Unusually Extensive Preformative Molt in Hatching-year Song Sparrows

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ABSTRACT

The preformative molt of the Song Sparrow (*Melospiza melodia*) is described as occasionally eccentric, with various flight feathers being replaced, but never the primary coverts. Since these coverts are thought to be retained in most species, they are relied upon widely as a tool for age determination. We show evidence of an "eccentric-plus-primary-coverts" molt in several hatching-year (HY) Song Sparrows caught during a migration monitoring program, where primaries and corresponding primary coverts were replaced during the course of their preformative molt. This ultimately results in the inability to differentiate between HY/second-year (SY) birds that underwent this molt and after-hatching-year (AHY)/after-second-year birds (ASY), once preformative/prebasic molts are completed. Therefore, we suggest that, contrary to current practice, the condition of primary coverts should not serve as an ageing tool for Song Sparrows in spring or late fall. We also advise that Song Sparrows be considered unknown age in late fall or AHY in spring, unless clear molt limits are seen within the flight feathers, birds exhibit especially worn or faded primary coverts, or incomplete skulls confirm the age as HY in fall. As many factors are likely to influence the variability of molt in Song Sparrows, we suggest further isotopic and behavioral studies to understand whether this phenomenon is more widespread than previously thought.

INTRODUCTION

Molt patterns, resulting from the normal loss and growth of feathers in generally predictable sequences, are among the most important tools used by bird banders to determine the age of birds. It is therefore critical that those who study birds take the time to carefully document any individuals that deviate from the accepted norm and to publish their findings (Pyle 1997a, 1997b).

The Song Sparrow (*Melospiza melodia*) is a complex species to study due to the extensive variation it shows over its broad geographic range, with anywhere between 24 and 38 recognized subspecies (Arcese et al. 2002). Pyle (1997b) describes the Song Sparrow's preformative molt (formerly known as the first prebasic; Howell et al. 2003) as varying from partial to incomplete. It usually includes all greater and median coverts, the innermost 1-6 secondaries, and sometimes up to 12 rectrices. This species may also exhibit an "eccentric" molt, characterized by the replacement of the outermost 1-7 primaries, and occasionally the replacement of the outermost 1-3 secondaries and the innermost 1-3 primaries. Certain individuals may even replace all primaries and secondaries (Pyle 1997b), but not the primary coverts (pp covs), since these are typically retained in cases of partial molt (Pyle 1997a). As a result, Pyle (1997b) indicates that "the condition of the pp covs should be reliable for ageing all birds, although it is often hard to judge without experience."

The work of Dwight (1900) contradicts Pyle (1997b), suggesting that for the species that occasionally molt their primaries during the preformative molt, the primary coverts follow the underlying remiges with rare exception. He states that the winter plumage of hatching-year (HY) Song Sparrows is attained through a partial, occasionally complete, postjuvenal molt. The most complete wing molts are ascribed to those from the first broods of the season, rendering them visually indistinguishable from adults. Marshall (1948) also briefly describes the Song Sparrow's preformative molt, but makes no mention of the primary coverts. He states that adults can be separated from young since HYs will retain all juvenal primaries, but adds that the occasional individual will replace some primaries, with a few specimens showing "complete replacement" (Marshall 1948). Here, we document the occurrence of an unusually extensive preformative molt pattern in HY Song Sparrows following Dwight's (1900) description, and argue its importance in terms of current ageing practices.

METHODS

Research was conducted at the McGill Bird Observatory (MBO), at the western tip of the island of Montreal, Quebec (45.43°N, 73.94°W). Song Sparrows (Eastern subspecies *M. m. melodia*) were trapped by mist net and banded between 1 Aug and 30 Oct in 2006 and 2007 as part of the standard Fall Migration Monitoring Program (Gahbauer and Hudson 2004).

Each bird was examined for molt during banding or recapture. Age was verified by checking the degree of pneumatization in the skull (Pyle 1997b). Specimens at the Canadian Museum of Nature (Gatineau, Quebec) were also examined for molt limits in the primaries and primary coverts. Only birds collected in Quebec and Ontario were examined to maximize the probability that the specimens were the same subspecies as those mist-netted at MBO. Furthermore, we focused only on those collected in August through the first weeks of October, which is when HY birds molt in this region. Since the subtle molt limits on Song Sparrows are difficult to discern on the open wing of a live bird, and nearly impossible on a specimen wing mounted in a tightly closed position, we hoped to find specimens that were collected while actively molting.

RESULTS

The McGill Bird Observatory banded 278 and 198 HY Song Sparrows during the respective 2006 and 2007 fall seasons. Eight (2.9%) of the HY Song Sparrows in 2006 and five (2.5%) of those in 2007 exhibited the eccentric molt pattern described by Pyle (1997b), except that they also showed atypical sequential replacement of corresponding primary coverts, which we refer to as an "eccentric-plus-pp-covs" molt (Table 1, Figure 1).

Table 1. Banded HY Song Sparrows undergoing the "eccentric-plus-pp-covs" molt at the McGill Bird Observatory during the 2006-2007 fall seasons.
pp = primaries; pp covs = primary coverts; gr covs = greater coverts (Pyle 1997b).
See corresponding photographs at www.migrationresearch.org/mbo/SOSPmolt.html

Individual	Date	Notes on primary tract molt
2241-39553	7 Aug 2006	Molting four inner pp and corresponding pp covs.
2241-39575	25 Aug 2006	Mid-molt of pp covs, exact sequence not specified.
2261-16099	25 Aug 2006	Molting gr covs, middle four pp and corresponding pp covs; inner pp and pp covs already replaced.
2261-16128	6 Sep 2006	Molting gr covs, two inner pp, and corresponding pp covs.
2261-39566	7 Sep 2006	Innermost four pp and corresponding pp covs already replaced.
2261-16132	7 Sep 2006	Molting pp and corresponding pp covs.
2261-16140	10 Sep 2006	Molting outer pp and corresponding pp covs.
2261-16024	13 Sep 2006	Molting pp and corresponding pp covs.
2261-16539	17 Aug 2007	Molting gr covs; inner five pp and corresponding pp covs already replaced.
2261-16425	19 Aug 2007	Molting gr covs; inner five pp and corresponding pp covs already replaced.
2261-16429	22 Aug 2007	Molting gr covs, inner pp and corresponding pp covs.
2261-16542	22 Aug 2007	Molting gr covs, inner two pp and corresponding pp covs.
2261-16453	14 Sep 2007	Molting gr covs, inner three pp and corresponding pp covs.

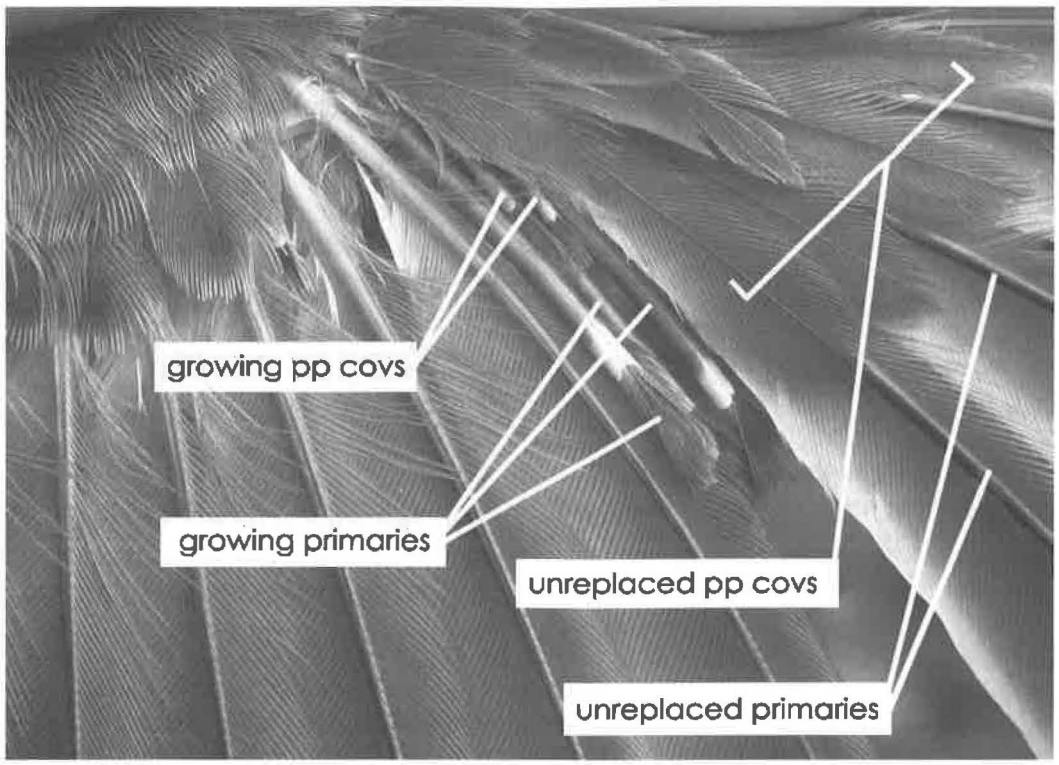

Fig. 1. HY Song Sparrow banded in fall 2006 undergoing the eccentric primary feather molt described by Pyle (1997a), paired with the atypical sequential replacement of corresponding primary coverts. Additional color photographs and descriptions are available on line at www.migrationresearch.org/mbo/SOSPmolt.html

Eighty-two specimens were examined at the Canadian Museum of Nature–66 from Ontario (41 HY birds, 19 after-hatching-year (AHY) birds, and six unknowns), and 16 from Quebec (seven HY birds, seven AHY birds, and two unknowns). Only one specimen showed the "eccentric-plus-pp-covs" molt pattern, a HY male collected 5 Sep 1931 in Cap Rouge, Quebec. It was collected while molting its outer three primaries and corresponding primary coverts, as well as its secondaries and outer rectrices.

DISCUSSION

Very little research has been published on Song Sparrow molt, despite the species being so widespread and common. Existing knowledge can be pieced together using the seminal work on molt by Dwight (1900), life history by Nice (1937, 1943) and geographic variability by Marshall (1948). For example, Marshall (1948), while discussing wing length in a Californian population of Song Sparrows, remarks in passing that out of 195 birds measured, two or three HYs underwent complete primary replacement, but the condition of the primary coverts is not specified. Only Dwight (1900) focuses on describing each type of molt and its extent and variability in northeastern species.

Most authors agree that Song Sparrow molt is highly variable in both timing and extent, and each ascribes a variety of possible reasons. Factors proposed to account for the variability in Song Sparrow molt include brood age (Dwight 1900, Marshall 1948, Arcese et al. 2002), fall territoriality and ensuing agonistic interactions (Dhondt and Smith 1980), breeding status (Dhondt and Smith 1980), and sex (Dwight 1900), though Dhondt and Smith (1980) dispute its importance.

One hypothesis explaining the occurrence of this unusually extensive preformative molt in HY birds is the availability of plentiful resources. Perhaps these young birds are from the first broods of the season, which begin fledging in late May (Gauthier and Aubry 1996), and have enough food resources and time available to undergo a more extensive molt, replacing lesser-quality juvenile feathers with

higher-quality adult ones (Dwight 1900). The hatch date of young from Mandarte Island in British Columbia correlated positively with the completeness of their preformative molt (Arcese et al. 2002). In both studies however, it is unclear whether a "complete" molt in this context includes the primary coverts. The extent of skull pneumatization (from trace to fully pneumatized), a possible method of estimating age, was not measured for all Song Sparrows captured at MBO. Thus, a comparison of developmental progress, representing age, with completeness of molt could not be done. Following known-age nestlings through their preformative molt would be the most accurate way to address this question, either through captive study or preferably through detailed mark-recapture work.

Fall territoriality and parental breeding status may play a role in the extent of the preformative molt in the Song Sparrow (Nice 1943, Dhondt and Smith1980). Song and territorial behavior usually resurge in adults once their prebasic molt is complete and when adult males no longer tolerate young males in their territories. It is possible that the HY Song Sparrows undergoing the "eccentric-plus-pp-covs" molt are young whose parents are molting late either due to a late breeding attempt or scarce food resources. Thus, these HY birds have the time to complete their molt before agonistic interactions force them from their natal territories. To test this, a population would have to undergo intensive study in order to document the beginning of territorial chases and singing, while banding nestlings and capturing individuals from each territory to determine age and molt status accurately (see Dhondt and Smith 1980).

Finally, Dhondt and Smith (1980), in their study of Mandarte Island Song Sparrows, conclude that molt does not differ by sex, as females and males from their population began molting at roughly the same time. This contradicts Dwight's (1900) finding in New York, that females molt later than males, highlighting differences between populations. It is possible that the territoriality hypothesis may come into play here as well. If adult males preferentially target HY males once they renew their territoriality post-molt, this may cause a sex bias, with HY males showing fewer cases of complete preformative molts than HY females. Determining the sex of HY Song Sparrows cannot be done in the field, as they are sexually monomorphic, but this should be investigated through blood or feather analysis, as a sex bias may help account for the differences in completeness of the preformative molt. These discrepancies could also be due to location though, as the Eastern and Californian subspecies (*M. m. gouldii*) have shown a higher proportion of individuals exhibiting eccentric replacement patterns (49%; Pyle 1997a). These subspecies may also show higher rates of complete preformative molts, but, to our knowledge, this has yet to be examined systematically.

Though the number of individuals observed undergoing this unusual molt sequence was small (2.5-2.9% of all HY Song Sparrows banded in 2006 and 2007), we recommend that all banders keep this pattern in mind, especially in spring when molt limits are often subtler. We believe that this percentage is likely an underestimate since: 1) not all young birds were caught, and 2) those that were caught may have been caught either too early or too late (i.e., pre-molt or post-molt) to detect the "eccentric-plus-pp-covs" molt pattern. As all 13 individuals captured were in mid-molt, this allowed for easy detection and documentation of the described pattern. The extent to which the primaries and associated primary coverts were ultimately replaced, however, could not be determined as these birds were released after banding. A few of the birds were captured with only one or two primary coverts left to replace, suggesting that all primaries and primary coverts are likely replaced during this "eccentric-plus-pp-covs" molt. If this is the case, upon completion there would be no difference between the primary tract of a HY/second-year (SY) and an AHY/after-second-year (ASY) bird, meaning that neither category could be assigned safely in fall (once skulling is no longer reliable and/or other features preclude differentiation), and all individuals without distinct limits in other feather tracts should be designated as AHY in spring. It should also be noted that the HY Song Sparrows we examined usually showed a marked difference between the outer two primary coverts (lighter brown and pointed) and the inner coverts (darker brown and less pointed), no matter what type of molt they were undergoing. Both the occasional replacement of the primary coverts in

HY birds and this potentially misleading difference between same-age coverts make it inadvisable to use the primary coverts as an aging tool for Song Sparrows.

The careful documentation of molt patterns in live birds during migration monitoring programs is not easy, as birds must be caught and measured during the course of bird-banding operations, which are often under time restrictions. In addition, most stations have strict protocols that take precedence over species-specific research. Thus, this type of research either needs to be pursued independently, or sacrifices of sample sizes are to be expected when bird volume is high at banding stations. With Song Sparrows in particular, molt limits can be so difficult to recognize that the time spent examining an individual may be prohibitive for high volume banding operations. Studying specimens is an option, as they are usually available in high numbers and without the time restrictions associated with live birds; however, most are mounted with both wings closed. This makes wing molt patterns very difficult to discern, especially in a species as notoriously difficult to age as the Song Sparrow.

Despite these difficulties, aberrant molt patterns are important to document and discuss. Recently, Rohwer et al. (2007) documented the replacement of primary coverts during the preformative molt in HY Lucy's Warbler (*Vermivora luciae*). They stated that this was the first case of a warbler executing a complete preformative molt, and one of only a few cases known for passerines. Given that they did not include the Song Sparrow among the known examples, our results indicate that this unusual preformative molt is perhaps not as rare as once thought and warrants detailed documentation in a wider variety of species. This is further supported by Burton and Pyle (2006), who documented symmetrically molted primary coverts in a Western Wood-Pewee (*Contopus sordidulus*) and a Brown-headed Cowbird (*Molothrus ater*). In fall of 2007, we began documenting the molt of Downy Woodpeckers (*Picoides pubescens*) at MBO, noting that at least one SY bird showed evidence of having previously replaced its inner primary coverts, presumably during its preformative molt, a phenomenon only recently discovered and requiring supporting evidence (P. Pyle, pers. comm.). We recommend further study of these phenomena by way of isotopic and behavioral studies: are these local birds, or are they molting after dispersal and/or partial migration; does sex play a role in molt completeness; and does fall territoriality and breeding status of adults affect the preformative molt of the young? Other subspecies of Song Sparrow, as well as other closely related species (e.g. Lincoln's Sparrow [*M. lincolnii*] and Swamp Sparrow [*M. georgiana*]), should be priorities for study to see whether they also exhibit the "eccentric-plus-pp-covs" molt pattern.

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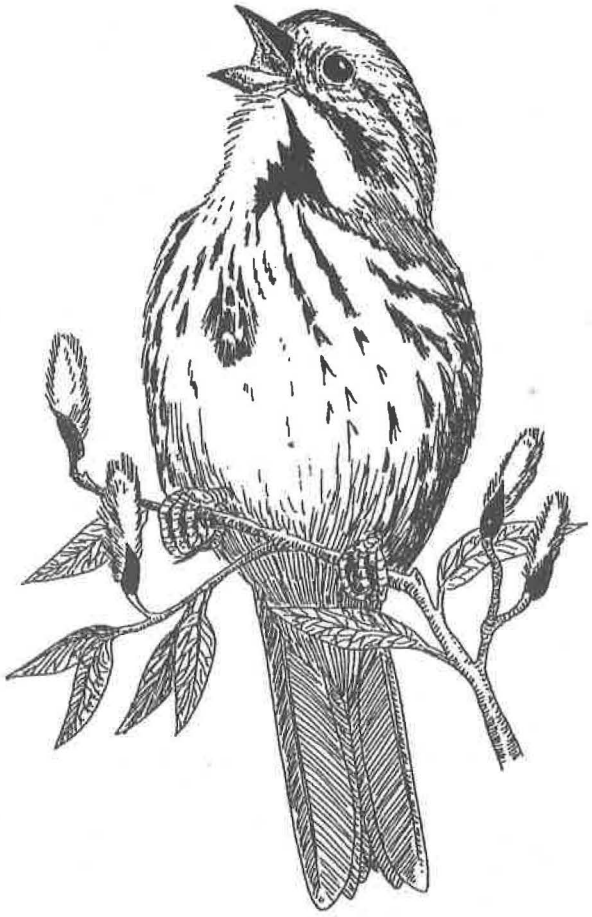

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