# Age Determination of the Spot-breasted Wren and the White-breasted Wood-Wren Using Molt Limits

*Angelina Ruíz-Sánchez*[1], *Rafael Rueda-Hernández*[1*] *Santiago Guallar*[2] *and Peter Pyle*[3]
[1]Posgrado en Ciencias Biológicas, Instituto de Biología, UNAM, Circuito exterior s/n, Ciudad Universitaria, Mexico D.F. 04510 México
[2]Galanthus, Carretera de Juià, 46, Celrà, Girona 17460, Spain
[3]Institute for Bird Populations, Point Reyes Station, CA.
*Corresponding author: rarh82@hotmail.com

## ABSTRACT

*The Spot-breasted Wren* (Pheugopedius maculipectus) *and the White-breasted Wood-Wren* (Henicorhina leucosticta) *undergo a partial preformative molt resulting in molt limits each between juvenal and formative feathers within and between the lesser, median and greater coverts, alula, and tertials. These two wrens do not replace secondaries or primaries, and only some White-breasted Wood-Wrens molt rectrices. Their definitive prebasic molt is complete, and, if present, their prealternate molt is limited to body feathers. These patterns combined allow the identification of first-cycle (HY or SY) individuals as those showing molt limits within the above-mentioned wing-feather tracts. Description of molt patterns enhances our ability to correctly age birds and, therefore, helps increase knowledge of the biology, age structure and population dynamics of these and other poorly known Neotropical species.*

## RESUMEN – *Determinación de la edad en el chivirín moteado y el chivirín pecho blanco usando el patrón de muda preformativa.*

*El chivirín moteado* (Pheugopedius maculipectus) *y el chivirín pecho blanco (Henicorhina leucosticta) presentan una muda preformativa parcial, que da como resultado límites de muda en las cobertoras pequeñas, medianas y mayores, el alula y las terciarias. Estos dos chivirines no reemplazan primarias ni secundarias, y solo algunos individuos del chivirín pecho blanco mudan rectrices. La muda prebásica definitiva de estas especies es completa, mientras que la muda prealterna, si sucede, se limita a las plumas del cuerpo. La combinación de estos patrones permite identificar directamente como ave en su primer ciclo (HY o SY) a cualquier individuo que muestre límites de muda simétricos en el ala. La descripción de los patrones de muda incrementa nuestra capacidad para determinar correctamente la edad de las aves y por lo tanto, permite mejorar el conocimiento de la biología, estructura de edades y dinámica poblacional de éstas y otras aves Neotropicales poco conocidas.*

## INTRODUCTION

Age is a fundamental parameter that influences many aspects of avian biology, including morphology (Alatalo et al. 1984), plumage (Rohwer 1978), behavior (Greenberg and Gradwohl 1997), survivorship (Saracco et al. 2010), and developmental processes such as molt (Jenni and Winkler 1994). Therefore, ageing birds is a basic operation in many ornithological studies.

In the majority of passerine species, criteria based on preformative molt patterns are the most powerful ageing techniques because of their reliability and temporal applicability (Pyle 1997, Guallar et al. 2009). Molt extent is a cyclic specific discrete character, which can be used to seperate birds in their first cycle from birds of subsequent cycles. Most passerines can be aged for a period of approximately one year solely on the basis of their partial or incomplete molt extent. From then on they acquire full somatic maturation, and it is impossible to distinguish if they are in their second or subsequent annual cycles (Pyle 1997, Wolfe et al. 2010). Other ageing techniques can have a shorter temporal applicability or are less reliable. For example, skull pneumatization in most passerines completes before six months (Pyle 1997), and tongue marks normally fade away in a few months, although sometimes these characteristics can be present throughout a lifetime for certain groups (Svensson 1992, Pyle 1997).

The extent of a molt episode along with the plumage it produces and the number and timing of molt episodes in a species' annual cycle are the main factors to be taken into account when using molt patterns to age passerines (Gualllar et al. 2009). The first molt episode after the growth of juvenal plumage (preformative molt according to Howell et al. 2003 molt terminology) is usually partial or incomplete (Pyle 1997). This characteristic makes it a very useful molting episode for subsequent age determination because it is characterized by the presence of molt limits, which are revealed by the contrast between two feather generations (Froehlich 2003). However, when the preformative molt is complete as, for example, in the Bushtit (*Psaltriparus minimus*), molt limits cannot be used to age birds, and other criteria such as skull pneumatization must be utilized (Pyle 1997).

Here we describe the preformative molt pattern (including extent and individual frequency of feather replacement) of the Spot-breasted Wren (*Pheugopedius maculipectus)* and the White-breasted Wood-Wren (*Henicorhina leucosticta)*, and apply molt limits to help age these monochromatic species of Middle America, for which little is known of molting strategies (Ryder and Wolfe 2010).

## METHODS

We gathered molt data from 34 study specimens (19 Spot-breasted Wrens and 15 White-breasted Wood-Wrens) in Colección Nacional de Aves and Museo de Zoología Alfonso Herrera from Universidad Nacional Autónoma de México and the Museum of Vertebrate Zoology from Berkeley, CA, and eight live birds, six that were mist-netted at Los Tuxtlas Biosphere Reserve in Veracruz state (two Spot-breasted Wrens and four White-breasted Wood-Wrens), Mexico (18° 35' 7" N, 95° 4' 30" W), and two White-breasted Wood-Wrens at Las Cruces Biological Station, Costa Rica (8° 47' 7" N, 82° 57' 32" W). All of the study specimens correspond to birds in formative plumage (Howell et al. 2003), whereas four of our live captures were adults.

The age of specimens was based exclusively on the retention of juvenal feathers (Svensson 1992, Jenni and Winkler 1994, Pyle 1997). For ageing live birds we also used incomplete skull pneumatization and, in Spot-breasted Wrens, iris color, which is dull brown in hatch-year birds and reddish in older individuals (Guallar et al. 2009, Wolfe et al. 2009; this study) to confirm age.

We scored non-active molt following the method proposed by Gargallo (2000), which organizes the wing and body feather tracts as follows:primaries, secondaries, tertials, alula feathers, greater coverts (including the carpal) and primary coverts are scored individually, lesser and median coverts are scored as complete tracts according to the percentage of feathers molted within the tract (0: 0%, 1: >0-10%, 2: >10-30%, 3: >30-60%, 4: >60-90%, 5: >90%), scapulars, upper parts, underparts, head, upper and under tail coverts (the six body tracts considered) are scored like the lesser and median coverts above.

We also noted the presence of active molt and the month of occurrence, as well as the number of feather generations.

## RESULTS

The preformative molt of the Spot-breasted Wren and the White-breasted Wood-Wren includes all of the body feathers and scapulars, and a variable number of lesser, median, and greater coverts, alula feathers, and tertials. The molt of White-breasted Wood-Wrens may also include some rectrices. None of the individuals that we examined had replaced primaries, secondaries, or primary coverts (Table 1).

The prebasic molt of these two species is complete. Both the preformative molt and the prebasic molt finish in late October, although some individuals may finish in November.

In first-cycle Spot-breasted Wrens, we found molt limits within the greater coverts in 33% of the birds of our sample, the alula feathers in 71%, and tertials in 24% (Fig. 1A, Table 1). The retained juvenal feathers are reddish while the formative and basic

Table 1. Summary of the preformative molt extent on the left upperwing and left half of the tail: range (medium) [% none molted: all molted]. n=21 for each species. TheWhite-breasted Wood-Wren has 10 rectrices as it was confirmed in other members of the genus (Guallar et al. 2009). The loss of the outermost pair of rectrices might be a consequence of a reduction of the caudal pterlya and the size of the feather follicles associated to a loss of functionality (Futuyma 1998).

| | Spot-breasted Wren | | | White-breasted Wood-Wren | | |
|---|---|---|---|---|---|---|
| | Range | Median | % Molted (none: all) | Range | Median | % Molted (none:all) |
| Lesser Covs | 5-5 | 5 | 0:100 | 3-5 (5) [0:71] | 5 | 0:71 |
| Median Covs | 5-5 [0:100] | 5 | 0:100 | 0-5 [10:57] | 5 | 10:57 |
| Alula | 0-3 (2) [19-10] | 2 | 19:10 | 0-2 (0) [76:0] | 0 | 76:0 |
| Greater Covs. | 4-10 (10) [0-67] | 10 | 0:67 | 0-9 (3) [24:0] | 3 | 24:0 |
| Carpal Covs. | 0-1 (0) [62-29] | 0 | 62:29 | 0 [100:0] | 0 | 100.0 |
| Primary Covs. | 0-0 [100:0] | 0 | 100:0 | 0-0 [100:0] | 0 | 100:0 |
| Tertials | 0-2 (0) [76-0] | 0 | 76:0 | 0-3 (0) [67:5] | 0 | 67:5 |
| Secondaries | 0-0 [100:0] | 0 | 100:0 | 0-0 [100:0] | 0 | 100:0 |
| Primaries | 0-0 [100:0] | 0 | 100:0 | 0-0 [100:0] | 0 | 100:0 |
| Rectrices | 0-0 [100:0] | 0 | 100:0 | 0-5 (0) [81:10] | 0 | 81:10 |

feathers are brown with a greenish tinge. (Fig. 2A, B).
[Editor's Note: Figures 2A-2E are available in high resolution color at:
**http://www.westernbirdbanding.org/NABB37_3_Ruiz-Sanchez.pdf**].
The black bars of juvenal ( feathers are paler and ill-defined [Fig. 2C] ).

We found signs of body molt in a second year Spot-breasted Wren specimen collected in April. This bird was molting around 50% of its head feathers and approximately 25% of its breast and belly feathers. Our small sample size precluded estimating the frequency of this molt episode.

In first-cycle White-breasted Wood-Wrens, we found molt limits within the greater coverts in 76% of the birds of our sample, the alula feathers in 24%, and tertials in 28% (Fig. 1B, Table 1). The juvenal greater and median coverts are dusky with reddish margins, whereas the formative ones are darker, frequently black with white margins or tips (Fig. 2D,E).

Molt-limits represent clear-cut differences between formative and the definitive basic feathers that make it possible to distinguish birds in their first annual cycle from older birds throughout the year. The best tracts to look at for molt limits are the alula and the greater coverts (Fig. 1).

## DISCUSSION

The preformative molt of Spot-breasted Wren does not involve primaries, secondaries or rectrices, and is rather dissimilar to that of its sister species, the Happy Wren (*Pheugopedius felix*), which replaces distal primaries in 35% of the cases (Guallar et al. 2009; phylogeny based on Mann et al. 2006). Happy Wren is also reported to present a prealternate molt in spring at a low but unknown frequency. This episode is apparently limited to body feathers as in other small sized Mexican wren species (Guallar et al. 2009).

Fig. 1. Frequency of replacement (%) of the upper left wing feathers in the preformative molt of: A) Spot-breasted Wrens (n=21), and B) White-breasted Wood-Wrens (n=21).

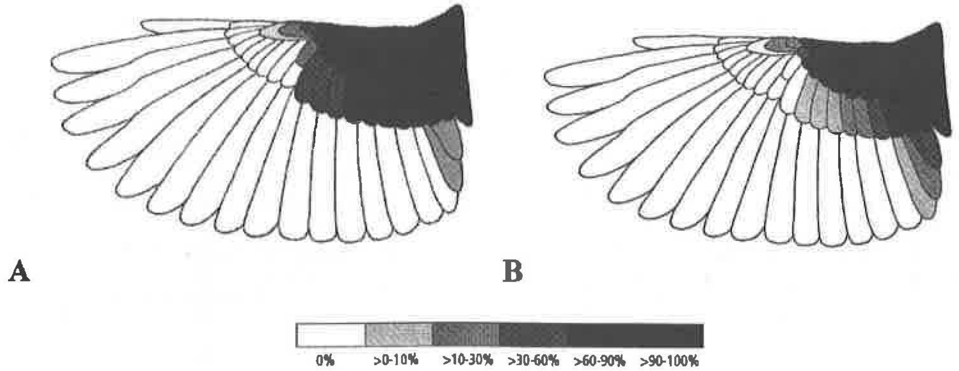
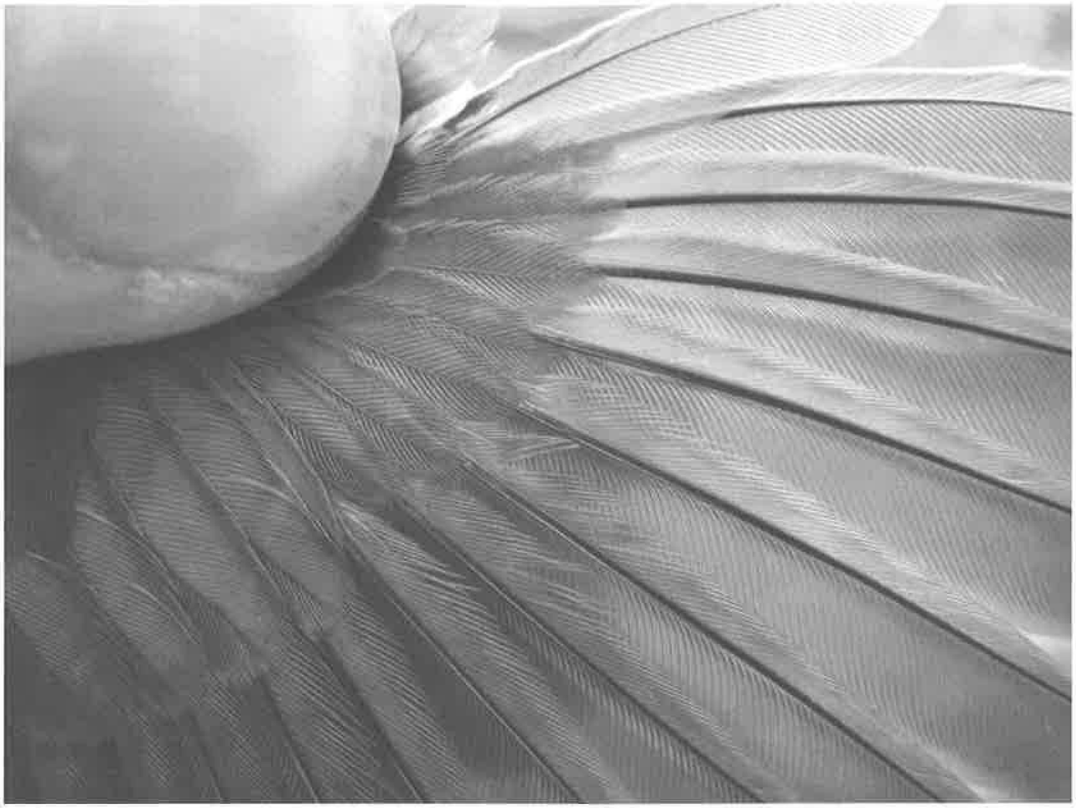



Fig. 2 A-E. The formative plumage of these two wrens is essentially composed by juvenal remiges and rectices, formative body feathers, and a mixture of formative and juvenal wing coverts. Formative feathers are indistinguishable from definitive ones. In both species, bars of juvenal feathers are blackish, not black, and ill-defined. These differences render molt limits relatively easy to detect. Provided that these species apparently have a single breeding season, their prealternate molts, if present, are limited to body feathers and their definitive basic molt is complete. The presence of molt limits within the wing feather tracts allows identifying first-cycle individuals.

A) Spot-breasted Wren: molt limits are between the greater coverts 2-3 and the lesser and median ulula.



**B) Spot-breasted Wren: molt limits are between primary coverts and greater coverts. (picture: D. Gabriel).**

**C) Spot-breasted Wren: molt limits between rectrices. (picture: D. Gabriel).**

D) White-breasted Wood-Wren: the second outermost greater covert is formative.

E) White-breasted Wood-Wren: molt limits within the greater coverts and between fomative tertials and older secondaries.

Alternatively, the report of "prebreeding" molts in these species may actually be protracted and/or suspended prebasic and preformative molts, unless follicles are activated twice within the cycle, as can be the case for North American species of wrens (Pyle 1997). The two or three molt episodes configure an annual molt cycle that probably matches the basic definitive life cycles described by Guallar et al. (2009), although we still lack information on the species' reproductive cycle.

On the other hand, the preformative molt pattern of the White-breasted Wood-Wren is similar to that of its sister species, the Grey-breasted Wood-Wren (*H. leucophrys)*, in that both tend to retain coverts around the alular carpal region, although the Grey-breasted Wood-Wren replaces inner secondaries in 18% of the cases and may occasionally replace one or more distal primaries (Guallar et al. 2009).

The extent of this molt episode in both species may be influenced by factors such as time of breeding, food availability, and mechanical abrasion as noted in other passerine species (Pyle 1998, Schondube et al. 2003). The patterns found are consistent with those expected for humid forest species with less abrasion than species living in arid habitats (Willoughby 1991, Pyle 1998). Some passerine families, such as the Parulidae, also show preformative molts limited to wing coverts; however, several wrens are known for the opposite, including at least two small Neotropical wren species, the Sinaloa and the Carolina wrens (*Thryophilus sinaloa* and *Thryothorus ludovicianus*), which can molt from zero to more than 10 remiges (Pyle 1997, Guallar et al. 2009).

Despite the fact that distant populations of the same species may present differences in molt extent (Mulvihill and Winstead 1997), especially when they differ greatly in latitude, preliminary analyses showed no significant statistical differences in molt extent between birds from Veracruz and Oaxaca, and those of Costa Rica and other Mexican states (Campeche, Chiapas, Hidalgo, San Luis Potosí and Tamaulipas). However, preformative molt pattern defined from our small sample size should not necessarily apply to all the populations of these two Neotropical wrens, and we do not rule out the possibility that some individuals, even of the same geographic area that we studied, may present different preformative molt patterns (e.g., replace primaries, secondaries and/or rectrices).

Our work illustrates that defining the preformative molt of passerines can be attainable easily with a reasonably low effort. Whereas confirming the preformative pattern can be difficult for some species, it only requires a few days for many, particularly if captures are increased by the use of target mist-netting. Monitoring stations in Mexico and Central America could implement protocols to gather molt data for the most commonly captured species, contributing in this way to improve our knowledge on Neotropical birds.

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## LITERATURE CITED

Alatalo, R.V., L. Gustafsson, and A. Lundberg. 1984. Why do young passerine birds have shorter wings than older birds? *Ibis* 126:410-415.

Froehlich, D. 2003. Ageing North American landbirds by molt limits and plumage criteria. Slate Creek Press, Bolinas, CA.

Futuyma. D.J. 1998. Evolutionary Biology. Sinauer. Sunderland, MA.

Gargallo, G. 2000. La nueva ficha de muda. Pp. 99-114 in Pinilla, J. (coord.) 2000. Manual para el anillamiento científico de aves. SEO/ BirdLife y DGCN-MIMAM, Madrid.

Greenberg, R. and J. Gradwohl. 1997. Territoriality, adult survival, and dispersal in the Checker-throated Antwren in Panama. *Journal of Avian Biology* 28:103-110.

Guallar, S., E. Santana, S. Contreras, H. Verdugo, and A. Gallés. 2009. Paseriformes del Occidente de México: morfometría, datación y sexado. Museu de Ciències Naturals de Barcelona, Barcelona, Spain.

Howell, S.N.G., C. Corben, P. Pyle, and D.I. Rogers. 2003. The first basic problem: a review of molt and plumage homologies. *Condor* 105:635-653.

Jenni, L. and R. Winkler. 1994. Moult and ageing of European passerines. Academic Press, London.

Mann, N.I., F.K. Barker, J. A. Graves, K.A. Dingess-Mann, and P.J.B. Slater. 2006. Molecular data delineate four genera of "*Thryothorus*" wrens. *Molecular Phylogenetics and Evolution* 40:750-759.

Mulvihill, R.S. and R.L. Winstead. 1997. Variation in the extent of the first prebasic wing molt of Dark-eyed Juncos. *Condor* 68:183-199.

Pyle, P. 1997. Identification guide to North American birds. Part I Columbidae to Ploceidae. Slate Creek Press. Bolinas, CA.

Pyle, P. 1998. Eccentric first-year molt patterns in certain tyrannid flycatchers. *Western Birds* 29: 29–35.

Rohwer, S. 1978. Passerine subadult plumages and the deceptive acquisition of resources: Test of a critical assumption. *Condor* 80:173-179.

Ryder, T.B. and J.D. Wolfe. 2009. The current state of knowledge on molt and plumage sequences in selected Neotropical bird families: a review. *Ornitologia Neotropical* 20:1–18.

Saracco, J.F., J.A. Royle, D.F. DeSante, and B. Gardner. 2010. Modeling spatial variation in avian survival and residency probabilities. *Ecology* 91:1885-1891.

Schondube. J., E. Santana Castelón and I. Ruán-Tejeda. 2003. Biannual cycles of the Cinnamon-bellied Flowerpiercer. *Biotropica* 35:250-261.

Svensson, L. 1992. Identification guide to European passerines. 4th ed. L. Svensson. Stockholm, Sweden

Willoughby, E.J. 1991. Molt of the genus *Spizella* (Passeriformes, Emberizidae) in relation to ecological factors affecting plumage wear. *Proceedings of the Western Foundation of Vertebrate Zoology* 4:247–286.

Wolfe, J., T.B. Ryder and P. Pyle. 2010. Using molt cycles to categorize the age of tropical birds: an integrative new system. *Journal of Field Ornithology* 81:186-194.

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## Primary Feather Replacement on a Hatch Year Common Pauraque (*Nyctidromus albicollis*)

***Alan Monroy Ojeda[1], Manuel Grosselet[2], Georgita Ruiz[2] and Jonathan Nochebuenas Jamarillo[2]***

[1]. Ave. Pajaritos 33, Tres Pasos, C.P. 61943, Xalapa, México (vanellusva@gmail.com)
[2]. Tierra de Aves A.C. Colina 145, Lomas de Bezares, CP11910 Mexico D.F. (info@tierradeaves.com)

### INTRODUCTION

Pauraques, like many other caprimulgids, present a partial molt during its first pre-basic molt (Pyle 1997, Howell et al 2003), where the juvenal flight feathers and some to all wing coverts are retained through the second pre-basic molt. After an individual has completed its first pre-basic molt, a HY/SY bird is easy to recognize due to its obvious panel of retained juvenal flight feathers, buff tips on the primary coverts and outer secondaries, as well