Wilson Bull., 115(4), 2003, pp. 360–366

DESCRIPTION OF THE NEST, EGGS, AND BREEDING BEHAVIOR OF THE ENDANGERED PALE-HEADED BRUSH-FINCH (*ATLAPETES PALLIDICEPS*) IN ECUADOR

STEFFEN OPPEL,[1,3,4] H. MARTIN SCHAEFER,[2] AND VERONIKA SCHMIDT[2]

ABSTRACT.—The Pale-headed Brush-Finch (*Atlapetes pallidiceps*) is a critically endangered endemic bird species that is restricted to a single valley in southern Ecuador. We present the first description of the nest, eggs, breeding behavior, and juvenal plumage of this species. Seventy-two percent of nests (n = 18) were placed on thin overhanging branches 1–3 m above the ground, directly beneath the top layer of foliage in dense thickets. Nesting material consisted of various proportions of grass, twigs, and bamboo stalks and leaves. Clutch sizes ranged from 1–3 eggs (n = 22), and ≥55% of nests (n = 18) were parasitized by Shiny Cowbirds (*Molothrus bonariensis*). The background color of eggs was buffish white to bluish, and they were spotted and blotched with diffuse brown markings. Mean egg size was 24 × 17.8 mm. Fledgling plumage differed from adult plumage and had some characteristics similar to the adult White-winged Brush-Finch (*Atlapetes leucopterus*). Females alone incubated the eggs, and both parents fed the offspring. Incubation and nestling times were 12–14 days each. Fledglings of the Pale-headed Brush-Finch were led for several weeks after fledging. No pair initiated a second clutch after a successful first one (n = 16), but we observed second and third clutches after nest failure had occurred. Prolonged postfledging care is assumed to prevent multiple broods of the Pale-headed Brush-Finch during one season. *Received 13 February 2003, accepted 30 July 2003.*

The avian genus *Atlapetes* (Aves: Emberizidae) comprises more than 20 species of brush-finches, which inhabit dense forest undergrowth, forest edge, or shrubby nonforest habitats in Central America and the Andes of South America (Paynter 1972, 1978; Hilty and Brown 1986; Ridgely and Greenfield 2001). Geographic differentiation and species limits are highly complex in the genus and have been revised recently (Remsen and Graves 1995, Garcia-Moreno and Fjeldså 1999). At least seven *Atlapetes* species have a restricted geographic range (Paynter 1978, Valqui and Fjeldså 1999). One of these is the Pale-headed Brush-Finch (*Atlapetes pallidiceps*), a critically endangered endemic that is limited to the upper Rio Jubones valley system of the Azuay province in southern Ecuador (Paynter 1972, Collar et al. 1992, BirdLife International 2000). The species was rediscovered in the Yunguilla Valley in 1998, after being unrecorded for 30 years (Agreda et al. 1999). Breeding behavior and nesting have not been described previously.

The only currently known population of *A. pallidiceps* consists of approximately 35 pairs which inhabit dense secondary scrub above a semiarid inter-Andean valley (N. Krabbe unpubl. data). The area is inhabited and intensively farmed, and due to ongoing clearance of forest for the creation of pastures, it is largely devoid of forest tracts (Bossuyt et al. 1997). Land use-induced loss of habitat is presumed to pose a serious threat to the remnant population (Agreda et al. 1999). In this study, we investigated the breeding biology and nesting requirements of the Pale-headed Brush-Finch in order to identify the main threats to its population and derive management objectives for its future conservation.

STUDY AREA AND METHODS

The study area was located in Yunguilla Valley, approximately 50 km southwest of Cuenca in the upper Rio Jubones drainage, Province Azuay, Ecuador (03° 13′ S, 79° 16′ W). It encompassed three steep (about 45°) slopes with an area of 50 ha ranging from 1,650–2,000 m in elevation. The site with the greatest concentration of brush-finch territories has been declared a reserve and is largely ungrazed, whereas a population on the neighboring hill inhabits an area that is still grazed

[1] Dept. of Landscape Ecology, Carl-von-Ossietzky Univ. Oldenburg, 26111 Oldenburg, Germany.

[2] Inst. for Avian Research, An der Vogelwarte 21, 26386 Wilhelmshaven, Germany.

[3] Current address: Siedlungsstr. 38, 95497 Goldkronach, Germany.

[4] Corresponding author; e-mail: steffen.oppel@gmx.net

by cattle (Agreda et al. 1999). Both hills feature semi-open habitats with dense arid scrub consisting mostly of composite and verbenaceous species, interspersed with grassland of old or recent pastures. Small stands of *Acacia* sp. and lauraceous trees are found in more humid parts, and fragments of semihumid forest persist on western and southern slopes. Monocultural stands of *Chusquea* sp. bamboo form large patches of habitat in small depressions, ravines, or on the western slopes. The arid scrub is deciduous and sheds its leaves during the dry season from June to December, whereas the bamboo remains green all year.

We monitored birds from mid-March to mid-July 2002 every morning between 05:45 and 08:45 (EST), when singing activity was most prominent. We mapped territories by connecting all song perches of a male to a minimum convex polygon, and tried to adjust territory boundaries based on further observations of intraspecific interactions and response to song playbacks. We searched for nests in the center among the males' most frequently used song perches, and located them by following birds returning to the nest (Martin and Geupel 1993). In order to minimize disturbance, we did not approach active nests closer than 3 m unless both parents were absent. We judged nest stage (incubation or nestling) from parental behavior and monitored nest stage every 3–5 days. After fledging or nest failure had occurred, we measured any remaining eggs and the nest and recorded the following variables: egg length, width, and coloration; nest height above ground; nest diameter; depth of nest cup; nest circumference; nesting material; and nest cover. Length variables were measured with a flexible tape measure, components of nest composition (material) were estimated to the nearest 10%, and cover was estimated by the percentage of nest shading at noon on a sunny day. We tried to determine causes of nest failure by searching the nest vicinity for signs of predators or remnants of eggs, chicks, or nesting material.

We confined our observations of breeding behavior to four nest sites that offered good viewing conditions without causing distress to the birds. In order to record parental movements, we observed nest sites for two consecutive hours during incubation, and for up to four consecutive hours during the nestling stage. We judged diet composition mainly from food carried to the nest, and from occasional foraging observations where the prey item could be determined. We recorded foraging behavior on an opportunistic basis whenever birds were followed.

FIG. 1. Nest and eggs of the Pale-headed Brush-Finch (*Atlapetes pallidiceps*) from Yunguilla Valley, Ecuador, April 2003. Photograph by H. Martin Schaefer.

In 2003, we monitored birds between late February and late May, and used these additional observations to support findings of the 2002 season. We did not measure nests and eggs in 2003, and all reported sample sizes refer to 2002 data unless otherwise stated.

RESULTS

Nests.—We found 18 nests of 13 different pairs of Pale-headed Brush-Finches. Renesting occurred in five pairs, of which two pairs renested twice and built three nests altogether. Distances between consecutive nests of one pair ranged from 15–45 m. Thirteen nests (72%) were attached to thin (<1 cm diameter) overhanging branches of shrubs or vines, and 11 of these were just beneath the top layer of the foliage. We found five nests in forks or along the main stem of erect standing bushes within tall stands of grass. Mean height above ground was 184 cm ± 61 SD (range, 84–302 cm). All but two nests were located on slopes exceeding 30°, the general inclination at the study site. The nest was a bulky open cup, constructed of small twigs, grass straws, herbaceous stems, or bamboo stalks (Fig. 1). Moss and lichen also were present in the nest, but only in small quantities comprising <5% of the nesting material. Depending upon surrounding vegetation, material composition varied from almost entirely (90%) bamboo

with a few twigs, to 70% grass, with twigs and stems but no bamboo. Nest cups were lined with fine grass, leaf fibers or bamboo leaves. Mean outer nest diameter was 127 mm ± 13 SD (range, 100–150 mm), and mean cup diameter was 69 mm ± 9 SD (range, 50–85 mm). Mean cup depth was 50 mm ± 5 SD (range, 45–60 mm), and mean nest cup circumference was 385 mm ± 64 (range, 245–510 mm). Nests had a mean foliage cover of 75% (range, 50–100%).

Eggs.—The eggs were subelliptical to oval in shape. Background color varied from buffish white to light bluish or a faint rosy pink, and eggs were of intermediate gloss (Fig. 1). Markings were deeply ingrained into the shell. They formed irregularly shaped spots without clear cut outlines, and ranged from very light to dark brown in color. Small markings were distributed over the entire surface, and often accumulated to large continuous spots around the poles. A large number of pinpoint-sized spots and speckles of blackish purple color were randomly distributed across the entire shell. For nine eggs, mean length was 24.0 mm ± 0.7 SD (range, 23–25 mm) and mean width was 17.8 mm ± 0.5 SD (range, 17–18 mm). Pale-headed Brush-Finch eggs differed slightly from the eggs of the Shiny Cowbird (*Molothrus bonariensis*), which were pale bluish, less glossy, with few dark purple spots, and with indistinct spots on the poles (n = 6).

During 2002, we inspected seven nests during the incubation stage, of which six contained two eggs each, and one contained three eggs. We found 1–3 parasitic cowbird eggs in five of the seven nests. This complicated assessment of mean clutch size, because cowbirds are known to remove host eggs when laying their own (Wood and Bollinger 1997, McLaren and Sealy 2000, Granfors et al. 2001). During 2003, we found 10 clutches containing one (n = 4), two (n = 5) or three (n = 1) eggs. Due to cowbird control in 2003, numbers of parasitic eggs were not comparable to the 2002 season.

Juveniles.—Plumage of nestlings was mostly uniform brown (Fig. 2). Tail, wing, and ventral coloration of the fledged offspring of the Pale-headed Brush-Finch was almost identical to the adult plumage, but the head pattern was strikingly different (n = 9). It was mostly slaty gray with a prominent dark rufous to rusty brown crown stripe extending from the top of the head down to the nape. Facial pattern was uniform, with an indistinct narrow black malar stripe. An off white to light gray ear patch developed about 2–3 weeks after fledging. The forehead also was dull gray, and showed two small buffy white supraloral spots. The beak was dull yellowish horn in color with a black culmen, and became gradually darker with increasing age. Slaty gray forehead with off white supraloral spots and a rusty brown crown stripe were characteristics similar to those in the southern White-winged Brush-Finch (*Atlapetes leucopterus dresseri*). The slaty color of the head extended to below the chin and was demarcated by an off white to buffish collar. Chest, belly, and underparts were buffish gray, and provided a well delineated contrast to the lighter collar. Flanks were slightly streaked gray, and thus darker than the midbelly. The rusty brown

FIG. 2. Nestling of the Pale-headed Brush-Finch (*Atlapetes pallidiceps*) in Yunguilla Valley, Ecuador, April 2003. Photograph by H. Martin Schaefer.

crown stripe merged without contrast into the brown back, which differed markedly from the darker gray-brown wings. The extent of the crown stripe appeared to diminish with increasing age of the juveniles. Simultaneously, the auricular patch developed stronger, giving the bird a blotchy appearance. Four adult birds were noted to have very broad brown facial markings, while three other adults had almost entirely white heads.

Breeding behavior.—Breeding activity commenced in February and nesting continued until late June. First clutches were initiated between February and April, and we confirmed this asynchronized breeding in 2003, with first clutches being laid between early February and early April. Singing activity was most prominent during early morning, and continued only until midday in very humid conditions (during fog or drizzle). Intensity and frequency of songs varied greatly among pairs, but generally declined during incubation and was reduced to almost zero at the nestling stage and while leading fledglings. Singing was elicited by the use of playbacks in only 2% of all attempts, and even neighboring males that intruded into a given territory did not necessarily elicit a response by the territory owner. Territorial defense was weak in that we observed agitated countersinging in only 2 of 27 cases where a male or a pair crossed the line of song perches frequently used by its neighbor. Territory boundaries were therefore rather ambiguous. Areas adjacent to different territories often were used by different pairs for foraging and singing at different times. We did not observe any aggressive interactions between conspecifics, or between the Pale-headed Brush-Finch and the sympatric Stripe-headed Brush-Finch (*Buarremon torquatus*).

Territory size ranged from approximately 0.5–2.0 hectares, and varied throughout the season. Neighboring pairs extended their home range or territories to occupy a vacant lot in places where another pair had abandoned its territory after a failed nesting attempt ($n = 2$). Five pairs ventured into previously unvisited neighboring areas while leading fledglings, regardless of these areas being occupied by conspecifics or not.

The female alone appeared to build the nest and incubate the eggs, and both parents fed the offspring. No incubation feeding was observed. During incubation, the male approached the nest in regular intervals to call the female off, and both foraged together for approximately 15–20 min. The female returned alone and remained in dense cover and very close to the ground while approaching the nest. During the nestling stage, the parents foraged independently and returned to the nest to feed the offspring every 5–25 min, depending upon age and size of the chicks. Food items that we could identify included invertebrates such as crickets and grasshoppers (Orthoptera), caterpillars (Lepidoptera larvae), adult Lepidoptera, beetles (Coleoptera), and earthworms (Lumbricidae). More than half of the food items we observed were fairly large, ranging from 1–3 cm in length. We observed a fruit being fed to nestlings only once, although we regularly observed adults eating fruit (*Rubus* sp.).

We found 61% of nests during the nestling stage, therefore only limited information is available regarding incubation length and fledging age of chicks. However, in three instances, where we observed the female building the nest, we observed the pair with fledglings 32–35 days later, indicating that incubation and nestling stages were approximately 12–14 days each. This was confirmed in 2003, when we documented 14 days between laying and hatching ($n = 2$), and 11.5 days between hatching and fledging ($n = 2$).

The first chicks fledged in late March and the last chicks fledged in late June. The offspring remained stationary inside very dense thickets for the first few days after fledging. Surviving fledglings were fed by their parents for $\geq$4 weeks, and three families stayed together for $\geq$8 weeks. We did not observe any pair leading more than two fledglings. Fledglings were able to forage independently after 3–4 weeks, but they still accepted food delivered by their parents.

In four nests that were parasitized by Shiny Cowbirds, only one cowbird fledgling was raised, but we also observed two mixed broods (one cowbird, one brush-finch fledgling) and one clutch with two cowbird fledglings. Brood parasitism affected almost half the population and presently is regarded to be the main threat to the Pale-headed Brush-Finch (SO unpubl. data). Otherwise failed

nests were either depredated (n = 5 in 2003) or abandoned (n = 4 in 2003). In one case, the nest was abandoned after a cow had destroyed the nesting bush.

Renesting occurred 1–3 weeks after we noticed breeding failure. At least two pairs initiated three nesting attempts after the first two had been unsuccessful. We observed no pair that started renesting after a successful brood (n = 16 for both years combined). Two pairs that fledged their first clutch in early April did not attempt a second brood. Altogether, timing and number of clutches was highly variable among pairs. In two pairs we could not discover any signs of nesting activity despite equal observation effort.

Foraging behavior.—We observed foraging mainly in scrub, and only rarely (<1% of time) in open grassy habitat or in taller trees. Foraging heights ranged from 0–4 m above the ground, with medium heights (2–3 m) most frequently observed. Most prey items were gleaned from the foliage or small twigs while the bird was perched, but we also noted short sallying, hovering, and flycatching. Birds also ripped and searched through debris and dead leaves on the ground and removed prey items from the soil. We observed three individuals pick at inflorescences of larger bushes. Blackberries (*Rubus* sp.) were consumed regularly, and two individuals fed on grass seeds that could be reached from a low perch branch.

We observed birds foraging in bamboo on only three occasions, even though bamboo scrub covered up to 75% of some territories and was used for nest sites. If foraging occurred in bamboo, it was at ground level; we did not observe foliage gleaning in bamboo.

DISCUSSION

The Pale-headed Brush-Finch occurs in a narrow climatic transitional zone with distinct seasonal rainfall distribution (Paynter 1972, Bossuyt et al. 1997). Breeding appears to be closely linked to the rainy season in the area, as also has been noted for other brush-finches (Koepcke 1958, Paynter 1972). The onset of the rainy season often triggers increases in insect abundance, which might be required to compensate for elevated energetic requirements (Aguilar et al. 2000).

Foraging appeared to be unspecialized and we recorded a large number of different prey items. Insects and larvae were used most frequently, but grass seeds and flower buds also were consumed. Paynter (1972) analyzed the stomach contents of eight Pale-headed Brush-Finches and found insect remains and cracked seeds along with large quantities of sand. The dominance of invertebrate prey observed during this study might be due to seasonal variation in food availability and consumption, as the gut analysis was conducted in November (Paynter 1972). Like most feeding generalists, other *Atlapetes* species also have been noted to be insectivorous during the breeding season (Paynter 1978).

That we did not observe Pale-headed Brush-Finches forage in bamboo scrub might be due to the monostructural composition of bamboo stands. Lower diversity in plant species and structure typically support lower numbers of invertebrates (Rotenberry and Wiens 1998, Söderström et al. 2001), which might render bamboo an inefficient foraging substrate for an unspecialized bird. On the other hand, bamboo is very dense and obstructs visual observations, which might have led to the false assumption that it is rarely used for foraging.

All but two nest sites were on steep slopes, and 72% of nests were found on high drooping branches or vines that extended away from the main stem. This has not been described for other *Atlapetes* species (Pereyra 1951, Paynter 1978, Greeney et al. 1998, Salaman et al. 1998). The construction of nests on very thin branches or vines may restrict access by some mammalian predators (e.g., mustelids), which are too heavy to be supported by the small branches. The availability of overhanging vines and bamboo stalks as nesting habitat might contribute to the restricted distribution of the Pale-headed Brush-Finch.

The nest structure and composition of the Pale-headed Brush-Finch is consistent with the descriptions of nests of other brush-finch species, which generally are described as open cups of straws, weeds, and grass, positioned in dense tangles close to the ground (Pereyra 1951, Paynter 1978, Hilty and Brown 1986, Greeney et al. 1998, DiGiacomo and Lopez-Lanús 2000) or higher up in trees (Salaman et al. 1998). Nesting material generally is taken from the surroundings (within 20–30 m) and

varies according to the local vegetation. The Pale-headed Brush-Finch appears to be a generalist in its selection of nesting material, using the most common materials available in its respective territory.

Egg measurements of *A. pallidiceps* were similar to those of other *Atlapetes* species described in the literature, ranging from 20.9 × 15.9 mm (*A. pileatus*; Schönwetter 1984) to 27.5 × 18.5 mm (*A. leucopis*; Salaman et al. 1998). Egg color in the brush-finches is either bluish with very few or no spots (Rowley 1962, Paynter 1978, Hilty and Brown 1986, Greeney et al. 1998), or pale cream with chestnut blotches (Schönwetter 1984, Salaman et al. 1998). *A. pallidiceps* eggs are intermediate between both descriptions. The less glossy eggs with fewer spots found in this study were ascribed to be of parasitic origin. The Shiny Cowbird has been recorded to have different egg colorations, including a spotted bluish morph of 25.4 × 20.3 mm in size (Schönwetter 1984, Johnsgard 1997, Fraga 2002). The eggs of both species show considerable overlap in size and background color, and further research is required to identify characteristics unique to the eggs of one species.

The Pale-headed Brush-Finch produces clutches of 1–3 eggs, as generally found in tropical passerine birds. Relatively small clutch sizes have been hypothesized to be a result of increased adult survival and reduced reproductive effort (Martin et al. 2000). There was no evidence of a second breeding attempt following successful breeding earlier in the season. Double brooding may be impossible given the prolonged period of postfledging parental care. In one case, a second breeding attempt followed an apparently successful attempt, but the second clutch was initiated only 13 days after the first chicks left the nest, which strongly suggests that the fledglings died. This re-lay interval was typical of that following breeding failure. Second and third clutches were initiated only when the previous clutches had failed.

Agreda et al. (1999) and Ridgely and Greenfield (2001) stated that pairs of the Pale-headed Brush-Finch usually forage together, which is common in several species of the genus (Paynter 1978, Lopez-Lanús et al. 2000). During the incubation stage, females were guarded by their mates when they left the nest to forage. Both during the nestling stage and while feeding fledglings, partners often foraged alone. Birds foraging by themselves did not utter contact calls, making them much harder to detect. We conclude that joint foraging is no more pronounced than solitary movements during the breeding season.

Agreda et al. (1999) found that tape playbacks yielded only a weak response in the Pale-headed Brush-Finch. This is consistent with the results of this study, where we observed almost no response to playbacks, and where territorial defense to conspecific intruders was entirely absent at times. While the biological reason for the lack of territorial defense needs to be analyzed in more detail, this behavior is of crucial importance for the assessment of distribution and population size. During previous searches, lack of singing activity has been taken as circumstantial evidence that the species was absent (Collar et al. 1992). Given the low singing intensities and the lack of response to playbacks even from breeding birds, care needs to be taken when declaring an area to be without the Pale-headed Brush-Finch.

N. Krabbe (pers. comm.) pointed out that small tract sizes of remaining suitable habitat might have led to the local extinction of the Pale-headed Brush-Finch. This study has identified nesting habitat as a new potential requirement that previously defined suitable habitat might lack. Detailed analysis of habitat selection will soon be available (Oppel et al. in press), but further ecological investigations into dispersal abilities, breeding biology, and population threats would be an important step aiding future recovery of the Pale-headed Brush-Finch.

ACKNOWLEDGMENTS

The study was funded by the German Academic Foreign Exchange Service, grant number 332404010, by the Sweden Club 300 and by the Royal Society for the Protection of Birds. The field research was conducted under the permit Nr. 004-IC-FAU-DBAP/MA of the Ministerio del Ambiente, Ecuador, and fully supported by Fundacion Jocotoco, the landowner of the study area. We are grateful to F. Sornoza (Fundacion Jocotoco) and R. S. Ridgely for assistance in the project and granting access to the study area. C. Wickert and J. Heathcote assisted us during the nest searches. The work benefited from correspondence with N.

Krabbe, D. Cadena, and T. E. Martin. The manuscript was improved by helpful comments from B. Schröder, J. Dierschke, P. C. Stoddard, and F. Bairlein.

LITERATURE CITED

AGREDA, A., N. KRABBE, AND O. RODRIGUEZ. 1999. Pale-headed Brushfinch *Atlapetes pallidiceps* is not extinct. Cotinga 11:50–54.

AGUILAR, T. M., M. MALDONADO-COELHO, AND M. A. MARINI. 2000. Nesting biology of the Gray-hooded Flycatcher (*Mionectes rufiventris*). Ornitol. Neotrop. 11:223–230.

BIRDLIFE INTERNATIONAL. 2000. Threatened birds of the world. Lynx Edicions, Barcelona, Spain, and BirdLife International, Cambridge, United Kingdom.

BOSSUYT, B., G. DERCON, B. D. BIÈVRE, F. CISNEROS, AND J. DECKERS. 1997. Agro-ecological zoning of the Austro Ecuatoriano. The Land 1:159–170.

COLLAR, N. J., L. P. GONZAGA, N. KRABBE, A. M. NIETO, L. G. NARANJO, T. A. PARKER, AND D. C. WEGE. 1992. Threatened birds of the Americas. International Council for Bird Preservation, Cambridge, United Kingdom.

DIGIACOMO, A. G. AND B. LOPEZ-LANÚS. 2000. New notes on the nesting of some species of Northwestern Argentina birds. Hornero 15:131–134.

FRAGA, R. M. 2002. Notes on new or rarely reported Shiny Cowbird hosts from Argentina. J. Field Ornithol. 73:213–219.

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.

GRANFORS, D. A., P. J. PIETZ, AND L. A. JOYAL. 2001. Frequency of egg and nestling destruction by female Brown-headed Cowbirds at grassland nests. Auk 118:765–769.

GREENEY, H. F., M. LYSINGER, T. WALLA, AND J. CLARK. 1998. First description of the nest and egg of the Tanager Finch (*Oreothraupis arremonops* Sclater 1855) with additional notes on behavior. Ornitol. Neotrop. 9:205–207.

HILTY, S. L. AND W. L. BROWN. 1986. A guide to the birds of Colombia. Princeton Univ. Press, Princeton, New Jersey.

JOHNSGARD, P. A. 1997. The avian brood parasites. Oxford Univ. Press, New York.

KOEPCKE, M. 1958. Die Vögel des Waldes von Zarate. Bonn. Zool. Beitr. 9:130–193.

LOPEZ-LANÚS, B., P. G. W. SALAMAN, T. P. COWLEY, S. ARANGO, AND L. M. RENJIFO. 2000. The threatened birds of rio Toche, Cordillera Central, Colombia. Cotinga 14:17–23.

MARTIN, T. E. AND G. R. GEUPEL. 1993. Nest-monitoring plots: methods for locating nests and monitoring success. J. Field Ornithol. 64:507–519.

MARTIN, T. E., P. R. MARTIN, C. R. OLSON, B. J. HEIDINGER, AND J. J. FONTAINE. 2000. Parental care and clutch sizes in North and South American birds. Science 287:1482–1485.

MCLAREN, C. M. AND S. G. SEALY. 2000. Are nest predation and brood parasitism correlated in Yellow Warblers? A test of the cowbird predation hypothesis. Auk 117:1056–1060.

OPPEL, S., H. M. SCHAEFER, V. SCHMIDT, AND B. SCHRÖDER. In press. Habitat selection by the Pale-headed Brush-Finch (*Atlapetes pallidiceps*) in southern Ecuador: implications for conservation. Biol. Conserv.

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

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

PEREYRA, J. A. 1951. Avifauna Argentina. Hornero 9: 291–347.

REMSEN, J. V., JR. AND W. S. GRAVES, IV. 1995. Distribution patterns and zoogeography of *Atlapetes* brush-finches (Emberizinae) of the Andes. Auk 112:210–224.

RIDGELY, R. S. AND P. J. GREENFIELD. 2001. The birds of Ecuador: field guide. Cornell Univ. Press, New York.

ROTENBERRY, J. T. AND J. A. WIENS. 1998. Foraging patch selection by shrubsteppe sparrows. Ecology 79:1160–1173.

ROWLEY, J. S. 1962. Nesting of the birds of Morelos, Mexico. Condor 64:253–272.

SALAMAN, P. G. W., L. DAVALOS, AND G. M. KIRWAN. 1998. First breeding records of White-rimmed Brushfinch *Atlapetes leucopis*, with ecological notes. Cotinga 9:24–26.

SCHÖNWETTER, M. 1984. Handbuch der Oologie: Band III. Akademie Verlag, Berlin, Germany.

SÖDERSTRÖM, B., B. SVENSSON, K. VESSBY, AND A. GLIMSKÄR. 2001. Plants, insects and birds in semi-natural pastures in relation to local habitat and landscape features. Biodiv. Conserv. 10:1839–1863.

VALQUI, T. AND J. FJELDSÅ. 1999. New brush-finch *Atlapetes* from Peru. Ibis 141:194–198.

WOOD, D. R. AND E. K. BOLLINGER. 1997. Egg removal by Brown-headed Cowbirds: a field test of the host incubation efficiency hypothesis. Condor 99: 851–857.