Rectrix Shape as a Criterion for Determining Age of the Pine Siskin

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ABSTRACT

Pine Siskins *(Carduelis pinus)* captured during the winter irruptions of 1987-1988 and 1989-1990 were used to assess the reliability of rectrix shape as an age-determining criterion by comparing this shape with wing covert contrast under artificial light. Based on examination of 6,682 birds, rectrix shape (pointed vs rounded) appears to be highly reliable (>98%) in separating two age classes of birds in the January-June period, provided intermediate feather shapes accounting for about 8% of the sampled population are excluded.

INTRODUCTION

Careful use of rectrix shape on certain passerines can be a valuable aid in determining age of these birds in the hand. Svensson (1984) and Pyle *et al.* (1987), and references therein, provide numerous examples. Typically, the juvenal flight feathers with which these species leave the nest include rectrices that are relatively pointed and narrower than those acquired at or after the second prebasic molt at which time they become rounder at the tip and wider.

I previously addressed this width criterion on a relatively small sample of Pine Siskins as part of a skull pneumatization study (Yunick 1992) and found the difference to be highly significant, $p<0.0001$. Past reporting of age classes on banding schedules to the Bird Banding Laboratory (BBL) using the shape-width criteria have been rejected claiming lack of reliability caused by possible adventitious loss and renewal of these feathers. The data reported here were gathered to test the hypothesis on a larger sample of winter and spring siskins that rectrix shape-width were reliable in ascertaining age. Contrast in coloration of primary coverts with that of other upper wing coverts under artificial light was used to ascertain age in order to compare agreement with rectrix shape.

METHODS

Pine Siskins were examined under artificial light, away from direct daylight, using the lamp portion only of a desktop magnified illuminator commonly found in laboratory supply catalogs. Birds were viewed under a 22-watt, cool-white, 21-cm (8-in) diameter, circline fluorescent tube lamp at a distance of 15-30 cm from the lamp. During examination of the tail plumage of a sample in 1988, rectrix shape was recorded as either pointed or rounded. In the 1990 sample, two additional classes of shape were recorded as semi-pointed and semi-rounded; and evidence of missing, molting, or replaced rectrices was noted. Replaced rectrices were recognized by a difference in shape compared to adjacent rectrices and/or also by width and the fresher condition of the replaced feather(s) noted by more intense color (less fade) and less wear on the edges or tip.

Next, the body and spread-wing plumage were examined dorsally and classed as either "dark" or "faded." This was a relative measure of the degree of brown ("dark") or tan ("faded") in the overall plumage. Finally, the wing coverts were examined by comparing primary covert color with that of the other upper wing coverts. Birds were classed by whether the primary covert color or intensity thereof had contrast or no contrast with the adjoining upper wing coverts. Birds with contrasting tracts were second-year (SY) birds that carried the older, more faded primary coverts of the juvenal plumage. These older feathers, grown while in the nest, contrasted with a newer generation of secondary, middle, and lesser coverts acquired three to four months later at the first prebasic molt. Birds with no contrast in these tracts were after-second-year (ASY) birds carrying one generation of coverts of uniform color acquired concurrently at one molt at or beyond the second prebasic molt.

Table 1. Comparison of covert contrast to rectrix shape in the 1988 sample.					
	Dark Body		Faded Body		
Rectrix Shape	No Contrast	Contrast	No Contrast	Contrast	Total
Pointed	100	8	17	1279	**1404**
Rounded	1216	0	40	35	**1291**
Total	**1316**	**8**	**57**	**1314**	**2695**

RESULTS

Observations were recorded on 2,695 Pine Siskins in the 1988 invasion between 11 April and 15 July, including 2,441 at my yard feeder at Schenectady, New York; 155 at a year-round feeder at my Adirondack cottage at Jenny Lake, 50 km N of Schenectady near Corinth, New York; and 99 at a feeder near Amsterdam, New York. These data are summarized in Table 1.

Between 27 January and 9 June 1990, data were taken on 3,987 additional siskins (total of 6,682 individuals): 3,404 from my yard, 401 at Jenny Lake, and 182 from Amsterdam. These results are summarized in Table 2.

The rectrix replacement data gathered from the 1990 sample are summarized in Table 3. In this table, replacement patterns are segregated by degree of symmetry of the replacement in an effort to assess if the replacement was part of a scheduled symmetrical molt or a random replacement as would be expected from accidental feather loss. Symmetrical replacement is defined as involving both the left and right members of any one or more of the six pairs of rectrices. The term "partially symmetrical" means symmetrical replacement of one or more pairs accompanied by one or more randomly distributed feathers. Non-symmetrical replacement refers to random replacement of one or more rectrices involving no identical pair.

Table 2. Comparison of covert contrast to rectrix shape in the 1990 sample.					
	Dark Body		Faded Body		
Rectrix Shape	No Contrast	Contrast	No Contrast	Contrast	Total
Pointed	15	1303	3	1224	**2545**
Semi-pointed	73	33	8	18	**132**
Semi-rounded	175	2	18	3	**198**
Rounded	1058	7	40	7	**1112**
Total	**1321**	**1345**	**69**	**1252**	**3987**

Table 3. Pine Siskin rectrix replacement in the 1990 sample.

Rectrix Shape	Individuals Displaying the Following Replacement Patterns							
	Symmetrical Replacement of				Partially Symm. Replacem't	Non-symm. Replacem't	Total	Per-centage
	Pair 1	Pair 1-2	Pair 1-2-3	Other Pair(s)				
Pointed	82	25	2	8	71	298	486	91.9
Semi-pointed or Semi-rounded	1				3	3	7	1.3
Rounded	2			1	2	31	36	6.8
Total	**85**	**25**	**2**	**9**	**76**	**332**	**529**	**100.0**

Table 4. Location of rectrix replacement in the 1990 sample.

	Left Rectrix						Right Rectrix					
	6	5	4	3	2	1	1	2	3	4	5	6
Number of Individuals	38	52	64	85	146	285	162	130	80	95	85	73
Total	**670**						**625**					

Table 4 summarizes the position of replaced rectrices of the 529 siskins that exhibited replacement of one to 12 of these rectrices.

DISCUSSION

Rectrix Shape - The results in Table 1 indicate that 91.7% of the birds with pointed rectrices showed covert contrast (therefore were SY birds), while 8.3% showed no contrast (therefore were ASY birds). This distribution fails to meet the 95% minimum reliability criterion of the BBL; thus justifying, in part, the BBL's prior rejection of this criterion for age determination. Those same data show that 97.3% of birds with rounded rectrices showed no covert contrast (therefore were ASY birds), while 2.7% had covert contrast and most likely represented SY birds that had undergone complete rectrix replacement. This roundness criterion met the 95% requirement for recognizing an ASY individual.

While gathering the 1988 data and prior to having analyzed them, it became apparent that not every bird precisely fit into a strictly pointed- or rounded-rectrix classification. Some birds fell in between. Once having analyzed the 1988 data and realizing the shortcoming of trying to fit every bird into a two-class system, the system was expanded to four classifications for evaluation during the 1990 invasion. Birds of questionable, intermediate shape were classed as either semi-pointed or semi-rounded. The results in Table 2 show that 8.3% of the sampled population exhibited these intermediate shapes. Excluding them from the analysis then shows that 99.3% of the birds with pointed rectrices had covert contrast (therefore SY), while 0.7% had no contrast (therefore ASY). Similarly, 98.7% of the birds with rounded rectrices had no covert contrast (therefore ASY) and 1.3% had contrast (therefore SY). Both findings meet the BBL 95% reliability criterion.

Rectrix Replacement - Data in Table 3 show that 529 siskins (13.3%) of the 1990 sample showed some rectrix replacement. The great majority of that replacement (91.9%) occurred among birds with pointed rectrices, and 6.8% occurred in birds with rounded rectrices. Among those with pointed

rectrices, 24.1% had symmetrical replacement, 14.6% had partially symmetrical replacement, and in 61.3%, the replacement was random and presumed caused by accidental loss. The 188 pointed-rectrix birds that had symmetrical or partially symmetrical replacement represent 7.4% of the total pointed-rectrix sample of 2,545 birds, and may represent the degree to which hatching-year (HY) or SY siskins undergo scheduled, partial tail molt.

Among the 36 birds with rounded rectrices, random replacement was observed 86.1% of the time (vs 61.3% in pointed-rectrix birds) and symmetrical replacement occurred 8.3% of the time (vs 24.1% in pointed-rectrix birds). The combined total of five birds with symmetrical or partially symmetrical replacement represents only 0.45% of the total sample of 1,112 rounded-rectrix birds, suggesting that any partial molt of rectrices in ASY members of this species, after the scheduled, normal prebasic molt, is a rare event.

Among the 3,987 siskins examined in 1990, one bird was found with 13 rectrices. It had the normal six left rectrices but seven right rectrices. The bird was a dark-bodied SY with pointed rectrices that had replaced left rectrices 1-3 and right rectrices 4, 6, and 7. No other abnormal rectrix counts were found.

The distribution of replaced feathers shown in Table 4 indicates that 31.8% of the replacements occurred at the innermost rectrix, rectrix 1; and 51.5% at rectrices 1 and 2. The average number of replaced feathers among birds showing any replacement was 2.7 per bird.

Body Coloration - At the start of this study, it was not certain whether the brownness of the dorsal plumage (dark vs faded in Tables 1 and 2) had any significance as far as identifying age or sex. The distribution in Table 1 suggests that the dark body is an attribute of ASY birds with rounded rectrices, and a faded body relates to pointed-rectrix SY's. The data in Table 2 show no such correlation, with a nearly 50:50 distribution of dark and faded bodies among pointed-rectrix SY birds. These results are at odds with a statement by Sellers (1986) regarding the closely related [Eurasian] Siskin *(Carduelis spinus)* in the U.K., wherein he states that first-year birds tend to be browner on the head and mantle.

Palmer (1986) attributes color differences in this species to geographical distribution. Siskins of the northeastern U.S. tend to be dark, while birds of the far West are paler. Body color correlated as follows to birds of known sex in the 1990 sample. Sex was determined by the presence of a brood patch in the female (F) and cloacal protuberance in the male (M). The ASY M's (n=96) were 100% dark, while ASY F's (n=29) were 96.6% dark. Among SY M's (n=233), 63.5% were dark, while 23.0% of the SY F's were dark. Thus, while darkness appears to be an attribute of adult birds of both sexes in this sample, it occurred in 52.5% of the SY birds of both sexes (63.5% of M's and 23.0% of F's). The faded or tan plumage was most prevalent (77.0%) in SY F's.

However, Sellers' statement about first-year birds being browner appears to apply to HY birds that are newly fledged. A total of 103 HY's was captured as follows: 61 in 1988 between 29 April and 15 July, and 42 in 1990 between 12 May and 15 July, mostly at Jenny Lake. These birds were uniformly dark dorsally in their juvenal plumage. They were easily recognized by their very buffy secondary coverts; buffy-yellow wash to abdomen; fresh, unworn plumage; and very incompletely pneumatized skulls. Among them, 101, or 98.1%, showed no contrast in the covert color under fluorescent light. One individual (1.0%) had semi-pointed rectrices, while all others (99.0%) had pointed rectrices. It was not possible to determine whether the difference between the dark and faded body plumage in the January-June birds was a result of some difference among them at the time of their first prebasic molt, or due to fading, geographical distribution or some other reason. It had no apparent relation to age or sex that could help to identify either.

Use of Rectrix Shape - The successful use of rectrix shape and width differences described here require the following precautions. The rectrices must be dry and in their natural shape, not frayed or bent due to capture or handling. Wet rectrices

assume narrower and more pointed shape, and handling can distort shape. Either one incorporates unreliability.

The entire set of rectrices must be examined, and it is best to avoid using the central pair because it tends to be more pointed than the rest, even in rounded-rectrix birds. Rectrix pairs 3, 4, and 5 were usually the most reliable in classifying shape.

Intermediate or questionable rectrix shapes should not be used. Such birds should be classed simply as after-hatching-year (AHY) after 1 January or unknown (U) prior to that if they have completed skull pneumatization. Only distinctly pointed or rounded rectrices should be used in order to benefit from the reliability of this method.

Given that upper wing covert contrast was used to segregate birds by age to start, one might question why bother using rectrix shape to tell age; rely instead on covert contrast. The reason is that covert contrast in this species is difficult to detect in variable natural light, worst of all in direct sunlight. Only in an indoor area of subdued natural light, where fluorescent lighting was used, was it possible to distinguish this contrast. Covert contrast was not a reliable field method, whereas rectrix shape could be distinguished in either natural or artificial light.

These results support the contention that siskins with pointed rectrices after the completion of the prebasic molt are HY birds prior to 1 January and SY thereafter. Birds with rounded rectrices in the same time periods are AHY or ASY, respectively. This method extends by many months the time period during which Pine Siskin age may be determined following completion of the prebasic molt and completion of skull pneumatization.

SUMMARY

SY Pine Siskins with contrasting covert color were segregated from ASY birds having non-contrasting covert color to then compare the rectrix shapes of these two age groups. From among 3,987 siskins in the January-June period, 99.3% of the birds with pointed rectrices had the SY covert contrast, and 98.7% of the birds with rounded rectrices showed the lack of covert contrast of ASY birds. Birds with rectrix shapes intermediate between pointed and rounded amounted to about 8% of the sample and were excluded from the analysis.

An earlier sample of 2,695 siskins wherein an attempt was made to class all birds only as pointed or rounded, without recognition of intermediate shapes, showed respective percentages of 91.7 and 97.3. The results obtained by excluding intermediate rectrix shapes meet the BBL criterion of 95% reliability for use of pointed rectrices to recognize HY/SY birds and rounded rectrices for AHY/ASY birds. This criterion allows Pine Siskins to be aged into the breeding season, following completion of the prebasic molt and after skull examination is no longer useful.

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