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Replacement of Primaries during the Prealternate Molt of a Yellow Warbler

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ABSTRACT

We examined an adult male Yellow Warbler that had replaced all secondary coverts and six inner secondaries (s4-s9) on both wings, the innermost primary (p1) and its corresponding primary covert on the right wing, and the innermost two primaries (p1-p2) and their corresponding primary coverts on the left wing, but no rectrices during the prealternate molt. This represents the first evidence of primary replacement during the prealternate molt in Parulidae and only the fourth North American passerine species documented to replace primaries during this molt. The combination of incomplete inner-secondary and inner-primary replacement represents a novel sequence pattern for molts among birds. We suggest that the relatively extensive prealternate molt of Yellow Warbler originally evolved due to the need to replace sun-bleached feathers and that the brighter feather edging of alternate feathers in male (but not female) Yellow Warblers represents a later adaptation for sexual selection.

Inserted prealternate molts have evolved in birds that need to replace feathers more often than once per basic molt cycle (Humphrey and Parkes 1959, Howell et al. 2003). The prealternate molt of Yellow Warblers (*Dendroica petechia*) averages more extensive than that of most other North American passerines (Pyle 1997a). Among *Dendroica* warblers, it is the only species that can regularly include up to all greater coverts and five inner secondaries (including the three tertials) during this molt, and in no parulid warblers and only a few other North American passerines has the prealternate molt been documented to include primaries (Pyle 1997a).

On 27 May 2010 we examined a Yellow Warbler captured at the Braddock Bay Bird Observatory (BBBO) banding station, near Rochester, NY, that showed evidence of symmetrical prealternate molt of inner primaries (Figs. 1-2). We aged and sexed it as an adult (after second calendar year) male based on characteristics of the primary coverts, rectrices, and body plumage (Pyle 1997b). We identified the extent of the prealternate molt based on molt limits, the replaced alternate feathers being brighter edged and looser in texture than the retained basic feathers (*cf.* Figs. 1-2). On both wings the prealternate molt included all secondary (lesser, median, greater, carpal, and alula) coverts and six inner secondaries (s4-s9), representing a more-extensive prealternate molt in Yellow Warblers than documented by Pyle (1997a). Two rectrices on the left side, r3 and r5, had apparently been replaced adventitiously since the complete prebasic molt the previous summer; otherwise, no rectrices had been replaced during the prealternate molt. On the right wing the innermost primary (p1) and its corresponding primary covert had been replaced (Fig. 1) and on the left wing the innermost two primaries (p1-p2) and their corresponding primary coverts had been replaced (Fig. 2). The symmetrical nature of this primary and primary covert replacement, including

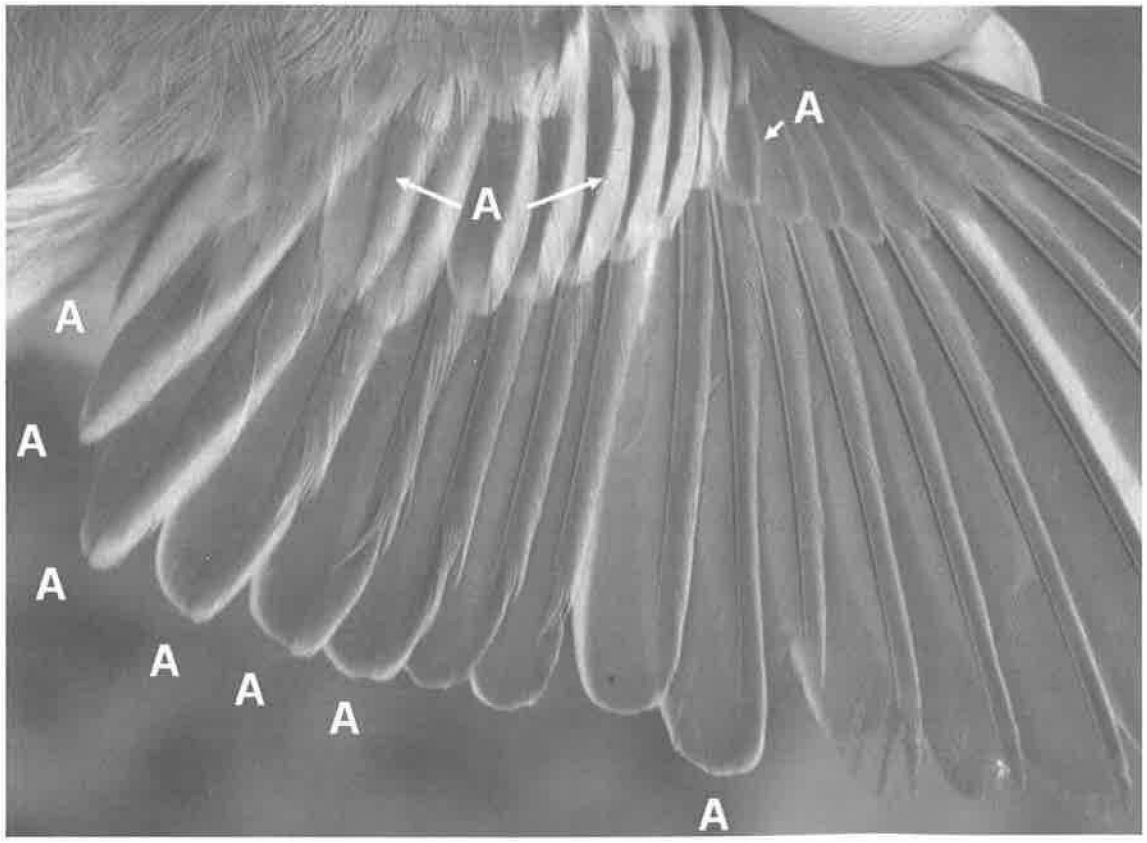

Fig. 1. Right wing of an adult male Yellow Warbler captured for banding at the Braddock Bay Bird Observatory banding station, showing alternate ("A") inner secondaries (s4-s9) along with p1 and its corresponding primary covert.
Photo: **Ryan Kayhart**

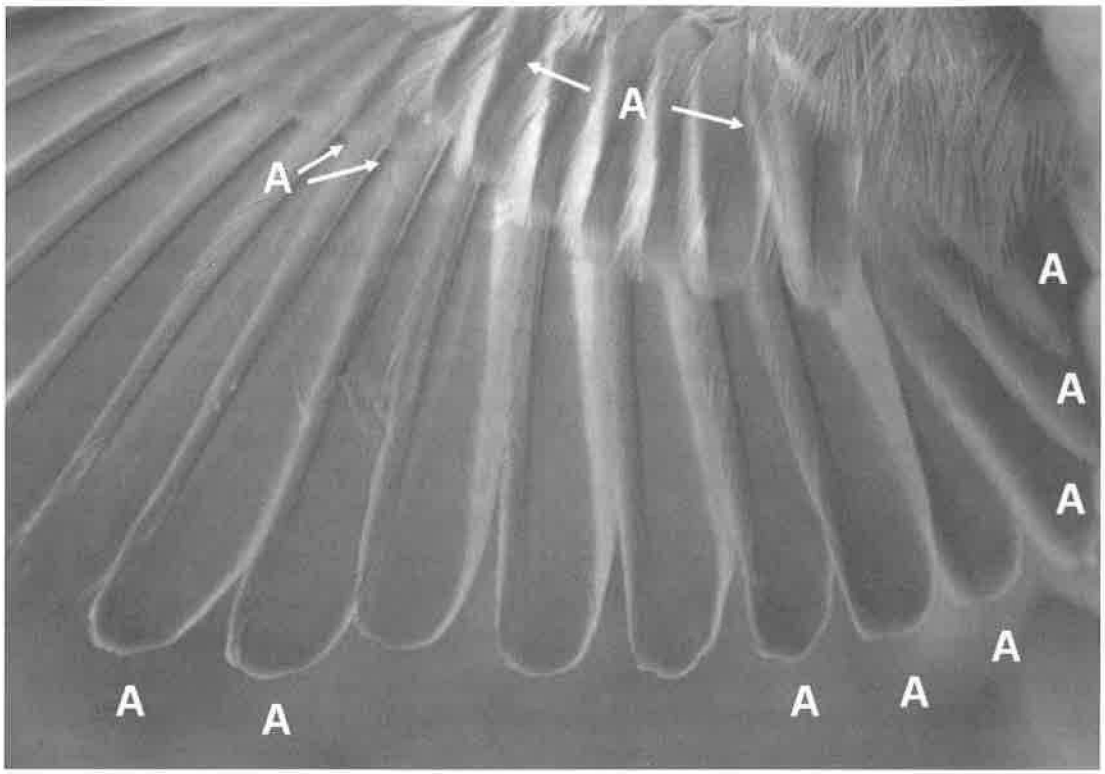

Fig. 2. Left wing of an adult male Yellow Warbler captured for banding at the Braddock Bay Bird Observatory banding station, showing alternate ("A") inner secondaries (s4-s9) along with p1-p2 and their corresponding primary coverts. Photo: **Ryan Kayhart.**

five feathers in four independent tracts, and following a sequence of inner primary replacement typical of complete molts (Pyle 1997b), along with the extensive replacement of greater coverts and secondaries in this individual, convinces us that the replacement of these primaries and primary coverts was part of the prealternate molt rather than representing feathers coincidentally lost and regrown adventitiously.

Replacement of primaries during definitive prealternate molts has been documented in only three other North American passerines: Nelson's Sparrow *Ammodramus nelsoni*, Bobolink *Dolychonyx oryzivorus*, and Lesser Goldfinch *Spinus (=Carduelis) psaltria* (Pyle 1997a). Bobolink shows a complete prealternate molt, whereas in the sparrow and goldfinch, primary replacement during this molt is eccentric, involving consecutive inner secondaries and outer primaries, as is also found during preformative molts of approximately 50 North American passerine species, some shorebirds, and a few other non-passerine species (Pyle 1997a, 2008). By contrast, birds that show incomplete inner primary molt typically also show incomplete outer rather than inner secondary molt (with the exception of the tertials). Thus, the incomplete replacement of six inner secondaries and 1-2 inner primaries in this Yellow Warbler represents a novel sequence pattern for molts among North American passerines. The lack of rectrix replacement also would be unusual for such an extensive preformative molt (*cf.* Pyle 1997a) further suggesting a separate sequence mechanism regarding both the primaries and rectrices during incomplete preformative vs. prealternate molts. Although the Yellow Warbler that we captured may represent an anomaly, we also believe that such replacement is rarely investigated specifically and might go unnoticed by ornithologists, and we encourage banders to look for more examples of novel inner primary replacement during prealternate and preformative molts.

Most North American bird species showing extensive prealternate molts inhabit open and sunny habitats and/or migrate to Neotropical America and are exposed to more hours of solar exposure on an annual basis than are resident North American species (*cf.* Pyle 1998, 2008). We suggest that the relatively extensive prealternate molt of Yellow Warbler among Parulidae, rarely including inner primaries, originally evolved based on the need to replace bleached feathers due to the migratory behavior and use of relatively open habitats by this species as compared with other species of North American warblers. The relatively pale flight feathers of Yellow Warbler also contain less melanin than the darker feathers of other *Dendroica*, perhaps causing them to be weaker and in need of more frequent replacement.

We further suggest that the bright feather edging of alternate feathers in male Yellow Warblers and other species with brighter alternate than basic plumages represents a later adaptation for sexual selection following the original insertion of this molt for feather-maintenance purposes. The prealternate molts of females of these species, many of which do not display colorful alternate-feather edging, are just as extensive as those of males, supporting the above premise.

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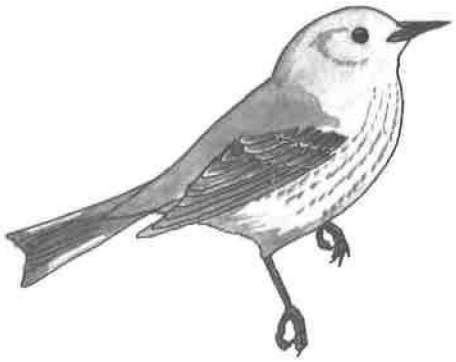

Yellow Warbler
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