

Modifications to a molt-based ageing system proposed by Wolfe et al. (2010)

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ABSTRACT. Wolfe et al. (2010. Journal of Field Ornithology 81: 186–194) proposed a coding system for ageing birds based on the sequence of molts and plumages, which is more practical than a calendar-based system, especially in tropical and southern latitudes where species often breed across 1 January. The Wolfe–Ryder–Pyle (hereafter, W–R–P) three-letter system is based on recognition of molt cycle (first, second, third, definitive, and so on) and plumage phase (juvenile, supplemental, formative, alternate, and basic). For example, a bird in First Cycle Formative plumage is coded as FCF. We propose the use of two additional code options that further refine age brackets. First, we suggest the use of an “after” or “A” code in place of the “C,” or cycle code, where an earlier molt cycle or plumage can be ruled out. For example, a bird that exhibits *Staffelmauser* might be aged as after-third cycle basic, or TAB. Second, we suggest using “pre” or “P” in place of the “C,” or cycle code, when birds are actively molting, such as for birds undergoing the second prebasic molt or SPB. For both codes, we discuss their applicability using examples based on actual banding data. Our proposed codes will improve the utility of the W–R–P system by better refining age brackets and by expanding its applicability to a diverse array of taxa.

RESUMEN. Modificaciones a un sistema para clasificar la edad de las aves en base a la muda, propuesta por Wolfe et al. (2010)

Wolfe et al. (2010. Journal of Field Ornithology 81: 186–194) propuso un sistema de codificación para clasificar la edad de las aves, basada en la secuencia de mudas y plumajes, que es más práctico que un sistema basado en el calendario, especialmente en latitudes tropicales y sur templadas donde las especies a menudo se reproducen alrededor del 1 de enero. El sistema de tres letras Wolfe–Ryder–Pyle (en adelante, W–R–P) se basa en el reconocimiento del ciclo de muda (primero, segundo, tercero, definitivo, y así sucesivamente) y la fase de plumaje (juvenil, suplemental, formativa, alternativa y básica). Por ejemplo, un pájaro en el Primer Ciclo Formativo de plumaje se codifica como PCF. Aquí proponemos el uso de dos tipos de códigos adicionales que afinan más la clasificación de la edad. En primer lugar, sugerimos el uso de un “después” o código “D” en lugar de la “C,” o código de ciclo, cuando un ciclo de muda o plumaje anterior puede ser descartado. Por ejemplo, un pájaro que exhibe *Staffelmauser* podría ser codificado como después del tercer ciclo básico, o TDB. Segundamente, recomendamos el uso de “pre” o “P” en lugar de la “C,” o código del ciclo, cuando las aves están activamente mudando, como para las aves en la segunda muda pre-básica o SPB. Para ambos códigos, se discute su aplicación con ejemplos basados en datos de anillamiento reales. Nuestros códigos propuestos mejoraran la utilidad del sistema W–R–P mediante una refinación de la clasificación de la edad y ampliando su aplicabilidad a una variedad de taxones.

Key words: annual cycle, molt cycle, *Staffelmauser*, tropical birds, W–R–P system

Ornithologists have historically used a calendar-based system to categorize bird age (Pyle 1997, 2008). Although this system is functionally adept at higher northern latitudes, it is less practical in tropical and southern latitudes where species often breed across 1 January. Wolfe et al. (2010) recently proposed a transformative age classification system based on the

recognition of homologous molt and plumage cycles. The Wolfe–Ryder–Pyle system (hereafter, W–R–P system) can be used to classify age irrespective of hatching date or latitude. Here, we use bird-banding data to propose several refinements to the W–R–P system, improving upon its broad applicability.

The W–R–P system uses two-tiered coding to categorize age by molt cycle and then by plumage phase, following terminology proposed by Howell et al. (2003). The current W–R–P

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system always uses a three-code nomenclature, e.g., a bird in juvenal plumage of the first molt cycle is coded as FCJ (representing “First Cycle Juvenal”), where “FC” (first cycle) distinguishes molt cycle and “J” (Juvenal) represents the plumage within the molt cycle. In a complex basic strategy (*sensu* Howell et al. 2003), FCJ is followed by the First Cycle Formative (FCF), then the Second Cycle Basic (SCB) or Definitive Cycle Basic (DCB) plumage. Given the predictable nature of the avian molt cycle, W–R–P codes can be associated with a range of ages (i.e., “age brackets”), such that each cycle code can provide a more biologically meaningful age than the calendar-based system. To refine age categorization and associated age brackets, we suggest including two more code options that would replace the central position’s “C” for cycle: “P” for pre when the bird is molting, and “A” for after a given plumage. Therefore, a bird leaving juvenile plumage and entering formative plumage upon initiation of the preformative molt would be coded FPF, whereas a bird identified as “After 4th Basic” would be coded as 4AB. These simple additions broaden W–R–P applicability to species that exhibit incomplete definitive prebasic molts and ensure refined age-brackets thereby maximally differentiating cohorts (Table 1).

Ageing molting individuals by the plumage acquired *after* a given molt misses a fundamental advantage provided by the original W–R–P system, i.e., using predictable phases of the annual molt cycle to categorize age. Recognizing active molt by using the “P” code refines age brackets for species with prolonged molts, especially during predefinitive molts. For example, furnariids and antbirds take between four and 10 months to complete a molt (Ryder and Wolfe 2009, E. I. Johnson, unpubl. data). In central Amazonian species, molt also occurs with regularity in nearly every month of the year. White-plumed Antbirds (*Pithys albifrons*), for example, can take 10 months to complete molt. Banding data also suggest that 40% to 60% of White-plumed Antbirds in the Central Amazon molt during any month of the year ($N = 3208$ captures; E. I. Johnson and P. C. Stouffer, unpubl. data). In this and many other species, the preformative molt is complete, prolonged, and results in a plumage indistinguishable from older birds; ageing birds undergoing a preformative molt as FPF is considerably more informative

Table 1. Age codes used by two systems for a hypothetical species with a Complex Alternate Strategy in the northern hemisphere that acquires definitive plumage in its third cycle. With consideration of additional annual cycles (e.g., TCB, TCA, 4CB, 4CA, and so on) and supplemental plumages (e.g., FPS, FCS, SPS, SCS, and so on), this is a complete list of possible W–R–P cycle codes.

W–R–P system	Unabbreviated W–R–P	North American Banding Codes
UCU	Unknown-cycle unknown plumage	U or AHY
UPB	Unknown prebasic molt	U or AHY
UCB	Unknown-cycle basic	U or AHY
UPA	Unknown prealternate molt	U or AHY
UCA	Unknown-cycle alternate	U or AHY
FCU	First-cycle unknown plumage	U
FPJ	Prejuvenal molt	HY
FCJ	First-cycle juvenal	HY
FPF	Preformative molt	HY
FCF	First-cycle formative	HY/SY
FAJ	After first-cycle formative	U or AHY
FPA	First prealternate molt	SY
FCA	First-cycle alternate	SY
SCU	Second cycle unknown	AHY
SPB	Second prebasic molt	SY
SCB	Second-cycle basic	SY/TY
SPA	Second prealternate molt	TY
SCA	Second-cycle alternate	TY
SAB	After second-cycle basic	TY
DCU	Definitive cycle unknown	AHY
DPB	Definitive prebasic molt	TY
DCB	Definitive cycle basic	ATY
DPA	Definitive prealternate molt	ATY
DCA	Definitive cycle alternate	ATY

than FCF. Importantly, by indicating active molt within the W–R–P system, investigators promote the study of molt timing and molt duration in poorly known species.

To preserve all age-related information, we recommend implementing a code used for identifying birds in advanced plumages where earlier plumages can be ruled out. In these cases, we recommend identifying birds in after-a-given plumage where the letter “A” for “after” would replace “C” in the three-letter code. The “A” code is necessary for large seabirds, wading birds, and raptors that commonly exhibit incomplete prebasic molts, delayed plumage maturation, or *Staffelmauser*, where “after” fourth, fifth, and sixth molt-cycles can be recognized (Pyle 2008).

For example, on 3 October 2009, a Pale-billed Woodpecker (*Campephilus guatemalensis*) was captured in Tortuguero, Costa Rica, with three distinct generations of feathers, none of which were juvenile. Because Pale-billed Woodpeckers can exhibit incomplete definitive prebasic molts, it was determined that the woodpecker had at least surpassed the second and third prebasic molts (J. D. Wolfe, unpubl. data). Using the new “after” code, the woodpecker in question would be aged as “SAB” or after-Second Cycle Basic. The “A” code can also be used when a bird can confidently be identified as nonjuvenile, but it is not clear if the bird is in formative or a subsequent plumage. This typically occurs when the preformative molt is complete and results in an adult-like plumage aspect. These birds should be identified as “FAJ,” or after-First Cycle Juvenile. In cases where the cycle is known, but the plumage is unknown, we support the W–R–P coding of FCU, SCU, TCU, DCU, and so on.

The diversity of avian molt strategies is easily summarized using a few letters with the W–R–P system. For example, the W–R–P prefix always represents the cycle of the bird; for most passerines, this includes F, S, T, and D (first, second, third, and definitive, respectively). We recommend replacing letters indicating cycle number (e.g., “F” for “First” and “S” for “Second”) with numerical values (e.g., 4CB, 5CB, 6CB, and so on) for species that can be aged after-fourth cycle to eliminate confusion and redundancy. The middle alpha code indicates if a bird is in stasis or not, relative to molt, i.e., C (Cycle, or in stasis/not molting), P (Pre, or actively molting), and A (After, or after a given plumage). Finally, the suffix represents plumage phase: J, F, S, B, and A (Juvenal, Formative,

Supplemental, Basic, and Alternate, respectively). The finite number of letters available for each field within the W–R–P system facilitates the creation of simple error filters for data-entry purposes while encompassing the entire diversity of molt strategies.

This is a critical time to crystallize an age-categorization system for tropical and southern-latitude birds because several Neotropical countries are establishing bird-monitoring programs and need a practical age-categorization system (Ryder and Wolfe 2009, Wolfe et al. 2009). Instead of using arbitrary calendar dates to classify bird age, investigators should use avian natural history, such as molt and plumage succession, to categorize age. The biologically centric W–R–P system provides an adequate framework to study molt and categorize bird age irrespective of latitude.

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