The Spotted Barbtail (*Premnoplex brunnescens*): a review of taxonomy, distribution, and breeding biology, with additional observations from northeastern Ecuador

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Abstract
The Spotted Barbtail (*Premnoplex brunnescens*) is a poorly known ovenbird (Furnariidae) inhabiting the undergrowth of humid montane forests in Central and South America. Here I summarize published information on Spotted Barbtail as well as present observations from northeastern Ecuador. Both adults participate in all aspects of reproduction. Adults build and sleep in dormitories, similar in form to breeding nests. Mean egg size (n = 269) was 22.3 x 17.1 mm. Incubation lasted 27-31 days and nestlings fledged after 19-22 days. Nests are built exclusively along streams and potential threats to Spotted Barbtail populations include human alterations to montane stream ecosystems.

***Key words*:** Andes, cloud forest, foraging, Furnariidae, *Margarornis* assemblage, nest and eggs, *Premnoplex brunnescens,* Spotted Barbtail.

Resumen
El Subepalo Moteado (*Premnoplex brunnescens*) es un furnárido poco conocido que habita en el sotobosque de bosques húmedos de las montañas de Centro y Sur America. Aquí presento un resumen de la información publicada e inédita sobre esta especie. Ambos sexos participaron en todas las fases de la reproducción. Los adultos construyen y duermen en dormitorios que tienen formas parecidas a los nidos utilizados para la reproducción. Los huevos (n = 269) miden 22.3 x 17.1 mm. La incubación duró 27-31 días y los pichones volaron después de 20-22 días. Los nidos son construidos exclusivamente en quebradas, lo que hace vulnerable a esta especie ante las alteraciones antropogénicas a este tipo de ambientes lóticos de montaña.

Palabras claves: Andes, bosque nublado, forrajeo, Furnariidae, grupo *Margarornis*, nido y huevos, *Premnoplex brunnescens,* Subepalo Moteado.

"The very strangeness of some of the birds which, like the Spotted Barbtail, live obscurely in the dim depths of the dripping mountain forests challenges us to cultivate their acquaintance; but often they are so retiring, the range of their activities and vocalizations appears to be so narrow when compared with those of birds of sunnier habitats, they seem so deficient in character or 'personality,' that we feel poorly rewarded for our strenuous efforts to know them more intimately."

Alexander F. Skutch, 1967

The Spotted Barbtail (*Premnoplex brunnescens*) is a poorly known inhabitant of the undergrowth of humid, montane, Neotropical forests from 600-3000 m.a.s.l. (Hilty & Brown 1986, Ridgely & Greenfield 2001, Hilty 2003, Remsen 2003). It is an inconspicuous, but strikingly patterned bird, overall dark brown with a white to tawny-colored throat and a breast bearing oblong tawny-ochraceous spots, lengthening posteriorly to a dull brown belly (Fig. 1). The tail is dark brown to rufus, with the central rectrices slightly stiffened and all rectrices lacking barbs on the terminal 3-6 mm, giving it a spiny appearance. Vocalizations range from a high, thin song, trilling at the end *eep, eep, eep ti'ti'ti'titititi* (Hilty & Brown 1986), to a high pitched *pssiit* call, and a cricket-like, high-frequency trill slowly descending in pitch and tempo, *ti-ti-ti-ti-ti-ti-ti-ti-ti-ti-ti* (Areta 2007).

Spotted Barbtails forage in the understory to mid-story, creeping along horizontal and vertical branches, only occasionally using their barbed tails as support. Adults glean and probe for a variety of arthropods on branches, bark crevices, epiphytes, dead leaves, and tree trunks, often hanging upside down (Wetmore 1972, Remsen 2003, Areta 2007). They may forage alone, in small groups, or occasionally with mixed flocks (Hilty & Brown 1986, Remsen 2003).

The taxonomic placement of *Premnoplex* has historically been uncertain, and little has been written on its natural history. Here I provide a review of the currently available data on its taxonomy, distribution, and breeding biology. In addition I provide general, unpublished observations on its natural history in northeastern Ecuador.

Fig.1. Spotted Barbtail (*Premnoplex brunnescens brunnescens*) at the Yanayacu Biological Station, Napo, northeastern Ecuador, 2050 m.a.s.l. (Photo: Murray Cooper).

Taxonomy. *Premnoplex* is a genus of ovenbirds (Furnariidae) comprised of only two species; Spotted Barbtail (*P. brunnescens*) and White-throated Barbtail (*P. tatei*). The systematic position of *Premnoplex* has long been debated, and while previous classifications have subsumed the genus into *Margarornis* (e.g., Meyer de Schauensee 1966, Vaurie 1980), *Premnoplex* is now recognized as a valid genus (e.g., Remsen 2003, Irestedt *et al.* 2006, Remsen *et al.* 2008). Based principally on size, wing shape, tarsal proportions, hindlimb musculature, and plumage pattern, *Premnoplex* was considered part of the "*Margarornis* assemblage," consisting of *Margarornis*, *Roraimia*, *Premnornis*, and *Premnoplex* (Vaurie 1980, Rudge & Raikow 1992a, 1992b). Within this group, however, relationships were unclear due to the incongruence between anatomical features, molecular data, and natural history (Dobbs *et al.* 2003, Irestedt *et al.* 2006, Areta 2007). While Rudge & Raikow (1992b) suggested that *Premnoplex* and *Premnornis* should be considered sister taxa, Dobbs *et al*. (2003) suggested that the divergent nature of *Premnornis* nest structure should exclude it from the *Margaronis* group. Indeed, recent DNA data suggest that *Premnornis* forms a separate clade with *Pseudocolaptes*, and is only distantly related to the *Premnoplex-Margarornis* clade (Irestedt *et al.* 2006). This is further supported by similarities in nest architecture between *Premnornis* and *Pseudocolaptes*, both building loose cup

nests of tree-fern scales inside tree cavities (Skutch 1969, Dobbs *et al.* 2003, Solano-Ugalde & Arcos-Torres 2007). Using the limited data available on nest architecture in the Furnariidae, Zyskowski & Prum (1999) suggested that *Premnoplex* belongs to a clade of "pensile nest" builders which included *Margarornis*, *Siptornis*, *Cranioleuca*, & *Thripophaga*. Recently, Areta (2007) agreed with previous studies that, in light of the convergence prone nature of characters associated with scansorial habits (eg. hindlimb musculature) (e.g., Feduccia 1973, Irestedt *et al.* 2004), as well as differences in nests and foraging behaviors, *Premnoplex* and *Margarornis* should be considered sister taxa with *Roraimia* provisionally considered related and with *Premnornis* excluded from this clade. Finally, in the most recently proposed phylogenetic hypothesis, Irestedt *et al.* (2006) concur that *Margarornis* and *Premnoplex* are sister taxa, forming a clade with *Pygarrhichas*.

Within *Premnoplex*, the distinction between *P. brunnescens* and *P. tatei* is also debated, with some authors considering them conspecific (Hellmayr 1938, Vaurie 1980) and others separating them, but considering evidence warranting this separation to be weak (Remsen 2003). Areta's (2007) recent ecological studies of the two species, however, including observations on vocalizations, behavior, and habitat use, suggests that these taxa are indeed deserving of species rank. *Premnoplex brunnescens*, originally described in the genus *Margarornis*, was later subdivided to exclude *Premnoplex tatei* by Chapman (1925), and this distinction is generally upheld (e.g., Ridgely & Tudor 1994, Remsen 2003).

Distribution. *Premnoplex brunnescens* is broadly distributed from Costa Rica southward to central Bolivia, and currently includes five recognized subspecies (Remsen 2003). Remsen (2003) provided the currently accepted subspecific breakdown as follows: ssp. *brunneicauda*, Costa Rica and western Panama; ssp. *brunnescens*, extreme eastern Panama into western Venezuela and southward through all three ranges of the Colombian Andes through Ecuador to Cuzco, Peru; ssp. *coloratus*, endemic to the Santa Marta Mountains of northern Colombia; ssp. *rostratus*, endemic to the costal mountains of northern Venezuela; and ssp. *stictonotus*, Andes of southern Peru south into Western and Central Bolivia as far south as Cochabamba. Spotted Barbtail's only sister species, *P. tatei,* is a range-restricted species endemic to Venezuela and considered vulnerable to extinction due to rapidly increasing habitat destruction (Remsen 2003, BirdLife International 2004).

Nesting biology. Despite its wide distribution, there is relatively little published on the breeding biology of the Spotted Barbtail. Most recently, Remsen (2003) summarized available nest descriptions as a "massive ball c. 30 cm in diameter." Skutch (1967) provided the first nest description from a single nest (ssp. *brunneicauda*) found at Agua Buena, Costa Rica, at 1,250 m.a.s.l. The nest was built into a natural cavity in a fallen log, suspended over a stream. Subsequently, Stiles & Skutch (1989) expanded upon this description of Costa Rican nests (ssp. *brunneicauda*), describing them as "more or less globular structure[s] of green mosses or liverworts, bound together with fine, dark-colored rootlets," with a tubular, downward oriented entrance leading to a chamber lined with thick mosses and liverworts. They describe nests as being attached to "rough or pitted surface[s] of upright or fallen trunk[s] or vertical rocky cliff[s], or in a crotch, often near tip of drooping branch[es]." Areta (2007), in Venezuela (ssp. *rostratus*), describes nests similarly, as mossy balls with an entrance "usually facing downwards" and leading to an inner platform with an elevated front portion to contain the eggs. Nests (n = 35+) in Venezuela were built "attached to rocks, trees, or roots, usually in dark, hidden, and extremely wet areas, but never in what would strictly be considered a cavity" (Areta 2007). Areta (2007) also mentions the propensity of nests to be situated next to, and in the spray of, small waterfalls. He states that they are "usually" placed in sites above fast-flowing water, but confirms that, indeed, all nests were directly over water (Areta pers. com.). Nests in Colombia (Hilty & Brown 1986) (ssp. *brunnescens*) are described as being "wedged in crevice[s] between logs, bark, or rocks, and usually low." In Ecuador (Marín & Carrión 1994, Greeney & Nunnery 2006, Greeney & Gelis 2007) (ssp. *brunnescens*), nests have been described in a generally similar fashion. Marín & Carrion (1994) provided the first Ecuadorian descriptions from four active nests and over 100 inactive nests in the northwest. Unlike previous descriptions, however, they mention that nests were lined with "fine rootlets and vegetable fibers." Like other authors, they note the wide variety of substrates to which nests are attached, adding to previous descriptions that some are attached to the terminus of hanging clumps of tangled vegetation. Additional descriptions of Ecuadorian nests from the northwest and northeast generally agree with these descriptions, but describe nest linings as simply

"pale fibers" (Greeney & Gelis 2007). Ecuadorian nests are (with one exception, see Greeney & Gelis 2007) all described as being directly over water, often near small waterfalls, and always in extremely humid situations. Only two nest illustrations have been published; Skutch's (1967) original detailed illustration (reproduced in Skutch 1996), and a photograph provided by Marín & Carrion (1994). Interestingly, of all described nests, Skutch's Costa Rican nest is the only one which was not a complete ball, but instead built of several sections of moss which partially filled an inverted cavity and used part of the log itself to complete the nest's globular structure. Skutch's (1967, 1996) figure also clearly shows the lack of an internal lining, though it does illustrate the raised anterior portion of the egg cup, forming a lip to prevent eggs from falling out.

Without exception across the species' range, clutch size is given as two, and eggs are described as immaculate white (Skutch 1967, Stiles & Skutch 1989, Hilty & Brown 1986, Marín & Carrión 1994, Greeney & Nunnery 2006, Greeney & Gelis 2007). Mean dimensions (± SD) of eggs described in the literature (n = 22, all from Ecuador, Marín & Carrión 1994, Greeney & Nunnery 2006, Greeney & Gelis 2007) are 21.5 ± 0.5 by 16.7 ± 0.4 mm. Almost nothing has been described of Spotted Barbtail nestling care. Areta (2007) provides the only published information, noting only that nestlings defecate through the nest entrance in the absence of adults, the fecal sacs presumably removed by the running water below.

The breeding season of the Spotted Barbtail in Costa Rica lasts from March-June (Stiles & Skutch 1989), and occurs at least during these months in Venezuela (Areta 2007). In Colombia, birds in breeding condition and nests with nestlings are reported from March-August (Hilty & Brown 1986, Fjeldså & Krabbe 1990), with one report of a juvenile in November (Fjeldså & Krabbe 1990). In northwestern Ecuador, active nests have been found in nearly all months, suggesting year-round breeding in this area (Marín & Carrión 1994, Greeney & Nunnery 2006). Fewer nests are reported from northeastern Ecuador, but several active nests were observed in March, April, and one in December (Greeney & Gelis 2007), again suggesting a prolonged breeding season. Too few nests have been reported, however, to accurately assess breeding seasonality on a larger geographic scale. There remains no published breeding data from Peru or Bolivia.

Additional data from northeastern Ecuador. During the past 7 years I have had the opportunity to study a variety of aspects of Spotted Barbtail breeding biology in northeast Ecuador at the Yanayacu Biological Station & Center for Creative Studies, Napo Province, 1900-2,300 m.a.s.l. (0°36' S, 77°53' W). Here I summarize previously unpublished information on their reproductive activities, filling in some of the gaps in our current knowledge.

I have observed breeding activity during almost all months of the year, confirming previously published suppositions that this species' has a protracted breeding season. Nest construction, incubation, and nestling and fledgling care are performed by both sexes. Interestingly, successful and unsuccessful nests are reused for multiple breeding attempts, both within and between years. On at least 10 occasions I observed clutch replacement, in the same nest, within 20 days of the loss of the first clutch. Currently, I have 4 nests which are still active after 7 years of observation and 3 nests still active after 6 years. I observed one nest which held at least four clutches during the course of a single year! Two of these breeding attempts failed, and I do not know the fate of the other two. In general, it appears that nests may produce two successful broods a year. I do not know if nests are used by only one pair, or if several pairs utilize the same nest. Paul Schwartz (in Skutch 1967) found up to three adults using the same dormitories in Costa Rica, thus it remains to be seen if, and how, breeding nests are shared between individuals.

I also confirmed that this species builds non-breeding dormitory nests in our area. These dormitories are similar to those described by Skutch (1967). They range in complexity from a simple cavity, seemingly hollowed out of existing moss, to partially constructed mossy balls. Often it appears that a natural cavity, usually in a hanging clump of moss and epiphytes, is amplified with a few additions of moss (Fig. 2). Dormitories are found in a variety of situations along streams, varying from crevices in tree trunks, rock faces, or dirt embankments, to naturally hanging clumps of moss and epiphytes. They differ from breeding nests in being smaller and lacking any sort of lining or egg cup. Most, however, have a slightly elevated rim at the front, presumably providing a perch for the adult. This rim is often formed by a naturally occurring feature of the attachment point, such as a horizontal stick or rock lip. While breeding nests are almost always built over running water (see below),

dormitory nests are often found up to 10 m from the nearest stream.

I found breeding nests exclusively along streams, despite extensive nest searching away from streams. While all nests were in well-shaded areas, this species seemed fairly tolerant of moderate disturbance, so long as most of the canopy remained intact. Nests were found as little as 10 m from forest edges. As expected from previously published descriptions of nest site selection (e.g., Marín & Carrión 1994, Greeney & Nunnery 2006, Areta 2007), I found nests attached to a wide variety of substrates, almost exclusively, however, over water. I found nests attached to substrates ranging from earthen banks and rock ledges, to horizontal or vertical tree trunks. Some nests were partially or entirely in an earthen or wooden cavity, while others were hanging in the open and attached to mossy clumps of vegetation. Nests, especially older ones, are extremely robust and thick-walled, almost impenetrable, even with a sharp object such as a pencil. Interestingly, the permanency and stability of barbtail nests occasionally led to their use as a nesting substrate by other species. On two occasions, the tops of currently inactive barbtail nests were used to support the nests of Slaty-backed Nightingale Thrushes (*Catharus fuscater*). One nest was used as an attachment point for the nest of Speckled Hummingbird (*Adelomyia melanogenys*), and another supported the nest of a Green-fronted Lancebill (*Doryfera ludovicae*). On one occasion the nest of a Grey-breasted Woodwren (*Henicorhina leucophrys*) was attached to the outside of a barbtail nest. At one nest, which had been partially torn open by a predator, the nest was taken over by a pair of Slaty-backed Chat-tyrants (*Ochthoeca cinnamomeiventris*), which actually entered their nest through the partially destroyed entrance of the barbtail nest structure. While it has only been well-documented once, I have evidence that the nests of Spotted Barbtail are occasionally usurped by Long-tailed Tapaculos (*Scytalopus micropterus*) in our area (Greeney 2008). Additionally, I observed two clutches of eggs, in nests previously built and used by Spotted Barbtails which were too large to belong to barbtails. While I did not confirm their ownership at the time, in retrospect, I now believe these other two clutches also belonged to tapaculos.

Fig. 2. A Spotted Barbtail (*Premnoplex brunnescens*) roosts for the night in a shallow cavity hollowed out in a hanging clump of epiphytes (Photo: Rudolphe A. Gelis).

In general, Spotted Barbtails appear to be relatively passive when interacting with other species at their nesting sites. In one case, a pair of barbtails beginning construction of either a dormitory or breeding nest under a horizontal log was displaced by a female Green-fronted Lancebill. The lancebill eventually built her nest hanging from the lip of the partially constructed barbtail nest. Construction by the barbtails was subsequently

abandoned and the nest was never built, even long after the lancebill had finished nesting. On another occasion a barbtail nest under construction was abandoned when a Rufous-breasted Flycatcher (*Leptopogon rufipectus*) began construction of its own nest only 20 cm away. Because Spotted Barbtails, Green-fronted Lancebills, and Rufous-breasted Flycatchers in my area favor similar nesting sites (Dobbs & Greeney 2006, Greeney *et al*. 2006a), the usurpation of barbtail nesting sites by these two species may be more frequent than these two isolated observations suggest. In addition, Highland Motmots (*Momotus aequatorialis*) and several species of *Thripadectes* treehunters also prefer nesting in tunnels in streamside banks with overhanging lips in my area (Greeney *et al.* 2006b, pers. obs.). While I have found many Spotted Barbtail nests in close proximity to motmot or treehunter tunnels, I have never found barbtail nests active concurrently with nests of these other species. Because both motmots and treehunters reuse old nest tunnels or excavate another in close proximity previous nests (pers. obs.), it is possible that nesting activity of these species may interfere with that of Spotted Barbtails.

Clutch size was almost exclusively 2 (n = 164 clutches), with only one nest found with three eggs. All eggs (n = 307) were immaculate white, but often they were slightly stained with vegetative liquids or blood and fluids deposited during laying. Mean dimensions (± SD) of 269 eggs were 22.3 ± 1.1 by 17.1 ± 0.7 mm. Eggs were variable in shape, ranging from nearly round to oblong (Fig. 3). Mean fresh weight (before visible development) of 60 eggs was 3.49 ± 0.25 g. Eggs were laid roughly 48 hours apart (n = 18 nests) and always in the morning before 09:00 (n = 37 eggs). Incubation period (starting from clutch completion) ranges from 27 (3 nests) to 31 (1 nest) days, with one nest taking 30 days to hatch, one taking 29 days, and 7 nests taking 28 days. In all cases where I observed hatching (n = 24), both eggs hatched on the same day. Spotted Barbtails show a remarkable pattern of diurnal incubation. By switching places at the nest, adults maintain nearly 100% coverage during the morning. Around 10:00 h they leave the nest, not returning until late in the afternoon. Often eggs are left unattended for over 5 h. A complete description of incubation rhythms in this species will be presented elsewhere (Greeney in review).

Nestling Spotted Barbtails are born with pinkish orange skin and sparse pale grey down. Nestlings fledge after 19-22 days (19 days at 1 nest, 20 days at 7 nests, 21 days at 1 nest, and 22 days at 1 nest). Both adults provision nestlings, bringing a variety of invertebrate prey including larval and adult insects, snails, and earthworms. As observed by Areta (2007), in all cases older nestlings defecated out of the nest entrance in the absence of adults. Adults removed or ate the fecal sacs of only very young nestlings too small to maneuver themselves into the position necessary to drop feces out of the entrance. Until ~ 4 days of age, nestlings remain oriented with their heads opposite the nest entrance, presumably to facilitate adult removal of fecal sacs. After this, they sit with their heads oriented towards the entrance, presumably turning about to defecate.

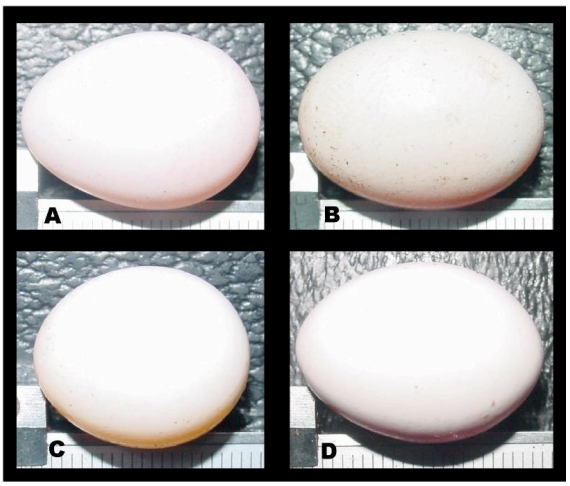

Figure 3. Eggs of the Spotted Barbtail (*Premnoplex brunnescens*) from northeastern Ecuador. A, B, & C, are from the Yanayacu Biological Station, 2050 m.a.s.l., while D is from the Parque National Gran Sumaco, 1750 m.a.s.l. They have the following measurements: A = 23.3 x 17.3 mm; B = 24.5 x 17.8 mm; C = 20.3 x 17.3; D = 23.5 x 17.0

Summary and comments on conservation. An incubation period of 27-31 days is the longest reported for any Furnariidae but, conversely, a nestling period of 19-22 days is similar to that of most other ovenbirds (Skutch 1996, Remsen 2003). Interestingly, despite the construction of large, elaborate nests by other ovenbirds, requiring considerable energy investments (Skutch 1996), Spotted Barbtails appear to be one of the few ovenbirds that repeatedly reuse the same nest. Even in species which build substantial nests, which often remain intact after breeding (i.e., *Furnarius* spp.), old nests are infrequently reused (Skutch 1996).

Because Spotted Barbtails nest exclusively along streams, the maintenance of healthy watersheds is critical for breeding in this species. While they do seem fairly tolerant of small levels of disturbance in breeding areas (this study), and a common practice in montane agriculture is to leave vegetation along riparian areas (pers. obs.), there are two major aspects of logging which potentially have a high impact on the reproduction of Spotted Barbtails. The first, and most severe, is the common use of streams as a means to access forest for the removal of wood. By necessity, to give access to horses and mules, this practice includes the removal of vegetation and logs overhanging streams. Because overhanging logs and vegetation are preferred nesting substrates for Spotted Barbtails, the use of streams by woodcutters poses a serious threat to this species, even if surrounding forest is left relatively intact. In one case, I personally witnessed the expatriation of breeding Spotted Barbtails from what was considered a "protected" area, because woodcutters were traversing streams in the protected sites to reach unprotected forest.
A second major factor affecting Spotted Barbtail breeding is deforestation of the upper portions of watersheds. This destabilizes stream banks and surrounding soils, causing landslides and depositing silt into riverbeds. While I have not quantified my observations, Spotted Barbtails appear to prefer nest sites along streams with rockier stream beds. The silting and muddying of streams as a result of recurring landslides upstream from otherwise intact breeding habitat has, on several occasions, reduced the number of breeding barbtail pairs along these streams. This exemplifies a particularly insidious effect of human disturbance, as large areas of intact, "protected" forest may be quickly and adversely impacted by activities outside of a reserve. In addition, while the relative role of aquatic invertebrates in Spotted Barbtail diets remains undocumented, the deleterious effects of such disturbance on stream communities (e.g., Wood & Armitage 1997, Mol & Ouboter 2004) suggests that such problems may affect other aspects of barbtail ecology. While the impacts of logging may limit breeding in the Spotted Barbtail, they may be of particular importance for the conservation of the Spotted Barbtail's range restricted congener, the White-throated Barbtail.

Overall, there remain many gaps in our understanding of Spotted Barbtail biology, including their breeding ecology. Subsequent to Skutch's (1967) eloquent description of their habits, which points to the challenges of gathering ecological data on Spotted Barbtails, several researchers have been successful in finding and describing nests and various aspects of breeding biology (e.g., Marín & Carrión 1994, Greeney & Nunnery 2006, Greeney & Gelis 2007, Areta 2007). Descriptions of the nests of Spotted Barbtail reveal a great deal of variation in placement and, to some degree structure (most notably with respect to nest lining). This variation is particularly well illustrated by their use of a wide variety of nest attachment points and the resulting variation in nest architecture. Their seemingly restricted nesting habitat (along streams), as well as their broad distribution and local abundance, make Spotted Barbtails an ideal study organism for understanding the complexities and details of the breeding biology of a poorly known family of birds. By following montane streams throughout their range, one can reliably find and study both adults and nests, as evidenced by the large sample of nests found by Marín & Carrión (1994) and Areta (2007). With such potential for large sample sizes, Spotted Barbtails make an excellent species with which to test a wide variety of ecological and natural history hypotheses.

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