

RECTRIX SHAPE AS AN INDICATOR OF AGE IN THE WOOD THRUSH

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Abstract.—The reliability of using rectrix shape to classify Wood Thrushes (*Hylocichla mustelina*) as second year (SY) or older birds (after second year [ASY]) was conservatively tested. SY feathers generally appear narrow and pointed, ASY ones broader and shouldered. Twenty persons with no experience handling or banding birds were able to classify single rectrices pulled from known-aged birds with 70–80% accuracy in three separate tests. Half of the subjects received feedback about their errors on Tests 1 and 2 but were not significantly more accurate than the non-feedback group on any subsequent tests. Higher scores on Test 3 than on Test 1 by both groups and scores of 80–95% by two persons who had field experience with the technique indicate that experience can improve accuracy. Even greater accuracy should result when all rectrices, plus other plumage features that were found to be helpful but less consistent, can be examined together in an intact bird.

LA FORMA DE LAS RECTRICES COMO INDICADOR DE LA EDAD EN *HYLOCICHLA MUSTELINA*

Sinopsis.—Se puso a pruebas la confiabilidad de utilizar la forma de las rectrices en el zorzal de bosques (*Hylocichla mustelina*) para clasificarlo como ave de segundo año (SA) o de más edad (mayor a dos años [MD]). Las rectrices de los individuos SA generalmente resultaron angostas y puntiagudas, mientras que las de los MD más anchas y obtusas. En estudios independientes, veinte personas (sin experiencia en el manejo o anillamiento de aves) fueron capaces de clasificar rectrices tomadas de un ave de edad conocida con una exactitud de 70–80%. La mitad de los individuos que cometieron errores recibieron retroalimentación sobre los mismos en las Pruebas 1 y 2, pero no mejoraron significativamente sobre el grupo que no recibió retroalimentación en ninguna de las pruebas. La tercera prueba en comparación con la primera y una puntuación de 80–95% por dos personas que tenían experiencia con la técnica en el campo, indicó que la experiencia puede mejorar la exactitud en la clasificación de rectrices. La precisión en la clasificación de aves, debe aumentar aún más cuando se puedan examinar todas las rectrices y otras características del plumaje (que se encontraron de ayuda pero menos consistentes) de un ave completa.

Second year (SY) males of some passerine species have plumage colors or patterns that distinguish them from older (after second year [ASY]) ones. Common examples of such delayed plumage maturation include male Indigo Buntings (*Passerina cyanea*), Painted Buntings (*P. ciris*) and American Redstarts (*Setophaga ruticilla*). Such differences permit distinguishing between SY and ASY birds in the field. In contrast, many species lack readily apparent, age-specific differences in plumage, making age classification difficult to impossible. This problem extends to females as well, including those species with distinct male, age-specific plumages.

Species lacking plumage differences as distinctive as those of male buntings and redstarts still may be aged by more subtle plumage characteristics. In many species, individuals retain their first (juvenile) remiges and rectrices until the second pre-basic molt, at the end of their first adult breeding season. If there is anything distinctive about the original remiges,

rectrices, or other retained feathers, it may be possible to discern SY from ASY birds (Pyle et al. 1987).

We examined the feasibility of using such characters for Wood Thrushes (*Hylocichla mustelina*), as part of a study of age ratios of populations nesting in forest fragments. The absence of conspicuous age-related plumage differences in Wood Thrushes requires the use of more subtle features only visible in hand-held birds. Pyle et al. (1987) offered several criteria for aging *Catharus* thrushes but expressed little confidence in such characters for Wood Thrushes. Our goal was to determine if any characteristic was a reliable indicator of SY Wood Thrushes. We examined several plumage characteristics and deemed the shape of the rectrices the most promising feature. We report here the results of a conservative test of its reliability using feathers of known-age birds.

METHODS

A banded population of Wood Thrushes in the University of Delaware Woodlot (UDW), subject of a long-term study (Roth and Johnson 1993), was a source of known-age birds in 1989–1992. Others were in 14 additional forests where we banded adults and juveniles in 1991 and 1992. All sites were within 5 km of UDW in Newark, New Castle County, Delaware (39°39'N, 75°44'W).

We collected one rectrix from each of 420 adult and late-season hatch-year (HY) birds captured in May–August on the sites. In some cases, a bird donated more than one feather when returning birds were recaptured in subsequent breeding seasons. We took the outermost, left rectrix (L6), or if it was damaged or missing, the right one. If necessary, we took L5 or R5. With descriptions of *Catharus* spp. and Wood Thrush from Pyle et al. (1987) as initial guides, we also recorded general descriptions of the rectrices, tips of the outermost primaries, and the degree of spotting on upper secondary coverts. The latter two features proved inconsistent or difficult to assess. We therefore focused our attention on the shape of the outer rectrices and developed a test to evaluate its reliability.

We selected feathers from our collection that were intact and from known-age (HY/SY and ASY) birds. From that pool, 60 feathers were randomly chosen and likewise divided into the three tests, with the constraint of a minimum of 8 SY or ASY feathers per test. Each test feather was mounted on a card with the proximal third of the feather hidden. We did that to cover the distinctly shorter length of some HY feathers, which otherwise are like SY feathers. Finally, HJW developed drawings reflecting between- and within-age variation in outer rectrix shape that he observed from known-age birds collected in 1989–1991 (Fig. 1). All test participants received the profiles and accompanying written descriptions as the initial instruction and for reference during the test.

We tested the ability of 20 college students, randomly assigned to two groups, to classify the feathers correctly as SY or ASY. None of the students had handled, banded or aged birds. We did not call attention to the possibility of HY feathers. Each person took three tests of 20 feathers

each. Those in the feedback group, however, received explanations of their incorrect answers after Tests 1 and 2. With this design we could determine if success improved with experience and feedback.

To test the hypothesis that subjects would perform better than random, we compared the results of each test against 50% accuracy using a one-way *t*-test. Effects of familiarity (i.e., within-treatment differences between Tests 1 and 3) were assessed by a paired difference, one-way *t*-test. Effects of feedback vs. no feedback (i.e., between-treatment differences) were tested by two-sample, one-way *t*-tests. Significance level was set at $P = 0.05$. The data were subjected to arcsine transformation for these analyses. By using *t*-tests rather than chi-squared tests, we avoided assumptions that ignore subject effect. We also used a *t*-test to test for differences in accuracy on male and female feathers. HY/SY:ASY ratios of the feathers in the three tests were 12:8, 8:12, and 12:8; male:female ratios for non-HY birds were 7:7, 12:3, and 7:6.

RESULTS

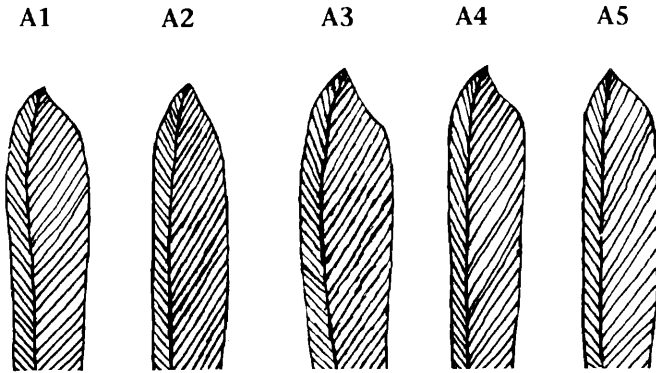
Characteristics of the rectrices.—Despite variation within each age group, certain between-age differences were apparent (Fig. 1). HY/SY feathers (profiles A1–A5) typically have an acute (profiles A2 and A5) or swept (profiles A3 and A4) tip and overall narrow appearance. Some are intermediate (profile A1). The uppermost 2–3 cm of the feather is often uniform in width before tapering to a pointed tip. The tip may have a slight “shoulder” but not as much as in some ASY feathers (see below), and the pointed tip sweeps steeply to the side (profiles A3 and A4). The key characteristics of the HY/SY feather are the steeply angled (acute or swept) tip and generally slender appearance. Yunick (1992) found HY/SY rectrices of the Pine Siskin (*Carduelis pinus*) to be significantly narrower than ASY ones.

The ASY feather is characteristically broad with a noticeable shoulder (Fig. 1). Some have angled shoulders (profiles B1, B2, B3, and B6); others have rounded shoulders (profiles B4 and B5). Some feathers may have a clubbed appearance, i.e., noticeably widest at the base of the shoulder (profiles B2, B3, and B4). Clubbed feathers may have either type of shoulder. The key characteristics of the ASY feather are the stocky appearance and obtuse tip.

A variety of grades within and between each shape class can exist. In each case, however, the aforementioned characteristics making the feather assignable to either SY or ASY are still apparent. These general tendencies allowed us to group feathers into the major shape classes. To estimate the frequency of the shape classes, we classified 78 ASY and 102 HY/SY feathers from our collection, all of them intact. Among ASYs, 42% were rounded, 54% angled and 4% other. Among SYs, 41% had a swept tip, 54% an acute tip and 6% did not conform to those categories.

Feather wear may modify certain features. For example, the extremely pointed tip shown in profile A4 may result from the wear of a white or lighter area present in some feather tips (especially along the outer edge).

A



B

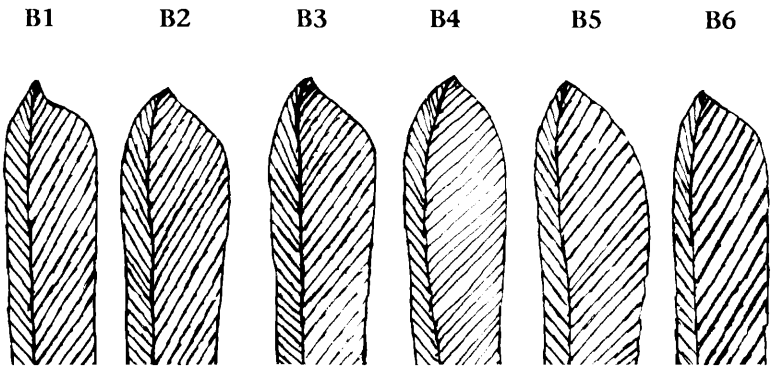


FIGURE 1. Distal portions of Wood Thrush L6 rectrices from hatch year (HY) and second year (SY) birds (A1–A5) and after second year (ASY) birds (B1–B6) showing the range of general shapes. Note that not all SY feathers are as narrow nor all ASYs as wide as depicted.

If the white portion of the feather wears more quickly (Burt 1986), the tip will appear more pointed. On the other hand, wear may round a previously pointed tip. Although wear may modify a feather, in most cases it does not appear to change the overall *gestalt* of the feather.

Test results.—Each group's mean score on each test (70–80% correct) was significantly better than expected by chance (all $P \leq 0.001$, Table 1). Of all 60 replicates (20 persons, three tests), eleven had ≥ 18 correct,

TABLE 1. Mean (\pm SE) number of Wood Thrush rectrices (out of 20) correctly classified as SY or ASY for feedback and no-feedback groups in three tests ($n = 10$ for each mean). P values for comparison of feedback and no-feedback groups.

Test	Feedback	No-Feedback	P
1	14.3* (0.60)	14.4* (0.70)	0.46
2	13.9* (0.77)	13.9* (0.95)	0.50
3	16.2* (0.92)	15.9* (0.87)	0.41

* $P < 0.001$ that correct classification was random.

25 scored 15–17, and 18 aged 12–14 feathers correctly. The remaining six tests had scores of 9–11. Ten persons had ≥ 14 correct responses on all three tests; three of those achieved ≥ 16 and one scored ≥ 17 .

Scores of feedback and no-feedback groups did not differ significantly on any of the three tests (all $P > 0.4$, Table 1). The feedback group's mean improvement in correct responses between Tests 1 and 3 (1.90 ± 0.90 SE) was significant ($P = 0.03$). The no-feedback group improved less on average (1.5 ± 1.05 , $P = 0.09$). Finally, correct response rate was not related to sex of the bird ($P > 0.05$). If any sex differences in shape exist, they did not affect accuracy of aging.

DISCUSSION

Our results show that novices using only drawings of feathers and accompanying written descriptions as references can correctly assign single, intact Wood Thrush rectrices from both sexes to SY and ASY classes in 70–80% of the cases. That accuracy is considerably better than random though borderline for solid testing of age-related phenomena. We believe, however, that the accuracy can reach higher, acceptable levels in the field than seen in our conservative assay.

Three points support our belief. First, none of the subjects had ever handled or banded birds. For comparison, two persons with 1 and 3 yr experience examining Wood Thrush rectrices and not privy to the test content took the test. They scored 16–19 on each test with three of six scores being ≥ 18 . Those performances suggest that experienced banders would score better than our novices did. Second, some birds have both pointed and shouldered tail feathers. We assume that any feather replacing a lost HY one would be an ASY-type, what the second pre-basic molt would produce. It is possible in some cases that a feather from an HY or SY bird had been lost and replaced by new "ASY" feathers. Thus an SY bird could have returned with one, some or all of its rectrices of ASY-type. This was the case for two of the 60 feathers used in the test. Those two feathers were replacement feathers on SY birds whose HY feather at the same position we had pulled the previous year. During the testing, one of these feathers was misidentified 16 of 20 times and the other 12 of 20. These feathers were being identified by shape as ASY most of the time, but because they were on SY birds, the answers were incorrect. Third, in the field, one is able to compare all rectrices while the bird is

in hand. This is beneficial when differences are subtle or some feathers have been replaced as described above. Mixes of ASY and SY shapes can be quite apparent. One or two pointed outer feathers can signal an SY bird even if all others have been lost and replaced. Test participants were unable to make such comparisons. They had only the distal two-thirds of the test feather and the feather profiles.

The significant gain in accuracy between Tests 1 and 3 in the feedback group suggests a benefit of training. The increase for the no-feedback group, however, suggests that experience alone may help. The possibility that Test 3 was easier than the others confounds the "feedback-experience" issue. Only one participant scored in the 18–20 range on Tests 1 and 2, but 10 (including six of 10 receiving feedback) scored in that range in Test 3.

Other possibly useful plumage characters exist though they seem to be more variable than rectrices. In the field, however, they sometimes can contribute to an overall *gestalt* that permits a reliable age assignment. Spotting on the nape was very apparent on HY birds but variable thereafter. Distinct buffy spotting on the tips of the upper secondary coverts was seen on many SY, but some ASY, individuals. The general trend was for increased covert spotting on younger birds, but the amount was quite variable, sometimes virtually absent. This is consistent with Shepard and Klimkiewicz's (1976) caution against using the absence of covert spotting as an age indicator. Shape of the tips of primaries 7–9 was also inconsistent. We sometimes saw ASY birds with distinctly rounded or truncated primary tips and SY birds with clearly pointed tips, but there were many intermediates and ambiguities. We did not evaluate two other possible features that may have value: wear of the wing coverts and symmetry of growth bars in the rectrices (Pyle et al. 1987).

Our results indicate that plumage characteristics, especially rectrix shape, can be used reliably to classify Wood Thrushes as SY or ASY. The ability to identify SY and ASY birds accurately in the field eases research of age-related phenomena such as differential uses of habitat (e.g., Sherry and Holmes 1991). We urge other workers involved in studies of marked populations to perform similar studies.

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