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Pale-headed Brush-finch *Atlapetes pallidiceps*: notes on population size, habitat, vocalizations, feeding, interference competition and conservation

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Summary

Pale-headed Brush-finch *Atlapetes pallidiceps* is on the verge of extinction, with fewer than 100 individuals surviving in an area of less than 4 km^2 in the Yunguilla valley in the province of Azuay, southern Ecuador. A reserve created for the protection of the species held 10 or 12 pairs in 1999, 14 in 2000, 16 in 2001 and 17 in 2002. Nearly all males had distinctive songs, showing little or no change from one year to the next. The yearly turnover of singing males was 40% in both 2000 and 2001 (4/10), and 29% in 2002 (4/14). Altitudinal range of *A. pallidiceps* was 1,650–1,950 m. Habitat was typical of regenerating landslides and fallow fields, composed of early succession growth in the ecotone between dry, thorny valley-bottom and humid forest remnants on the upper slopes. Territory size averaged 1.0 ha (range 0.7–1.4 ha, $n = 37$), and nearly all territories were within 100 m of a stream or an irrigation channel. Most were on steep slopes with *Chusquea* bamboo, and deciduous bushy cover with few or no spines, typically including the composite *Steiractinia sodiroi*, and with some open areas. Although habitat improved considerably between 1999 and 2002, some territories were vacant some years. Shiny Cowbird *Molothrus bonariensis* parasitism was noted, and could be even more important than habitat as a limiting factor of the population size. The song of *A. pallidiceps* was found to be similar to songs of several other *Atlapetes* spp. in general pattern. Diet was composed of arthropods, fruit and a few seeds. Arthropods were almost invariably picked from the bark on upper- and under-surfaces of twigs and small branches. Seeds were taken from the ground. Young (cowbirds) were apparently only fed insects. Between 1,800 and 1,950 m *A. pallidiceps* occurred with Rufous-naped Brush-finch *A. latinuchus*, which replaces it at higher elevations. Territories did not overlap, and where they met, *A. latinuchus* was confined to slightly taller and more humid vegetation, or to forest. In interspecific encounters *A. pallidiceps* was subordinate to Stripe-headed Brush-finch *Buarremon torquatus*, with which it coexisted in all its territories. Habitat management began in 2002, and limited cowbird control is planned to begin in 2003.

Introduction

Before 1998, Pale-headed Brush-finch *Atlapetes pallidiceps* was recorded from only four localities in the Río Jubones drainage, southern Ecuador, and most recently in 1969 (Paynter 1972, 1978). The drainage is a steep-sided desert valley with humid upper slopes; its pleasant climate with access to water has made it a favoured area for human settlement for thousands of years, as is evident from

old "Cañari" wall scrapings in the caves; on the upper slope a few small patches of original forest remain, but the transitional zone and the dry valley bottom are entirely altered owing to human activity (N. Krabbe pers. obs.).

One of the major obstacles to rediscovering the species was the lack of information on its habitat requirements. Older specimens had been collected without information on habitat. The collector of the most recent series of specimens (Paynter 1972, 1978) noted that although he collected the specimens in *Acacia* scrub, he suspected that the birds were fugitives from a patch of different habitat nearby that had been destroyed. Later searches for the species by myself and others, notably M. B. Robbins and R. S. Williams (pers. comm.), in the many patches of *Acacia* scrub within the species' former range, including what was almost certainly the same patch where Paynter collected his series, seemed to confirm Paynter's suspicion.

From 1991 to 2001 I searched for the species at 20 different localities within its former range, over a total of 31 days, and found it at only one locality, in the Yunguilla valley in the province of Azuay, southern Ecuador, where I then studied it over the next four years with the help of Francisco Sornoza, Orfa Rodríguez and Ana Agreda. Particular attention was paid to the population size and the identification of individuals by voice. In 2002 Martin H. Schaefer, Veronica Schmidt, Steffen Oppel and co-workers began a more intensive study of the species. They obtained a considerable amount of data on nesting, including cowbird parasitism, a topic not dealt with here.

Methods

Observations were made over 62 days in 1998–2002, including 54 days in the rainy season (February: nine days, March: 19 days, April: six days, May: 16 days, June: four days), and eight days in the dry season (September: one day, November: five days, December: two days). Each territory size was estimated and a brief description of the vegetation was made. At first, birds were mist-netted, colour-banded, and blood samples taken for future genetic analysis. Blood was conserved in dimethylsulphoxide at room temperature and later stored at the Zoological Museum, University of Copenhagen. Four of the five individuals caught were banded with one or two colour rings, but none was seen again. Because it was believed that the capture caused these birds to abandon their territories, the method was halted and a less intrusive method of identifying individuals by voice implemented instead.

Birds were tape-recorded and observed from when they became active at early dawn (05h55) until they could no longer be heard or seen. Surveys using tape-recordings of song were performed to establish presence when no natural song was heard. Sonograms of the recordings were later compared to estimate the turnover of singing males. Older, well-established birds were presumed to sing less than birds setting up their first territory, so frequency of song was not used as an indication of preferred habitat.

Results

During the surveys, *Atlapetes pallidiceps* was encountered on 412 occasions. It was found in pairs throughout the year, as is typical for other species of *Atlapetes* and

the closely related Stripe-headed Brush-finch (pers. obs.). Females followed males and chose less conspicuous perches. Birds vocalized most actively and fed most conspicuously before 08h00. They sometimes had a short period of activity again in the late afternoon, but were generally difficult to observe after 10h00. On cool and foggy days they were occasionally observed at other times of day to an extent that indicated they remained within their territories or the immediate vicinity.

Population size

A slight year-on-year increase in population was observed in the study area. At the same time the amount of natural habitat increased as a result of regeneration and management. Several new territories were established, but a few of the old territories were left vacant, suggesting that habitat was not the only limiting factor. In February and March 2001, 34 different males were recorded in 32 territories, 16 of them outside the reserve. The presence of mates was confirmed in most territories. Suitable habitat not investigated would allow for a maximum of another three to five pairs to inhabit this area. Turnover in singing males during the breeding season indicated that more birds were present, but the total population of the upper Yunguilla valley was almost certainly fewer than 100 birds in 2001.

In 2002, not all territories outside the reserve were visited, but in the reserve, the same number of birds was present. Counts of singing males in the reserve were 10 in 1999 (but two more might have been present), 14 in 2000, 16 in 2001, and 16 or 17 in 2002. Outside the reserve, numbers increased rapidly between 1999 and 2001. Where Sornoza and I found only one pair in 1998 and 1999 (one or two more pairs could have been present), Sornoza and B. Carlos found five in 2001, when they also found more pairs higher on the same slope (F. Sornoza verbally 2001). Altogether 16 territories were found outside the reserve in 2001 (pers. obs.), Schaefer and co-workers recorded only nine pairs outside the reserve in 2002, but may not have visited all the territories from 2001 (M. H. Schaefer, V. Schmidt and S. Oppel verbally 2002).

In the reserve new birds had apparently replaced four males every year, a remarkably rapid turnover (30–40%). Some turnover was also noted within the same season. Five birds sang in the same territories for three consecutive years, only one or two for four consecutive years.

Habitat

Although all previous records of the species were from a narrow elevational range (1,650–1,900 m), all types of forest and scrub, including dry *Oreopanax* forest, laurel forest, mixed dry, humid and semi-humid forest and scrub, from 1,100 to 2,500 m, were visited during the searches. *A. pallidiceps* was located only in relatively undisturbed, early succession, dense, bushy growth along streams and irrigation channels on steep slopes in the ecotone between the humid and arid zone, just above the acacia zone, at elevations between 1,650 and 1,950 m. In this habitat, birds were found with relative ease at the end of the dry season when not singing, suggesting it was likely that they were genuinely absent from

areas previously searched. This was confirmed in May 1999, when I performed surveys using tape-recordings of songs during the breeding season in several areas where previous searches had been unsuccessful, all to no avail. I also searched a new area (Napa, 03°22–23′S 78°16–17′W, 1,850–2,000 m) that held nearly 200 ha of habitat that appeared suitable at a distance but which on closer inspection proved to be more disturbed than where the birds were found in the Yunguilla valley. Cattle trails traversed the entire area, leaving no dense, undisturbed patch larger than 10 m²; Chilca *Baccharis trinervia* was present (see below), and no brush-finch was heard singing during an intensive survey from dawn to 10h00. If *A. pallidiceps* were present in the area, then it had to be in very low numbers. Some isolated patches of seemingly suitable habitat between Girón and Yunguilla valley, each no larger than 1 or 2 ha were also found to be devoid of *A. pallidiceps*.

Altogether 37 territories were found in the Yunguilla valley, all within an area of 4 km². Another three sites within this area had a singing bird once or twice but did not appear to be permanently occupied.

The territories were from 40 to 200 m wide, ranging in size from 0.7 to 1.4 ha (mean 1.0 ha). All had at least some small clearings, and all but one were situated on sloping ground, some on very steep slopes. All but five were within 100 m of a stream or irrigation channel.

All territories had some cover of 2–3 m tall, dense, mostly non-spiny bushes of several species, characteristically with all bushes about the same height and with a few young trees *c*. 3–5 m tall, which were used as song posts early in the morning. Bush cover averaged 54% and ranged from 5% to nearly 100%. The composite bush *Steiractinia sodiroi*, widespread in the dry valleys of southern Ecuador (B. Øllgaard pers. comm.), occurred in nearly all territories, and dense stands of it proved to be a good indicator of the presence of *Atlapetes pallidiceps*. In the dry season the naked stalks gave a characteristic grey colour visible at long distance (see photo 2 in Agreda *et al*. 1999), and in the rainy season these composites were distinctive by their light-green colour. Owing to the density of the vegetation, observation was difficult in much of the habitat. Typically the composite *Baccharis trinervia* ("Chilca"), an indicator of disturbed habitats, was entirely absent from *A. pallidiceps* territories.

Chusquea bamboo was found in 28 territories (76%) in stands that covered from 5% to 95% of the ground (mean 39%). *A. pallidiceps* spent considerable time in these thickets. In some territories, one or a few larger trees were present, mostly acacias or laurel trees, or in a few cases *Inga* or other leguminous species. These trees were only used by the brush-finches as brief lookout and song posts and appeared not to be an essential requirement. A few territories were in rather disturbed habitat that resembled the vegetation found at Napa and other sites where the brush-finch was absent. Such habitat was presumed to be marginal. As judged from two local fires observed, the habitat of *A. pallidiceps* was fairly fire-resistant; bamboo recovered after only a few months, and bushes reached a suitable size again after just 1 or 2 years.

Vocalizations

Of all encounters, 334 (81%) involved singing birds. Song was tape-recorded during 190 encounters (1,576 phrases), 134 of them (1,374 phrases) without use of

playback. Nearly all birds heard were tape-recorded. Song activity was high during the rainy season (February–May), lower in late June, and very low in September, when only two birds each gave one song in an entire morning. No song was heard in November and December, late in the dry season.

Birds sang from the edges of clearings or from near the tops of bushes or small trees that were taller than the surrounding vegetation, some using fairly conspicuous perches. Songs were given most frequently at dawn, beginning at 05h55–06h08 (in September at 06h30). Bouts of song at dawn were usually 3–10 min long and were frequently interrupted by Stripe-headed Brush-finch singing nearby. Undisturbed birds would sometimes sing for up to 20 min. Intervals between songs during natural bouts were for the most part 7–16 seconds long (76% of intervals; $n = 811$) and ranged from 6 to 29 seconds or more.

Some birds repeated a phrase, varying only the number of endnotes, but most shifted between two or three, in rare cases four different types of phrases. One individual gave as many as 22 different variations of its four phrases. Most phrases were repeated only once or twice before being varied or changed, but occasionally longer series occurred, the extreme being a bird that repeated the same variation 11 times before changing it.

Territorial disputes during which males or pairs countersang or gave cascading series of notes at close range were observed on three occasions, none involving fighting. One dispute resulted in one bird taking over the opponent's territory.

Songs were apparently given only by males. In general pattern they resembled songs of several other *Atlapetes* species, especially *leucopterus*, *seebohmi*, and the geographically distant *fulviceps*. Song phrases were 0.7–1.5 seconds long, of five to 12 notes, and composed of three parts. The first was of one or two (rarely three or four) call notes, and the last (or the last two) sometimes transitional and nearly always distinctive for each individual in quality and pace. The second part was a single, less commonly none, two, or three loud notes, in most birds falling, but in some falling and rising or vice versa, in others of a highly distinctive shape. The end was a series of two to 12, usually four or five notes at slightly lower or descending volume, the notes either all similar (Figure 1A–C, E) or as two series of different notes (Figure 1D, F). Endnotes were of six general types: "sweet" notes, "rattled" notes, "long rattled" notes, "h-"notes, "slow" notes or "inverted N-"notes (Figure 1), and often common to several individuals. Most individual males could be readily recognized by at least some of their song phrases, which showed barely any differences between years (Figure 2).

During countersinging between a bird giving only one type of song phrase and one giving four, the latter used this phrase type more often than when it sang alone. Several other, less conclusive instances involving countersinging birds also suggested that imitation between neighbouring birds occurred, making identification of individuals on the basis of only a few common phrases uncertain. A particular phrase was part of the repertoire of several different individuals (Figure 1A).

Playback of song sometimes elicited loud or incomplete songs, but in most cases the phrases given after playback were indistinguishable from those given under natural conditions. Intervals also remained much the same, averaging

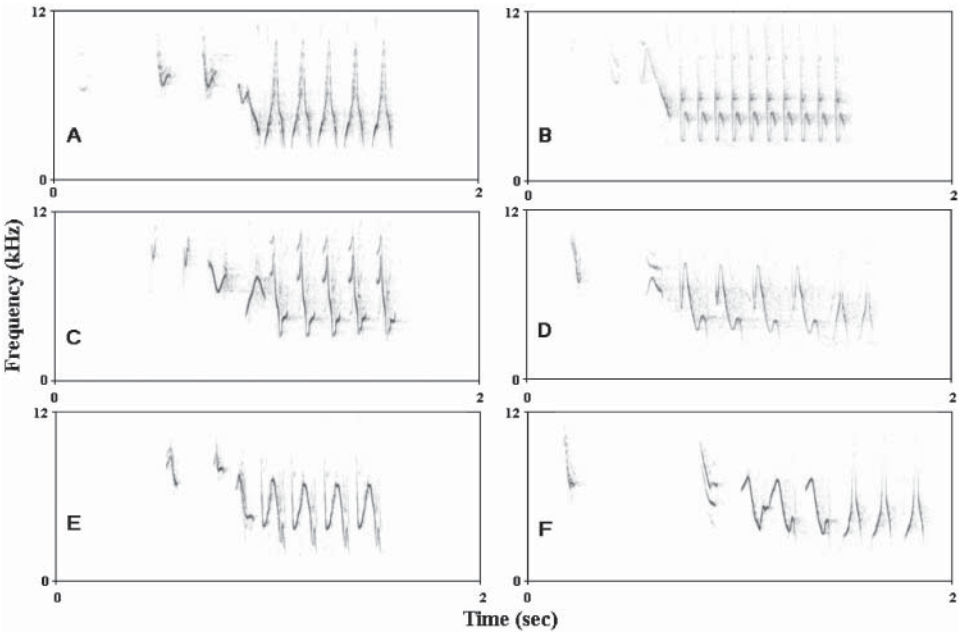

Figure 1. Different types of song phrases of Pale-headed Brush-finch. Songs of each individual included up to four types. The first two to four notes were distinctive for most birds, endnotes more similar and usually of the types shown. A few birds had highly irregular songs. Terms for different types of endnotes are: (A) "sweet"; (B) "rattled"; (C) "long rattled"; (D) "h" (here followed by two "sweet" notes); (E) "inverted N"; (F) "long" (here followed by one "h" and three "sweet" notes). Broader-based "sweet" notes and intermediates between the other types were also recorded. All recordings are by the author, in the Yunguilla valley in the province of Azuay, southern Ecuador, 1998–2002.

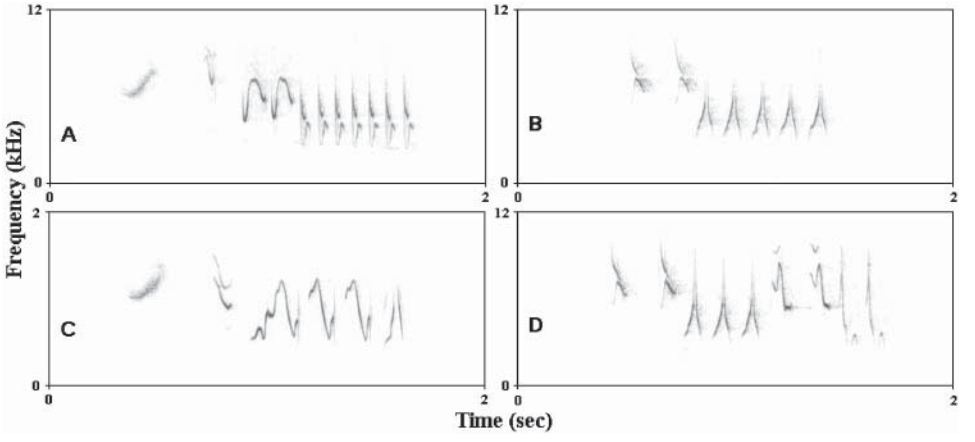

Figure 2. Four types of song phrases given by a Pale-headed Brush-finch during a bout of song. The number of endnotes varied. Up to 20 of the 22 song variants recorded in this individual were given during a single bout of song. The bird was recorded in the same territory all four years. Recorded by the author, in the Yunguilla valley in the province of Azuay, southern Ecuador, 2000.

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17 seconds after playback ($n = 219$) and 16 seconds under natural conditions ($n = 812$).

Both members of a pair often gave a cascading series of notes in duet when they met after being out of each other's sight or when they met another pair. Playback of song also frequently elicited this vocalization. Similar "cascades" are given by other *Atlapetes* species, but not by members of the genus *Buarremon* (pers. obs.). High-pitched call notes of two or three different kinds were heard throughout year, apparently functioning as contact notes and alarm calls.

Feeding

Feeding was observed on 60 occasions, 29 of them in September–December (dry season) and 31 in February–June (rainy season).

On 24 occasions birds were observed to feed on fruit, mostly *Rubus*, *Acnistus*, *Solanum* and *Acalypha* and Sornoza also found them feeding on *Heliotropium* berries (Lozano 2001). During the dry season, 16 (55%) observations of feeding were of fruit, which were plentiful during this time, in contrast to only 8 (26%) observations during the rainy season. Fruit was picked by reaching out, sometimes involving considerable manoeuvring with circular movement of the tail to counter-balance. Once (in May) a pair was seen to leave the shelter of bushes to venture 5 m into an open patch of short grass to feed on the seeds of a creeper (Polygonaceae) on the ground. On three occasions birds were observed to peck the ground under dense bush cover, apparently feeding on seeds.

On 33 occasions birds were observed to feed on insects: 23 during the rainy season, 10 during the dry season. Generally the prey could not be identified, but on two occasions could be seen to be caterpillars. Prey was invariably picked from the bark of the upper- and underside of twigs and branches, often *Steiractinia sodiroi*, the birds reaching up or down. Oppel and co-workers also noted earthworms among the prey fed to the young (pers. comm.).

Interference competition

As is the case for several species of *Atlapetes* (Paynter 1972, 1978, Remsen and Graves 1995a, b) the distributional range of *A. pallidiceps* appears to be influenced by that of congeners. Upwards it is sharply replaced by the range of *A. spodionotus* (formerly considered a subspecies of *A. rufinucha*; see García-Moreno and Fjeldså 1999). In the sharp replacement zone *A. spodionotus* occupies taller, more humid vegetation than does *A. pallidiceps*, and some of the latter's territories were found in early succession growth on what were undoubtedly territories of *A. spodionotus* before the forest was cleared. Higher on the slope *A. spodionotus* occupied both forest and early succession growth, and along forested ravines it occurred down to 1,800 m. Nowhere was *A. pallidiceps* found in forest.

In adjacent valley systems, *A. leucopterus* replaces *A. pallidiceps* in a similar, although wider altitudinal range and habitat: to the north nominate *A. l. leucopterus*, to the south *A. l. dresseri*, possibly specifically distinct from the nominate form, from which it differs in a number of respects (Fjeldså and Krabbe 1990).

Stripe-headed Brush-finch (often placed in *Atlapetes* but see Remsen and Graves 1995b) occupied a wide range of dense habitats in the Río Jubones drainage, both humid and dry. It occurred with *A. pallidiceps* in all the latter's territories. The larger *Buarremon* monopolized the densest parts of the vegetation and often did not tolerate the presence of singing males of *A. pallidiceps* in close proximity. Some individuals were particularly aggressive. On 15 occasions *A. pallidiceps* song was clearly interrupted by song of *B. torquatus*, causing *Atlapetes* to either move further away, or to stop singing altogether. In one case, when a singing male of *A. pallidiceps* stayed its ground singing as it waited for its young (cowbird) to follow, it was attacked directly by a *B. torquatus*, which left its dense undergrowth habitat to attack 3 m above the ground in an open acacia tree. On 2 December pairs of the two species were observed for several minutes as they attended the same mixed-species flock, frequently within 2 m of each other. Interaction between them was seen only once during this time, when a *B. torquatus* displaced an *A. pallidiceps* pecking eagerly at the ground under a low tree.

Discussion

Elsewhere in the Río Jubones drainage, to which the species was probably always confined, only small and isolated patches of suitable habitat remained during the study period, none big enough to hold 10 territories (pers. obs.). Several small patches investigated were found to hold no brush-finches, but it remains possible that some patches with a few pairs remain undiscovered. Larger patches of habitat could be fairly easily restored in many places by leaving pasture fallow (pers. obs.).

Paynter (1972) investigated the stomach contents of eight individuals collected in November. All contained a good deal of sand, which at times made up almost half the material in a full stomach. Insect remains were found in six, varying from very little to 25% of the recognizable material, and most birds had relatively large pieces of what appeared to be endosperm from a big seed, the outer coating of which was never attached. A few very small seeds (2 mm or less) of several types were also noted, and a cocoon (2×5 mm) and tiny (3×8 mm) larval case probably of a fly larva were found in one specimen.

Vegetable matter apparently forms a greater part of the diet in the dry than in the rainy season, but it should be noted that Paynter collected the specimens in what he believed to be atypical habitat. Although the density of the habitat and paucity of observations during middays and afternoons renders it possible that seeds form a more substantial part of the diet than observations in the Yunguilla valley would lead one to believe, it seems more likely that *Atlapetes pallidiceps* obtained most of its food in the morning while most active, and that the observed feeding was representative of the bird's diet.

The low breeding success (only five fledglings from 16 nests) in the reserve in 2002 (Schaefer, Schmidt, Oppel and co-workers pers. comm.) does not seem consistent with a turnover as rapid as that found through identification of individuals by voice over previous years. Whether some birds changed their voice beyond recognition, or some colonized from outside the reserve, or whether 2002 was a particularly poor year for production of young, remains to be established through further studies.

Conservation

In 2000 Fundación Jocotoco purchased 26 ha of land holding 10 territories of *Atlapetes pallidiceps*, and declared this area a private reserve for the protection of the species. The reserve was enlarged in 2001 when 30 ha of adjacent land were acquired, and it now encompasses 17 territories. The 16 territories found outside the reserve are on five different properties. The owners of two properties who hold over half these territories were approached in 2001. They were not willing to sell, but had no plans to change the use of the land dramatically in the immediate future. The steepness of much of the terrain also precludes intensive use.

Oppel *et al.* (2004) who commenced a thorough study of the Pale-headed Brush-finch in 2002, reported such a high level of parasitism by Shiny Cowbird *Molothrus bonariensis* in the reserve in 2002 that it was decided to begin cowbird control on a small scale in 2003.

The 26 ha of land purchased in 2000 encompass a large landslide, which was colonized by the introduced African Honey Grass *Melinis minutiflora* decades ago (information from locals). Bushy growth was encroaching on the landslide, but at such a slow pace that the presence of clearings should be ensured for several years to come (pers. obs.). Part of the 30 ha of land acquired in 2001 held much pasture, which had been kept open by daily cutting with machete. Scattered patches of vegetation remained, and suitable habitat will undoubtedly regenerate in only a few years. In 2002, the only parts of the reserve with larger areas in need of habitat management were the more humid west slope of the ridge, where much of the vegetation was too dense and tall. Some clearing, aiming at removing vegetation taller than 3 m and leaving a maximum of 10 small trees and two big trees on each territory, commenced in 2002.

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References

Agreda de La Paz, A., Krabbe, N. and Rodríguez Barahona, O. (1999) Pale-headed Brush-finch is not extinct. *Cotinga* 11: 50–54.

Collar, N. J., Gonzaga, L. P., Krabbe, N., Madroño Nieto, A., Naranjo, L. G., Parker III, T. A. and Wege, D. (1992) *Threatened birds of the Americas*. Cambridge, U.K.: International Council for Bird Preservation.

Fjeldså, J. and Krabbe, N. (1990) *Birds of the high Andes*. Copenhagen: Apollo Books.

Garcia-Moreno, J. and J. Fjeldså. (1999) Re-evaluation of species limits in the genus *Atlapetes* based on mtDNA sequence data. *Ibis* 141: 199–207.

Lozano, C. P. (2001) Caracterización florística y ecológica de "Bellavista" Yunguilla, propiedad de la Fundación Jocotoco. Unpublished report (38 pp) to the Jocotoco Foundation.

Oppel, S., Schaefer, H. M., Schmidt, V. and Schröder, B. (2004) Cowbird parasitism of Pale-headed Brush-finch *Atlapetes pallidiceps*: implications for conservation and management. *Bird Conserv. Internat*. 14: 63–75.

Paynter, R. A. (1972) Biology and evolution of the *Atlapetes schistaceus* species-group (Aves: Emberizinae). *Bull. Mus. Comp. Zool.* 143: 297–320.

Paynter, R. A. (1978) Biology and evolution of the avian genus *Atlapetes* (Emberizinae). *Bull. Mus. Comp. Zool.* 148: 323–369.

Remsen, J. V., Jr and Graves IV, W. S. (1995a) Distribution patterns and zoogeography of *Atlapetes* brush-finches (Emberizinae) of the Andes. *Auk* 112: 210–224.

Remsen, J. V., Jr and Graves IV, W. S. (1995b) Distribution patterns of *Buarremon* brush-finches (Emberizinae) and interspecific competition in Andean birds. *Auk* 112: 225–236.

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