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NESTING ECOLOGY OF THE SPECTACLED WHITESTART IN ECUADOR

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Resumen. – Anidación de la Candelita de Anteojos en Ecuador. – De tres sitios en Ecuador, describimos por la primera vez el nido, los huevos, los pichones, los ritmos de incubación, y el comportamiento de los adultos durante la reproducción de la Candelita de Anteojos (*Myioborus melanocephalus*). Los nidos son estructuras con forma de horno, en o cerca del suelo. Están construidos de hojas y musgos, con la parte interior de la copa hecha de materiales suaves como algodón y escamas de helechos arborescentes. La nidada es de dos huevos puestos en días siguientes. La construcción de nidos dura de 12 a 18 días, la incubación dura 15 días, y los pichones vuelan después de 12 días. Los ritmos de incubación durante el día son muy regulares y, en promedio, la duración de cobertura de los huevos es 25 min y los periodos de ausencia de 12 min. Los ritmos normales comienzan hasta 2 días después de que esta completo el puesto, y luego el tiempo de cobertura de los huevos corresponde a 67% del día. La reproducción de esta especie coincide con las temporadas mas secas en cada una de nuestras áreas de investigación.

Abstract. – We describe the nest, eggs, nestlings, incubation rhythms, and adult nesting behavior of the Spectacled Whitestart (*Myioborus melanocephalus*) from three study sites in eastern Ecuador. Nests are domed structures built on or close to the ground, composed primarily of leaves and moss, and lined with softer materials such as seed down and tree-fern scales. Complete clutches consist of two eggs laid on consecutive days. Nest construction lasts 12–18 days, incubation lasts 15 days, and nestlings fledge after 12 days. Diurnal incubation behavior is consistent between nests, with a mean on-bout duration of 25 min and mean off-bout of 12 min. Regular incubation is delayed by up to 2 days, at which point mean coverage of the eggs during daylight hours is 67%. Nesting at all three study sites appears to coincide with drier periods. *Accepted 12 April 2008.*

Key words: Nest, egg, Ecuador, Andes, cloud forest, Spectacled Whitestart, *Myioborus melanocephalus.*

INTRODUCTION

Parulids of the genus *Myioborus* include around 12 species of medium-sized warblers, with species distributed throughout most of the Americas from the southern United States to Argentina, but with the highest diversity in the South American Andes (Curson e*t al.* 1994, Pérez-Emán 2005). Despite its broad distribution through the Andes from Colombia to Bolivia, and relative abundance within its range (Curson *et al.* 1994), the nest of the

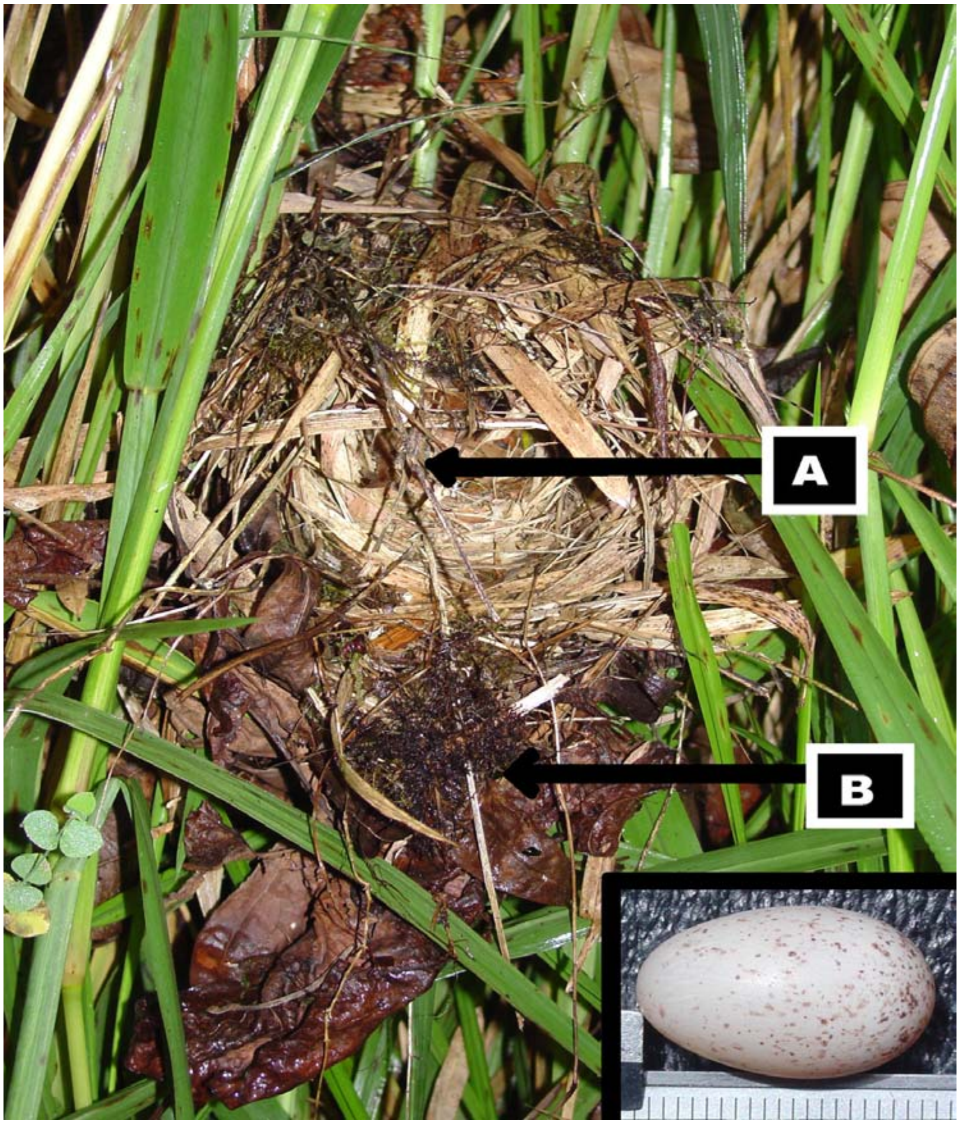

FIG. 1. Nest and egg (inset) of Spectacled Whitestart (*Myioborus melanocephalus*) in northeastern Ecuador, Yanayacu Biological Station, Napo Province, Ecuador, 2100 m. A = nest entrance. B = platform in front of nest.

Spectacled Whitestart (*Myioborus melanocephalus*) remains undescribed 160 years after its formal species description. Spectacled Whitestart ranges from 2000–4100 m a.s.l., and is usually seen foraging actively, flushing prey with wing and tail flicking, moving with mixed species flocks inside cloud forests as well as in adjacent disturbed areas (Fjeldså & Krabbe 1990, Curson e*t al.* 1994, Ridgely & Greenfield 2001). Based on fieldwork carried out in Ecuador, we describe, for the first time, the nest, eggs, and breeding behavior of this ubiquitous Andean bird.

MATERIALS & METHODS

From May 2001 to October 2007, we studied 13 nests of the Spectacled Whitestart in Ecuador. We found 7 nests of this species at the Yanayacu Biological Station and Center for Creative Studies (00°36'S, 77°53'W) at approximately 2100 m, Napo Province, northeastern Ecuador. We found an additional 5 nests in the vicinity of Papallacta (00°36'S, 78°15'W) above Yanayacu at elevations near 3800 m. We also made observations on a final nest at the Tapichalaca Biological Reserve (04º30'S, 79º10'W) at 2650 m, in the Zamora-Chinchipe Province of southeastern Ecuador. We recorded nest dimensions to the nearest 0.5 cm, egg dimensions to the nearest 0.1 mm, and egg weights to the nearest 0.001 g. Eggs were weighed periodically during incubation to measure rates of mass loss (mass loss = water loss; Ar & Rahn 1980), and rates were converted to% mass loss/day relative to mass at the original weighing. To describe the composition of nests, we collected 4 nests after fledging (3 Yanayacu, 1 Tapichalaca) and returned them to Yanayacu where they were dried at ambient conditions for at least 3 months. We then carefully separated the lining from the external portion of the nest and separated each part into its various components. We intensively studied three nests at Yanayacu during incubation. At one nest, we filmed incubation behavior during daylight hours (05:30–18:30 h EST), using a video camera placed on a tripod 6 m from the nest in a concealed position. We later transcribed the videos, recording on and off bouts to the nearest second. At two additional nests, we placed HOBO dataloggers (Onset, Pocasset, Massachusetts) inside the lining of the nest cups, recording on and off bouts to the nearest minute based on changes in internal nest temperature.

RESULTS

Building behavior and nest architecture. At all nests observed during construction (n = 6), only one adult brought material to the nest. From observations on banded individuals at one nest, only the female appears to build. This appeared to always be accomplished in the absence of their mate, and we rarely observed a second individual in the vicinity of the nest during construction. Building takes only 12–18 days, with the nest appearing completed, with little subsequent material added, during the 4–5 days before the first egg is laid. In general, the first 6–10 days are spent building the outer nest structure, beginning with a disorganized platform of leaves and moss. Lining of the egg cup is then usually accomplished within 3–5 days.

Nests are domed structures built of dry grass, strips of dried leaves, dead *Chusquea* bamboo leaves, bark strips, and rootlets (Fig. 1). Egg cups were generally lined with seed down, tree fern scales, feathers, and pale fibers. Mean total dry weight of four nests was 50.8 ± 15.5 g. At these four nests the dry weight of the lining represented a mean of only 6.5 ± 3.7% of the total nest mass. The relative composition of external nest structures and egg cup linings are given in Figure 2. Nests were located at heights ranging from on the ground (on a bank) to 0.75 m above the ground, either nestled into dense vegetation or in a small natural niche in the bank. Nests on banks (n = 3) were, on average, 1.4 ± 0.6 m from the ground below. Nests suspended in vegetation were supported by pasture grass (n = 6), *Equisetum* reeds (Equisetaceae) (n = 2), *Chusquea* bamboo (n = 1), and miscellaneous small branches (n = 1), respectively. The high number recorded in pasture grass probably reflects the large number of nests (n = 7)

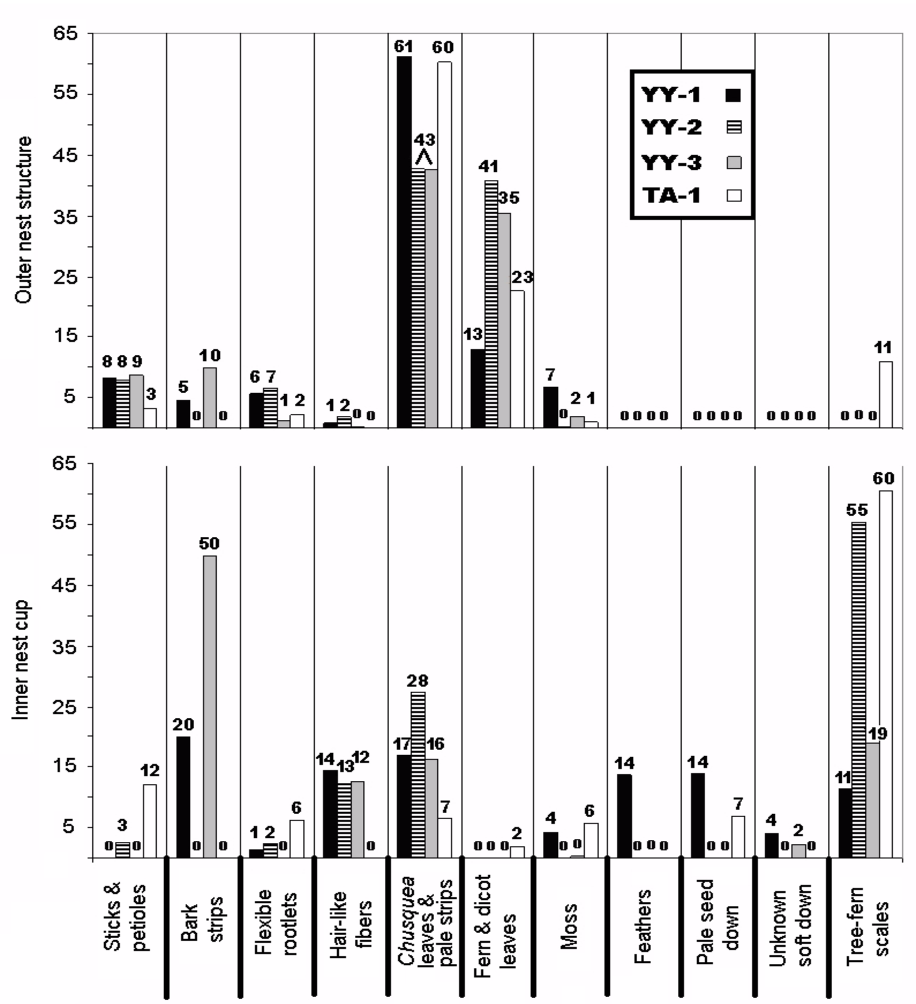

FIG. 2. The relative percent dry weight represented by various materials in four nests of Spectacled Whitestart (*Myioborus melanocephalus*) in Ecuador. Nests YY nests were collected from Yanayacu Biological Station and the TA nest was collected at Tapichalaca. The outer nest structure and inner cup linings are considered separately. Numbers above bars represent actual values for each nest.

found in disturbed areas around the Yanayacu station. For all nests, including the three on the ground (banks), mean nest height above the ground was 0.3 ± 0.3 m. All were in disturbed areas such as pastures and bamboo thickets. Mean (cm ± SD) measurements for 6 nests were: inside width 6.4 ± 1.0, chamber height 8.4 ± 0.6, inner cup depth 4.1 ± 0.6, inner cup diameter 5.2 ± 0.4, outside width 13.7 ± 2.0, outside height 15.6 ± 1.9, outside front to back 13.0 ± 1.7, entrance width 6.3 ± 1.4, entrance height 4.9 ± 0.8. Most nests

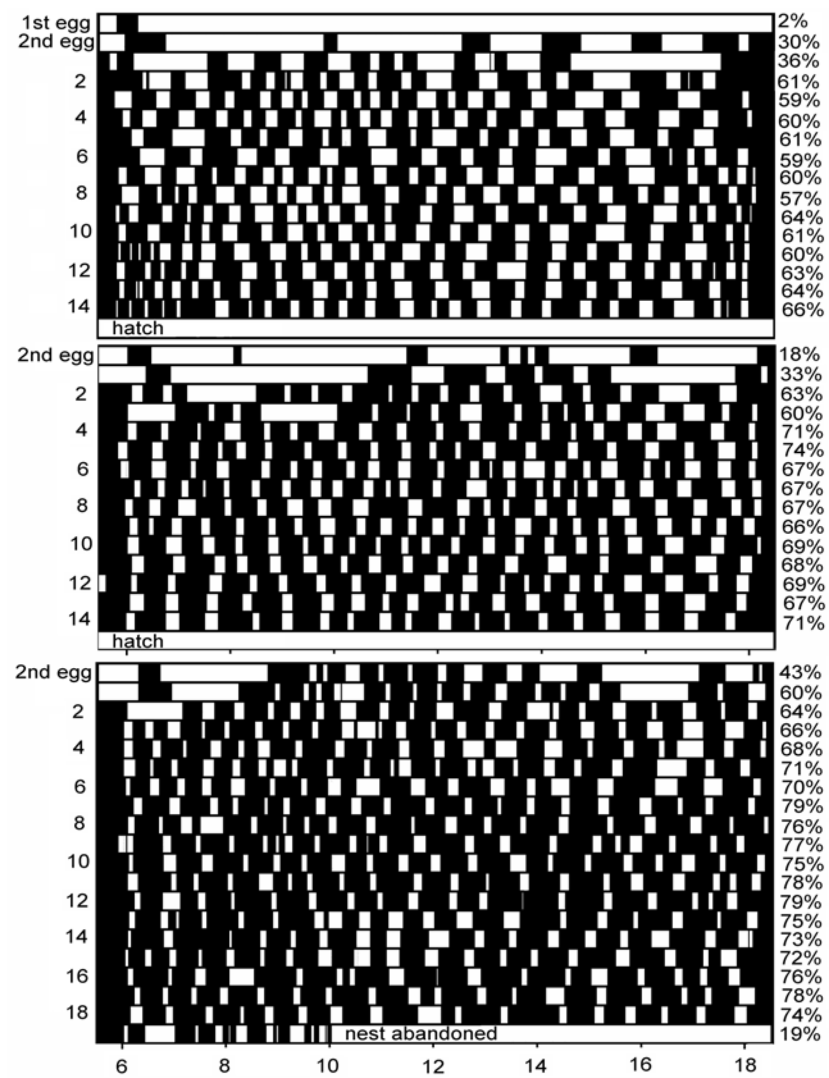

FIG. 3. Incubation rhythms of Spectacled Whitestart (*Myioborus melanocephalus*) at three nests in northeastern Ecuador. The day of incubation is shown of the left and the total percent coverage for each day is shown on the right. Black areas indicate periods of egg coverage while white areas indicate periods of adult absence. The rhythms shown in the lower figure are those of a nest where both eggs failed to hatch and where the nest was subsequently abandoned 18 days after laying the final egg.

included a loose lip of material that extended 3.5–18 cm (mean = 8.8 ± 5.4) out from the entrance (Fig. 1).

Eggs. Clutch size was 2 eggs (n = 7 nests), with eggs laid on consecutive days (n = 3 nests) between the hours of 06:00 and 07:00 h (n = 7 eggs at 4 nests). Eggs were white with sparse cinnamon speckling, heaviest around the larger end (Fig. 1). Mean measurements of

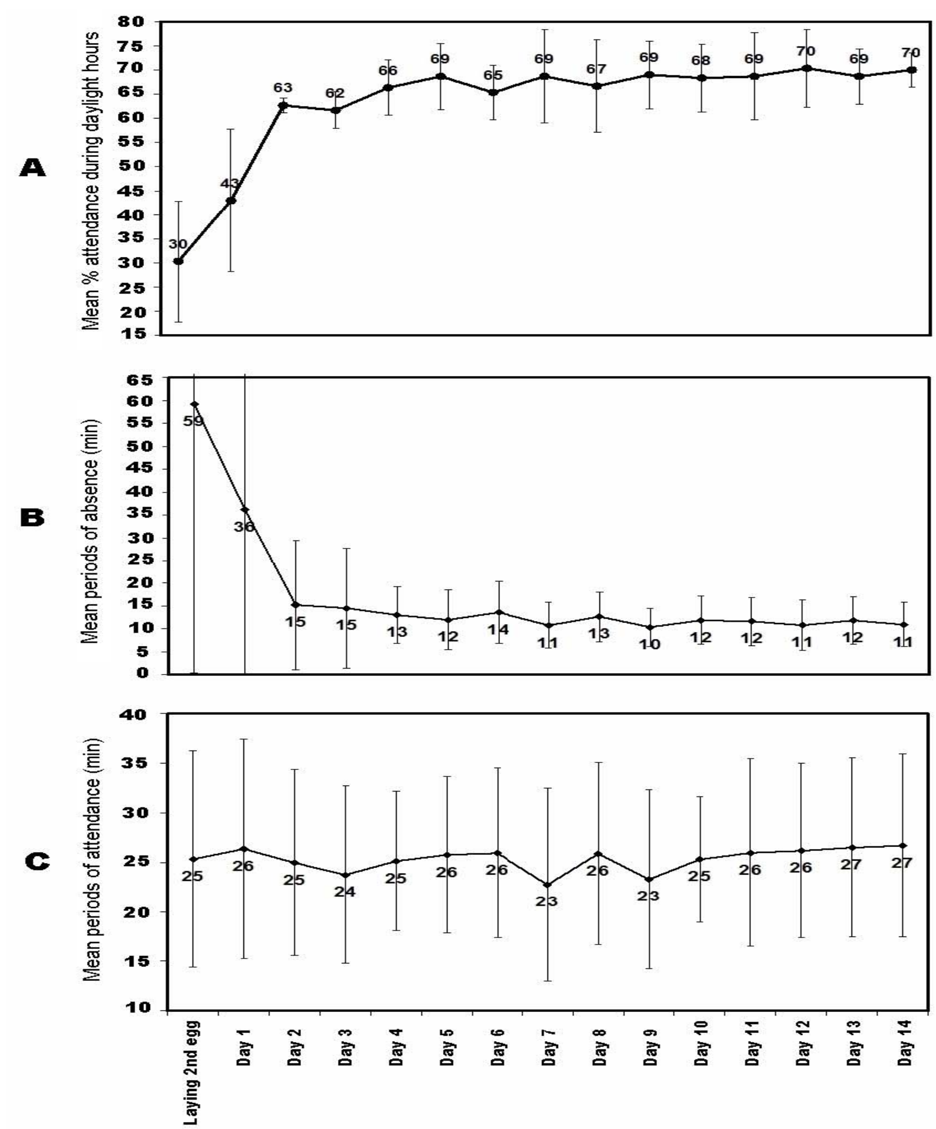

FIG. 4. Incubation data (diurnal behavior only) from three nests of Spectacled Whitestart (*Myioborus melanocephalus*) in northeastern Ecuador. Numbers by data points represent actual mean values and error bars represent one standard deviation. The day of incubation is shown across the bottom. A. Mean percent of diurnal coverage of the eggs. B. Mean periods of adult absence from the nest. C. Mean periods of adult presence at the nest.

13 eggs (± SD) were 19.6 ± 0.6 by 13.5 ± 0.2 mm. Fresh mass (measured within 1 day of laying) of eggs was 1.93 ± 0.02 g (n = 5 eggs). Eggs at Yanayacu lost mass during incubation at a rate of 1.1 ± 0.2% /day (n = 4 eggs from 2 nests).

Incubation. From observations of banded individuals at one nest, only the female participated in incubation. While incubating, adults were very reluctant to flush, often waiting until an observer approached to within 50 cm. Incubation period at two nests was 15 days from the laying of the second egg to hatching of both eggs. At one nest, which contained two infertile eggs, the adult incubated for 17.5 days before abandoning the nest. At two nests regular incubation (> 50% attendance during daylight hours) did not begin until 2 days after clutch completion. At a third nest, rhythms similar to regular incubation began with the laying of the final egg (Fig. 3). For all three nests, mean percent coverage of the eggs during the daylight hours for the day of clutch completion and the first day of incubation was low, while during regular incubation (days 2–14 after clutch completion) mean coverage rose to 67 ± 6% (Fig. 4). In general, daily incubation rhythms were very regular, and varied little between nests (Fig. 3). Mean periods of absence from the nest became most consistent around day 2–4 of incubation (Fig. 4), at which point they had a mean duration of 12.1 ± 7.4 min (days 2–14 of incubation, n = 708 off bouts at 3 nests). In contrast, mean periods of attendance varied little between days across the entire incubation period (Fig. 4). Mean on bout duration from days 2–14 of incubation was 24.9 ± 8.6 min (n = 654 on bouts at 3 nests). In general, morning incubation rhythms were characterized by many short periods of attendance and absence, while afternoons were characterized by fewer, but longer, periods of presence and absence (Fig. 3).

Nestlings. Nestlings hatched between 07:00 and 10:00 h at three nests and fledged after 12 days at two nests. At hatching, nestlings are pinkish-orange-skinned with sparse, long grey down on the crown and dorsum. Bills are mostly yellow with the upper mandible duskier. The gape is brighter yellow-white and mouth linings are yellow. Primary pin feathers emerge from their sheaths at 7 days of age. While our observations during the nestling stage are limited, we confirm that both adults (male and female, color-banded) feed the nestlings.

Seasonality. At Tapichalaca, the single active nest was estimated to have the first egg laid around 12 October 2004. Also in this area, we observed adults with dependent fledglings in November 2003, and three pairs with fledglings in November 2004. At Papallacta, we observed adults building in October (2), November (1), and December (1), nests with nestlings in October (2) and November (1), and adults feeding fledglings in December. At the nest under construction in December, adults were accompanied by older fledglings, still in juvenile plumage but not being fed, suggesting at least two broods in a year for this pair. At Yanayacu we observed building activity in May (2), June (1), August (1), September (4), and October (1). We found one nest with incubation under way in May, and adults with fledglings in June (1), July (1), August (1), September (2), October (1), and November (1). At one nest under construction in September, the female was still feeding older fledglings between bouts of building, again suggesting multiple broods per year. While our limited seasonal observations in Tapichalaca preclude any generalizations on seasonality in that area, relatively steady observations at Papallacta and year-round work at Yanayacu suggest strong seasonality in Papallacta with breeding lasting from late August to early January and a slightly longer breeding season at Yanayacu from May to December. Both of these periods, as well as the few observations from Tapichalaca, correspond to the drier months in each of the respective areas.

General observations on adult behavior. During construction of the nest, females generally maintained a steady series of sharp chipping notes as they moved back and forth from the nest. Material was gathered from up to 100 m away from the nest, but most seemed to be collected from within 20 m. Flights to the nest with material were generally long, with the female arriving at the nest after flights of 10–20 m. When approaching the nest during incubation, the female was usually silent, generally making a series of short flights in the direction of the nest, then a final direct entrance into the nest from a distance of 1–4 m. Undisturbed departures from the nest during incubation involved a longer preliminary flight of 5–10 m, generally directly into the closest vegetation. This departure was usually accompanied by a series of sharp chip notes, qualitatively thicker than those typically heard during foraging, and presumably a signal to their mate. At all nesting stages, adults' initial flights during departures from the nest appeared to us to be distinct from other short flights, with the adult spreading its tail slightly and pumping it up and down so as to create a slightly undulating flight path. This seemed especially apparent for females leaving the nest during incubation.

When flushed from a nest by an observer, the behavior of adults was quite variable, seeming to vary between nests more than between nesting stages. At some nests the incubating female flew quickly and silently away from the nest. At others she would stay 2–5 m from the observer, hopping about in dense vegetation and chipping loudly. At only a few of the nests we observed did adults perform any sort of distraction display. At these nests the adult would flush from the nest only a few meters before stopping in plain view, spreading and quivering its wings and tail, often hopping onto a small branch and slowly leaning forward and falling to the ground.

DISCUSSION

Of the roughly 12 species of *Myioborus* warblers, the nests of only five were described prior to this study. Despite some confusion in the literature, it appears that all species build domed nests on or near the ground. While secondary literature (e.g., Hilty & Brown 1989, Curson *et al.* 1994) describes the nest of Slate-throated Whitestart (*M. miniatus*) as an open cup, and Sclater & Salvin (1879) also describe the nest as a cup, Skutch's (1954) description from Costa Rica, as well as our own unpublished information from Ecuador, suggest that these descriptions are in error. Sclater & Salvin (1879) also describe the nest of Golden-fronted Whitestart (*M. ornatus*) as an open cup, presumably misconstruing available information as with their description of the Slate-throated Whitestart. As Golden-fronted Whitestart and Spectacled Whitestart are closely related, perhaps conspecific (Curson *et al.* 1994), we believe modern nests descriptions of Golden-fronted Whitestard will show that they also build domed structures. Until now, the only thorough treatment of tropical *Myioborus* breeding ecology is the work of Skutch (1954) on Slate-throated Whitestart in Costa Rica.

In general, most aspects Spectacled Whitestart breeding ecology appear similar to those of Slate-throated Whitestart. Except for one nest of Slate-throated Whitestart (Skutch 1954), only females participated in nest construction. Skutch (1954), however, observed male Slate-throated Whitestarts around the nest more frequently than males of Spectacled Whitestart (this study). In both species the nests, though bulky, are built quickly, with a period of 5–7 days of reduced activity just prior to laying of the eggs. Eggs of both species are laid early in the morning, and on consecutive days. Skutch (1954) found that incubation in Slate-throated Whitestart was delayed until clutch completion and our data suggest that for Spectacled Whitestart, regular patterns of incubation are not seen until several days after clutch completion. While incubation lasts 13–15 days in Slate-throated Whitestart (Skutch 1954), in 4 of 6 nests that Skutch observed, incubation period was 15 days as in Spectacled Whitestart. Similarly, the incubation period of their North American congener, the Painted Whitestart (*M. pictus*) lasts 13–14 days (Barber *et al.* 2000). Like Spectacled Whitestarts observed here, nestling Slate-throated Whitestarts fledge after 12–14 days (Skutch 1954). In addition, adult Spectacled Whitestart behavior, when disturbed at the nest, showed a similar degree of variability to the behavior of Slate-throated Whitestarts observed by Skutch (1954). Seemingly variable between nests in both species, some adults performed vigorous distraction displays while others quickly left the area.

While this one of the few species of *Myioborus* to have the details of its breeding ecology published (Skutch 1954, Stiles & Skutch 1989, Curson *et al.* 1994, Barber *et al.* 2000, Mumme 2002), there appear to be a fair number of generalities which can be made with regards to natural history and breeding behavior. As more than half of the described *Myioborus* species are considered range restricted or of conservation concern (Curson *et al.* 1994, Birdlife International 2004), we suggest that these data may potentially be broadly useful to conservationists working with other *Myioborus* species. We encourage others to publish further information on these and other species to provide conservationists with valuable, but often unavailable, natural history information.

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