the lagoon. They approached the water only at a protected spot where small rocks bridged the lagoon to the lava. While drinking, a male, perching on higher rocks and uttering a soft and short call, acted as a sentinel for the drinking flock.

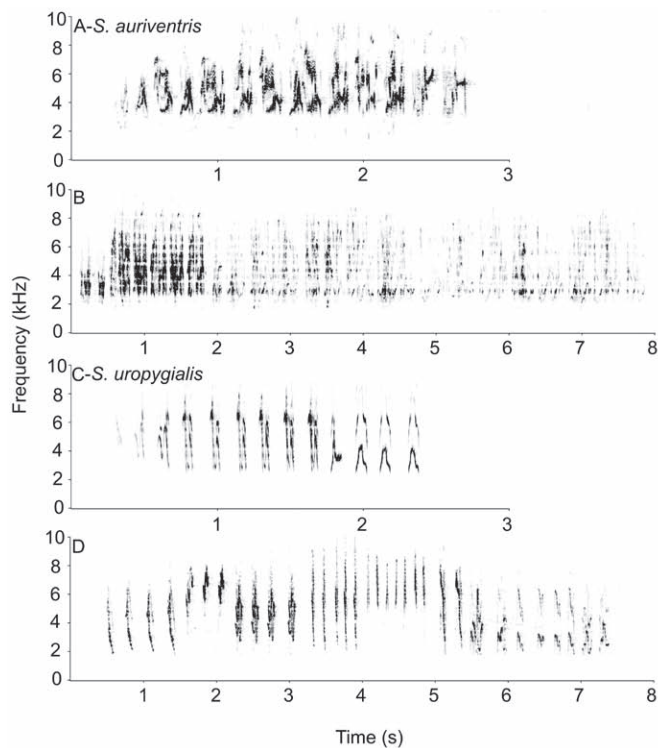


FIGURE 6. Spectrograms of vocalizations of the Greater Yellow-Finch (*Sicalis auriventris*) and Bright-rumped Yellow-Finch (*S. uropygialis*). Greater Yellow-Finch: (A) song (El Portillo valley, Región Metropolitana, Chile, JIA); (B) long song (Vallecitos, Mendoza, Argentina, JIA). Bright-rumped Yellow-Finch: (C) song (Chucuyo, Parque Nacional Lauca, I Región, Chile, JIA); (D) long song (Cañón del Río Misicuni, Cochabamba, Bolivia, Sjoerd Maijer, Maijer 2000).

TAXONOMY AND SYSTEMATICS

The taxonomic challenge of *Sicalis mendozae* was elucidated rather precisely by Hellmayr (1938), and here we show that it was previously and subsequently confused with at least five valid species of *Sicalis*, *S. olivascens*, *S. uropygialis*, *S. lutea*, *S. auriventris*, and *S. luteocephala*, as well as with a composite (invalid) species, *Crithagra chloropsis*. Standing on the shoulders of Hellmayr's magnificent work, and on the achievements of other great ornithologists who struggled to study and to identify their birds with the scanty material at hand, we are able to further confirm that *S. mendozae* is a valid species under any species concept. In the context of the rather homogeneous genus *Sicalis*, the marked morphological, vocal, and ecological differences between *S. olivascens* and *S. mendozae* here reported demand recognition of *S. mendozae* as an autonomous biological entity and argue in favor of the application of the binomial *Sicalis mendozae* (Sharpe, 1888) to designate it.

First, given the conservatism in the basic structure of song of *S. olivascens* over a wide geographic area, we interpret the geographically abrupt change of song type in *S. mendozae*

as an indicator of species-level differentiation (i.e., the variation cannot be attributed to the existence of dialects or regions within *S. olivascens*). Vocalizations have seldom been used as a taxonomic tool in the neotropical oscines, presumably because of the predominant role that learning plays in their final outcome (Kroodsma and Bailey 1982), although interest in this topic has been renewed (Dingle et al. 2010, Danner et al. 2011). In this sense, it is worth noting that “the fact that the songs are not the innately canalized epigenetic expressions of genetic relationships among birds does not mean that songs cannot be used in phylogenetic estimates” (Payne 1986). In a broader taxonomic rather than phylogenetic sense, the same holds true. Taxonomic work with other neotropical emberizids of the tribe Thraupini (Eisenmann and Short 1982 for *Emberizoides*, Assis et al. 2007 for *Poospiza*, Areta 2008 and Areta and Repenning 2011 for *Sporophila*), where *Sicalis* belongs according to molecular data (Bledsoe 1988, Klicka et al. 2007), have shown the concordance of diagnostic morphology and voices to be in alignment with species limits in those groups. Second, the sudden geographic (nonclinal) appearance of *S. mendozae*, whose morphological differences exceed those found within currently accepted subspecies of *S. olivascens* but are consistent with species-level differences within *Sicalis*, argue in favor of species rank for *S. mendozae*. Third, we interpret the persistent habitat-related parapatry of *S. olivascens* and *S. mendozae* without any geographical barrier to be consistent with their status as species (see García-Moreno and Fjeldså 2000). Finally, *S. mendozae* is ~10% smaller and 20% lighter than *S. olivascens*, yet its range extends much farther south. We also stress that the morphologically and vocally distinctive *S. lebruni* of lowland Patagonian steppes differs strikingly from *S. olivascens* in virtually all its features, and its species status is fully supported by our data (see Peters 1923). Although Vuilleumier (1993) suggested that competition with *S. auriventris* prevents coexistence of *S. olivascens* and *S. lebruni*, the very different bill morphology, different habitats, and paleoenvironmental history seem enough to explain the lack of geographic overlap between *S. lebruni* and *S. olivascens*.

Judged from plumage and structural features, *S. mendozae* appears to be more closely allied to *S. lutea* or *S. lebruni* than to *S. olivascens*. The staccato voice of *S. mendozae* resembles the song of *S. lebruni* and may provide some evidence for their relationship, whereas *S. lutea* is not obviously sexual dimorphic like *S. mendozae*, undermining the idea of a close relationship between them. However, since we lack a comparative phylogenetic study to assess the value of plumage as a phylogenetically informative character in *Sicalis*, the precise relationships within *Sicalis* await further analyses. Until that moment, we consider *S. mendozae* and *S. lebruni* to be sister species, and recommend placing *S. mendozae* between *S. olivascens* and *S. lebruni* in the linear sequence. With the addition of *S. mendozae* to the list of the South American Classification Committee (Remsen et al. 2010) the genus

Sicalis comprises, at the moment, the following species (subspecies not listed): Stripe-tailed Yellow-Finch (*S. citrina*), Puna Yellow-Finch (*S. lutea*), Bright-rumped Yellow-Finch (*S. uropygialis*), Citron-headed Yellow-Finch (*S. luteocephala*), Greater Yellow-Finch (*S. auriventris*), Greenish Yellow-Finch (*S. olivascens*), Monte Yellow-Finch (*S. mendozae*), Patagonian Yellow-Finch (*S. lebruni*), Orange-fronted Yellow-Finch (*S. columbiana*), Saffron Finch (*S. flaveola*), Grassland Yellow-Finch (*S. luteola*), Raimondi's Yellow-Finch (*S. raimondii*), and Sulphur-throated Finch (*S. taczanowskii*).

The lack of uniform criteria for ranking species has resulted in 10 to 13 species of *Sicalis* being recognized by different authors despite working with the same array of taxa (no valid taxon has been described since Hellmayr's 1938 work). Our contribution on *S. mendozae* highlights that vocalizations and habitat use can be safely used to identify and uncover species-level taxa of neotropical oscines, and it supports voice and ecology as powerful tools to solve taxonomic riddles where strictly morphological studies have failed to shed light. Much work remains to be done with the *S. olivascens* complex, in which patterns of variation in plumage, morphology, and songs are not fully understood (Taczanowski 1874, 1886, Hellmayr 1932, 1938, this work), and *Sicalis* has defied proper interpretation of its taxonomy and identification by great ornithologists for a long time.

The pooling of all yellow-finches into *Sicalis* is also questionable on the basis of their differences in bill shape, displays, songs, and nesting behavior; *Sicalis* is likely not a holophyletic assemblage. For example, while the similar *S. luteola* and *S. citrina* have a parachuting display with flight song, no other *Sicalis* species are known to engage in such display. Future taxonomic and systematic studies of *Sicalis* yellow-finches will certainly benefit from natural-history data.

BIOGEOGRAPHY

The geographical distributions of the various Andean species of *Sicalis* seem fairly concordant with areas of endemism (Cracraft 1985). *Sicalis luteocephala* is endemic to the Austral Andean Center, *S. raimondii* to the West Peruvian Andean Subcenter, the non-Andean *S. lebruni* to the Patagonian Center, and *S. lutea*, *S. uropygialis*, and *S. olivascens* occur within the Peruvian Andean Subcenter and the Austral Andean Center (Cracraft 1985). The distinct patterns of bird endemism in the Andes are likely to reflect historical isolations (Fjelds  1995, Garc a-Moreno and Fjelds  2000), so we asked ourselves whether *S. mendozae* fits any known area of endemism.

The Monte Desert or Provincia del Monte (Cabrera 1971, Cabrera and Willink 1980), is a sparse xerophytic scrub that occurs only in Argentina. It harbors several endemic or near endemic birds such as the White-throated Cacholote (*Pseudoseisura gutturalis*), Steinbach's Canastero (*Pseudasthenes steinbachi*), Patagonian Canastero (*Pseudasthenes patagonica*), Hudson's Black-Tyrant (*Knipolegus*

hudsoni), Straneck's Tyrannulet (*Serpophaga griseicapilla*), Lesser Shrike-Tyrant (*Agriornis murinus*), Black-crowned Monjita (*Xolmis coronata*), Sandy Gallito (*Teledromas fuscus*), White-banded Mockingbird (*Mimus triurus*), Carbonated Sierra-Finch (*Phrygilus carbonarius*), Cinnamon Warbling-Finch (*Poospiza ornata*), and Monte Yellow-Finch (*Sicalis mendozae*). The Monte is located in the transition zone between the Patagonian and tropical biotas. This transition zone has been dynamic and has moved repeatedly as a consequence of climatic changes during the Cenozoic (Roig et al. 2009). Thus both Andean-Patagonian and Chacoan bird elements are mixed in this ecoregion (Blendinger 2005, Roig et al. 2009). The Monte birds have been subdivided into an avifauna of the plains with Andean-Patagonian influence and an avifauna of the northern valleys and mountain slopes with Chacoan influence (Rabinovich and Rapoport 1975). Blendinger (2005) discussed the problems with this hypothesis and argued that "three coarse areas could be differentiated in the Monte desert according to bird species composition and their biogeographical affinities, a Northern Monte valleys area (Andean-Patagonian influence), a Central Monte plains (Chaco influence) and an Austral Monte plain and plateau area [Andean-Patagonian influence]." *Sicalis mendozae* is distributed within the Northern Monte valleys area, which has a strong influence of Andean-Patagonian birds. The high endemism of insects and reptiles and the more moderate endemism of birds and mammals support the Monte as an independent center of evolution (Rundel et al. 2007, Roig et al. 2009), showing that this desert acted as both a center of differentiation and a barrier to genetic exchange between the Pampas-Chaco to the east and the Andes-Patagonia to the west and south.

Depauperate avifaunas are expected to have fewer endemic species than are rich avifaunas, partly as an effect of the diminished chances of differentiation due to a low number of species in the initial stock from which diversification can occur. Moreover, in the case of the arid Monte of Argentina, there are few habitat types that might pump the speciation process. Thus recognition of meaningful areas of differentiation in species-poor and habitat-limited environments should be based in fewer differentiated forms than in areas of species-rich and habitat-diverse environments. We propose to recognize the Monte Desert as a new endemic bird area.

What can the phylogenetic and biogeographic affinities of other species in the Monte Desert tell us about the relationships of *S. mendozae*? The distribution of *S. mendozae* resembles that of subspecies *hoi* of the Rufous-banded Miner (*Geositta rufipennis*) (Contreras 1980, Darrieu and Camperi 2006), a species in need of taxonomic revision. Two types of voice are known in *G. rufipennis* from Argentina and Chile (A. Jaramillo, unpubl. data.; pers. obs.), which replace each other altitudinally and parapatrically much as do *S. mendozae* and *S. olivascens*. The high-Monte endemic *Pseudasthenes steinbachi* is related to the Cactus Canastero

(*P. cactorum*) within a clade that includes the Dusky-tailed Canastero (*P. humicola*) and the Patagonian Canastero (*P. patagonica*) (Derryberry et al. 2010). The mostly montane Monte endemic *Poospiza ornata* seems closely related to the high-altitude Bolivian Warbling-Finch (*P. boliviana*) (although the Bay-chested Warbling-Finch [*Poospiza thorcica*] was not sampled, see Lougheed et al. 2000). The lowland *Phrygilus carbonarius* is closely related to the mostly Andean montane Band-tailed Sierra-Finch (*P. alaudinus*), from which it diverged ~2 million year ago (Campagna et al. 2011). The distribution of *S. mendozae* within the Northern Monte valleys area (with a strong influence of Andean–Patagonian birds, Blendinger 2005) overlaps with that of some of the endemic birds that occur in the highest reaches of Monte Desert (e.g., *Pseudoseisura gutturalis*, *Pseudasthenes steinbachi*, *Teledromas fuscus*, *Phrygilus carbonarius*, and *Poospiza ornata*). Thus several Monte Desert endemic birds may have been influenced by the same orogenic and climatological processes that appear to have triggered the genesis of *S. mendozae*. Available phylogenetic data suggests that taxa descended from both high-Andean and Patagonian ancestors inhabit the highest reaches of Monte desert. Likewise, biogeographic, vocal, and morphological data indicate that *S. mendozae* is of Andean–Patagonian origin, given its presumed close relationship to the Patagonian *S. lebruni* (see Taxonomy and Systematics).

Although the timing of the differentiation of *S. mendozae* from an ancestral stock is unknown, we hypothesize that it must have occurred after the appearance of the arid, mid-elevation shrubby habitats where it dwells. During the Cenozoic, the Andes had a complex geological and vegetational history, which affected in various ways the distribution and the types of habitats available, directly influencing bird distributions and patterns of differentiation (Haffer 1970, Vuilleumier 1991, Fjelds  1994, 1995). Since the Andes are not a single entity, uplifted in different areas at different rates (Gregory-Wodzicki 2001), the specific geological history of the arid central Andes of Chile and Argentina may shed light on its historical identity. Many of the main features of the Andes appeared in the Miocene, but the Quaternary also brought major modifications to the topography. The final and significant uplift of the Central Cordillera of Argentina and Chile occurred during the Pliocene Diaguita Phase of diastrophism (Yrigoyen 1979) ~3–5 million years ago, creating a rain shadow and making a desert of the area sandwiched between the also newly raised Pampean Mountain Range and the Central Andes (Pascual et al. 1996, Alberdi et al. 1997). Successive glaciation–deglaciation cycles must have influenced the diversification in these new hostile arid environments. The available evidence on Pleistocene vegetational changes and on fossil birds is congruent with these expectations. First, the habitat boundaries that resulted in the isolation and subsequent differentiation of the taxa in the Monte area of endemism were set by a “zone of

continuous aridity across the Cordillera which has served as a barrier to north–south migration during glacial and interglacial times” (Simpson 1979: 167) to the north and by forested areas and glacial tongues to the south (Simpson 1971). Second, fossils of an unidentified large *Sicalis* and of *Cinclodes major* from coastal mid-Pleistocene deposits in the lowland pampas of Buenos Aires province were thought to have inhabited dry and cool habitats (Tonni 1973, 1977, 1980) and provide further evidence of how paleoenvironmental changes affected the distribution of essentially Andean genera like *Sicalis* and *Cinclodes*, bringing them to formerly cooler low-lying areas. Moreover, a relictual population of *S. auriventris* is found in the isolated pampean range the Sierra de la Ventana, southern Buenos Aires province (Pearman and Chiappe, unpubl. data).

The arid central Andes of Chile have several distinctive endemic birds, the Chilean Tinamou (*Nothoprocta perdicaria*), Dusky-tailed Canastero (*Pseudasthenes humicola*, perhaps formerly also in Argentina), Crag Chilia (*Ochetorhynchus [Chilia] melanurus*), Moustached Turca (*Pterotochos megapodius*), and Chilean Mockingbird (*Mimus thenca*) (recently found in Argentina). Two additional species, the Dusky Tapaculo (*Scytalopus fuscus*) and White-throated Tapaculo (*Scelorchilus albicollis*), occur only in the coastal ranges of Chile and on the coast (Jaramillo 2003). Most of these taxa were included in the *Nothofagus* (Chilean Andean) Center of endemism by Cracraft (1985), together with several forest forms. However, they inhabit dry matorral and sclerophyllous forest usually surrounded by open rocky areas, and not the typical *Nothofagus* forests. They occur mostly within the Provincia Chilena Central biogeographic region (Cabrera and Willink 1980), but some of them extend to the neighboring Provincia del Desierto. Fjelds  (1994: 217) proposed that “the arid diagonal from coastal Peru to mid-Argentina was accentuated since the late Pliocene. Hereby the southern cone of the continent was isolated, and the evolution has since been mainly phyletic in the south.” Yet considerable diversification has occurred to the south and within this arid diagonal, pointing to a more complex speciation history than has been hitherto acknowledged.

In synthesis, there seems to have been considerable differentiation in arid ecosystems in the western part of the southern cone, with distinctive species arising on both sides of the Andes in Argentina and Chile. Further understanding of the timing and spatial location of the multiple uplifts of various mountain ranges, of their effect on vegetation, and more data on the phylogeny and taxonomy of southern central Andean birds are crucial to understanding the biogeography of the region.

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Supplementary Online Material for “Taxonomy and Biogeography of the Monte Yellow-Finch (*Sicalis mendozae*): Understanding the Endemic Avifauna of Argentina’s Monte Desert”

Juan I. Areta, Mark Pearman, and Raúl Ábalos

APPENDIX 1. Specimens of *Sicalis* yellow-finches examined and measured for this study. Acronyms are as follows: AMNH (American Museum of Natural History, New York), BMNH (Natural History Museum, Tring, England), CORBIDI (Centro de Ornitología y Biodiversidad, Lima), FML (Fundación Miguel Lillo, Tucumán, Argentina), IADIZA (Instituto Argentino de Investigaciones de las Zonas Áridas, Mendoza, Argentina), MACN (Museo Argentino de Ciencias Naturales, Buenos Aires), MNHN (Muséum National d’Histoire Naturelle, Paris), MLP (Museo de La Plata, La Plata, Argentina), MP-GEH (Museo Privado de Ciencias Naturales Guillermo E. Hudson, San Luis, Argentina), NHMV (Naturhistorisches Museum, Vienna) and USNM (National Museum of Natural History, Washington, DC).

Sicalis lutea. MACN: 2346a (4 specimens so numbered), 5677, 7944, 37845. AMNH: 145619, 468333, 786528.

Sicalis uropygialis. AMNH: 468093, 803502, 803503, 803504, 803505, 803507, 803508. CORBIDI: AN895, CS507, CS68, DG18, EM59, KV26, RTC153, RTC59, TV67, TV678, TV810.

FML: 2172, 6008. MACN: 18484, 18498. MLP: 12112, 12284. NHMV: 67562, 67563, 67564.

Sicalis luteocephala. MACN: 138063, 138064.

Sicalis auriventris. BMNH: 1899.1.20.54 (type specimen of *incae*). FML: 2262, 5611, 8759. MACN: unnumbered, 2172a, 5013a, 18485, 35187, 35417, 42549, 51506, 52248. MLP: 10250.

Sicalis olivascens. AMNH: 786531. BMNH: 1896.10.6.344 (type specimen of *salvini*), 1922.9.28.2, 1922.9.28.3, 1922.9.28.4. CORBIDI: DG13, DG15, EB531, FH63, JN633, JS214, LB1, SF61. FML: 1483, 2259, 2261, 2263, 2267, 7787, 8614, 8615, 8616, 8617, 13015, 14425, 15061. MACN: 2506a (7 specimens so numbered), 37847, 8633, 37849, 8633, 8502a (3 specimens so numbered), 52630, 37850, 8633. MNHN: 1907-769, 1907-770 (type specimens of *olivascens*). NHMV: 83735, 83736.

Sicalis mendozae. BMNH: 1885.2.10.754 (type specimen of *mendozae*), 1885.12.14.1274, 1885.12.14.1292, 1922.9.28.1 (type specimen of *stewarti*). IADIZA: 2506, 2534, 2703, 3159, 4273. FML: 2265, 5973, 5974, 9364, 9414, 11234. MACN: unnumbered, 27839, 27840, 27841, 51089, 51091, 51080, 51079, 51076, 51077, 51078, 57587. MP-GEH: 196/333, 196/334. USNM: 227867.

Sicalis lebruni. AMNH: 708601, 708602. FML: 12147, 12151, 12159, 13720, 13721, 14235. MACN: 53253, 9562, 8339, 52328, 8339. MLP: 5742, 9561, 9563. NHMV: 77169, 77170, 77171, 77172, 77195, 80337.

Sicalis taczanowskii. CORBIDI: AQ5.

APPENDIX 2. List of recordings used for this study. Capitalized names refer to Argentine provinces, Chilean regions, and Bolivian or Peruvian departments. Each locality is followed by the name of the recordist, number of individual birds recorded at each locality, and source or catalogue number when available (XC = www.xeno-canto.org, MLNS = www.macaulaylibrary.org).

Sicalis lutea. **ARGENTINA**. JUJUY. Azul Pampa (Pearman 1), Sierras de Cochinoca (Ferrari 1, XC54601). **BOLIVIA**. ORURO. Callipampa (Krabbe 1, Maijer 2000).

Sicalis uropygialis. **ARGENTINA**. CATAMARCA. Santa María (Straneck 1, Straneck 1990a). JUJUY. Abra Pampa (Macaulay 1, MLNS 116029), Cieneguillas (Areta 1), Larcas (Pearman 1). **BOLIVIA**. COCHABAMBA. Cañón del Río Misicuni (Maijer 1, Maijer 2000). **CHILE**. REGION I. Parque Nacional Lauca (Areta 4). **PERU**. CUSCO. Río Velille, Chumbivilcas (Aragon 1, XC28863). JUNIN. Ondores (Clock 1, MLNS 147894).

Sicalis luteocephala. **ARGENTINA**. JUJUY. Yavi (Ferrari 1, Monteleone 1, Pearman 1). **BOLIVIA**. CHUQUISACA. North of Tarabuco (Krabbe 1, Maijer 2000). COCHABAMBA. Between Arani and Vacas (Krabbe 2, Maijer 2000).

Sicalis auriventris. **ARGENTINA**. LA RIOJA. Laguna Brava (Pearman 1). MENDOZA. Vallecitos (Areta 6), Refugio Scaravelli (Areta 2). NEUQUÉN. Copahue (Areta 4), Laguna Tromen (Roesler 1). SANTA CRUZ. Río La Leona (Imberti 1). **CHILE**. REGION METROPOLITANA. El Portillo valley (Areta 3), El Yeso valley (Areta 2, Pearman 1).

Sicalis olivascens. **ARGENTINA**. CATAMARCA. Cuesta de Randolpho (Areta 2), Laguna Alumbreira (Areta 2), Corral Blanco (Areta 1), Minas Capillitas (Straneck 2, Straneck 1990a). JUJUY. Abra Pampa (Pearman 1), Azul Pampa (Pearman 2), Yavi Chico (Pearman 1), Yavi (Ferrari 1, Roesler 1, Athanas 1, XC13003). TUCUMÁN. Aconquija–El Infiernillo (Roesler 1 complex song, Mazar Barnett 1, XC15436; Macaulay 1, MLNS 115992). **BOLIVIA**. CHUQUISACA. Cerro Huayra Huasi (Krabbe 1, Maijer 2000). COCHABAMBA. Cerro Kheñwa Sandra (Krabbe 2, Maijer 2000), Tortorata (Hennesey 1, MLNS 101947). **CHILE**. REGION I. Putre (Areta 10, Pearman 1), between Socoroma and Putre (Pearman 2). **PERU**. LIMA. Cieneguilla Valley (Lane 1, XC65598).

Sicalis mendozae. **ARGENTINA**. CATAMARCA. Hualfín (Areta 1). MENDOZA. Cajón del Atuel (Areta 2, Ábalos 1). SAN LUIS. Parque Nacional Sierra de las Quijadas (Areta 12, Pearman 5, Ferrari 1, XC53184).

Sicalis lebruni. **ARGENTINA**. RÍO NEGRO. Paso Córdoba (Areta 3). SANTA CRUZ. Estancia Buitreras (Imberti 5), Bosque Petrificado (Straneck 1, Straneck 1990b). **CHILE**. XII REGIÓN. Laguna Verde (Jaramillo 2, XC60232, 60233).