VARIATIONS IN THE TAIL SPOTTING OF THE SLATE-COLORED JUNCO

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INTRODUCTION

A study of tail spotting in the Slate-colored Junco (*Junco hyemalis*) was conducted on a series of spring- and fall-banded birds in an attempt to determine whether variations in spotting could serve as part of an age- or sex-determining scheme for this species. Over 300 tail patterns were analyzed and compared with wing length (chord) and plumage coloration. These data were compared to some of the recognized sex-determining criteria in the literature and to certain museum data.

COLLECTION OF DATA

Slate-colored Juncos were captured by mist net and trap in my yard in 1964 through 1970. Major emphasis was put on the periods of 1 March - 15 May and 15 September - 31 October. In the course of banding these birds, data were gathered on weight, fat class, wing chord, age (skull pneumatization in the fall), and the intensity of the gray of the body plumage. With respect to body plumage, birds were classified as either "pale" or "dark" gray (or "unknown" in borderline cases). In some cases notes were kept on flank coloration and the amount of brown in the body plumage, but no attempt has been made to analyze these latter data.

Starting in 1967, I recorded tail patterns using a drawing of the six outer right rectrices. The areas of gray and white were recorded at the time of banding. At a later date, the dark areas were filled in with a felt-tipped pen and the percentage of white area in each rectrix was estimated by eye to the nearest five per cent. In cases of trace quantities, estimates of two and 98 per cent were used.

RESULTS AND DISCUSSION

The percentages of white areas were segregated according to wing length and averaged. The rectrices were identified by numbering with the outer rectrix counted as the first. The averages for the first three rectrices were plotted against wing length. The spring data (1 March - 15 May) are given in Figures 1 and 2. Also included in Figure 1 is a plot of the percentage of birds judged to be "dark"-plumaged for each wing chord sample. Figure 3 is a plot of similar data gathered on fall hatching-year birds (HY - birds with incompletely ossified skulls). There were insufficient data on after-hatching-year birds (AHY - birds with ossified skulls) in the fall to warrant treatment of this group.

A small series of specimens at the American Museum of Natural History in New York was examined to correlate body plumage color and wing length with sex.

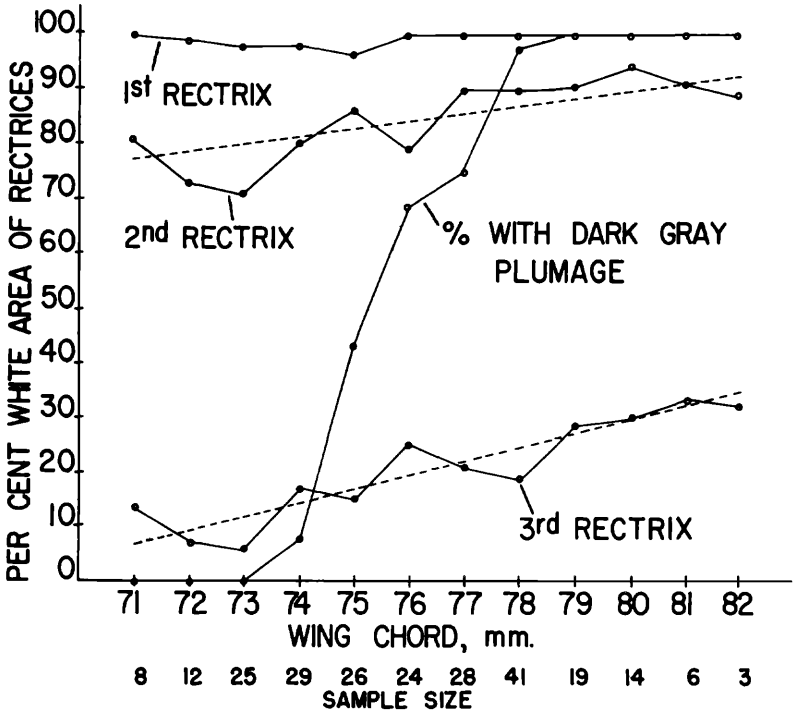

FIGURE 1. White area in the tails of spring Slate-colored Juncos. Numbering of the rectrices started with the outermost right rectrix. The dashed lines are apparent trends drawn by eye. Included is the percentage of each wing chord sample judged to have dark gray plumage as contrasted to pale gray plumage.

A. *Spring* — Figure 1 shows that the average amount of white area of the first, or outer, rectrix varies only slightly from 96 to 100 per cent, with only minor variation occurring at shorter wing lengths. The white areas of the second and third rectrices increase as wing length increases, with the slope of increase greater for the third rectrix. The least amounts of white tail spotting occur in birds that have "pale" gray plumage. As wing length increases, the samples become progressively more "dark" gray in plumage.

In order to investigate further the relationship between tail spotting and the intensity of the gray of the body plumage, I segregated the data into groups of "pale" and "dark" body plumage and plotted data for the second and third rectrices in Figure 2. They show that the "dark" birds tend to have greater amounts of white in these rectrices, but the differences are not great. Further, an examination of the individual data indicates that there is considerable variability from bird to bird, with substantial overlap between individual "pale" and "dark" birds. Table 1, which presents minimum and maximum areas for the four rectrices of each wing length group, illustrates this point. Some birds in every wing length

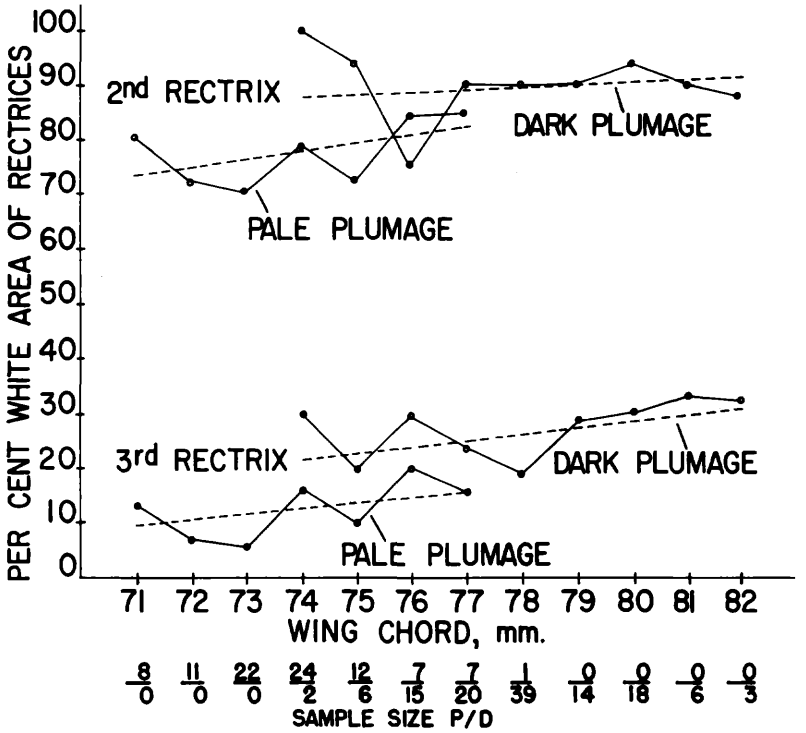

FIGURE 2. White area in the tails of pale- and dark-plumaged spring Slate-colored Juncos. Numbering of the rectrices started with the outermost right rectrix. The dashed lines are apparent trends drawn by eye. The sample size ratio refers to the respective numbers of pale and dark specimens.

group, except the last two, show no white in the third rectrix. In addition, the maximum white areas in the third rectrix vary from 40 to 90 per cent independent of wing length or intensity of gray.

B. *Fall* — Figure 3 shows how the amounts of white area increase in all three rectrices as wing length increases in HY birds. Generally the amount of white is less in the HY group than in the spring group of mixed ages. Similar to the spring data, the fall data show that the amount of white area is least in the "pale" birds and greatest in the "dark" birds; however, the data are not sufficient to allow separate treatment of the two groups.

The HY group shows the same variability and overlap as the spring sample. Table 2 gives the minimum and maximum amounts of white area for each rectrix and wing length.

C. *Tail Spotting as an Aid to Sexing* — Several authors have reported results which relate mensural data and plumage characteristics to age and sex in this species (Blake, 1962, 1964, 1967; Dow, 1966; Grant and Quay, 1970; Wood, 1951; Wood, 1969). In North

TABLE 1. Minimum and maximum tail spotting areas per wing chord sample—spring.

		Wing chord, mm.											
		71	72	73	74	75	76	77	78	79	80	81	82
First rectrix,	min.	90	95	90	90	60	95	98	90	95	95	100	100
	max.	100	100	100	100	100	100	100	100	100	100	100	100
Second rectrix,	min.	60	25	40	55	40	60	50	60	60	75	80	65
	max.	95	98	100	100	100	100	100	100	98	100	98	100
Third rectrix,	min.	0	0	0	0	0	0	0	0	0	0	15	15
	max.	55	40	50	90	65	55	55	90	65	70	60	40
Fourth rectrix,	min.	0	0	0	0	0	0	0	0	0	0	0	0
	max.	0	0	0	0	2	5	2	0	5	5	0	0

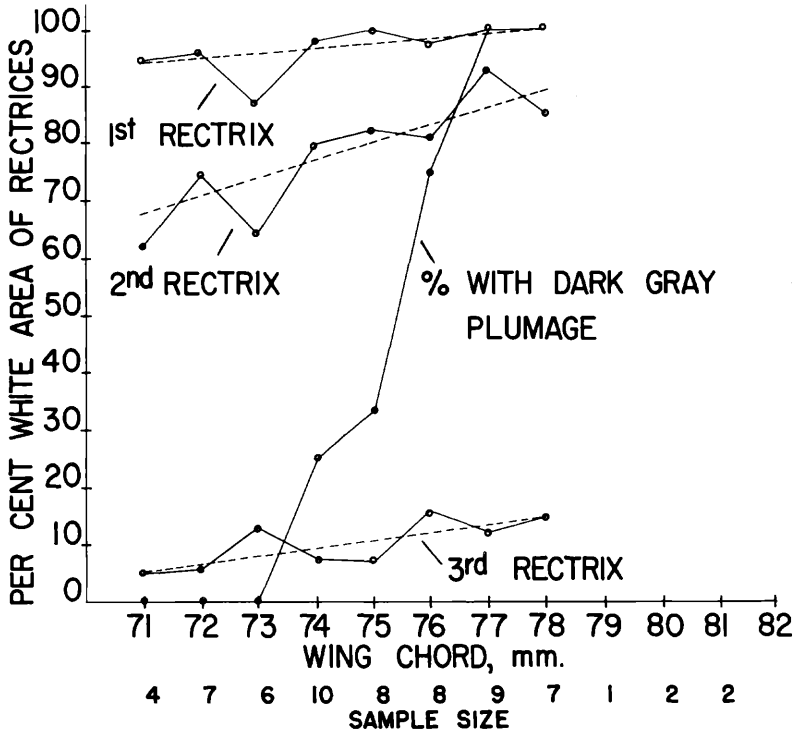

FIGURE 3. White area in the tails of fall hatching-year Slate-colored Juncos. Numbering of the rectrices started with the outermost right rectrix. Included is the percentage of each wing chord sample judged to have dark gray body plumage as contrasted to pale gray plumage.

Carolina, Blake (1967) sampled 99 males and 47 females and found a wing chord mean and standard deviation of 78.7 ± 1.5 mm for males and 73.7 ± 1.5 mm for females. Also in North Carolina, Grant and Quay (1970) found 40 males had a wing chord mean of 78.3 ± 2.0 mm, and 31 females had a wing chord mean of 73.6 ± 2.0 mm. Grant and Quay (1970) indicated that birds with wing chords less than 73 mm were female and over 78 mm were male. Based on 20 males and five females in Ontario, Dow (1966) found wing chord means and standard deviations of 76.6 ± 2.5 mm for the males and 72.4 ± 0.7 mm for females. Similarly, Wood (1969) lists a wing chord of 72 mm or less as usually female and 78 mm. or more as usually male. Based on a series of 71 males and 22 females at the American Museum of Natural History, data for the males ranged from 74 to 85 mm with a mean and standard deviation of 79.1 ± 2.3 mm, and the females ranged from 72 to 78 mm with a mean and standard deviation of 74.0 ± 1.7 mm.

In the same museum series, body plumage color was correlated with sex. Of the 63 birds judged to be "dark" gray, 60 individuals

TABLE 2. Minimum and maximum tail spotting areas per wing chord sample—fall HY

		Wing chord, mm.										
		71	72	73	74	75	76	77	78	79	80	81
First rectrix,	min.	85	90	60	90	95	80	98	98	—	100	90
	max.	100	100	100	100	100	100	100	100	—	100	100
Second rectrix,	min.	50	60	30	65	60	65	90	65	—	85	75
	max.	75	95	90	98	95	98	100	98	—	95	85
Third rectrix,	min.	0	0	0	0	0	0	5	0	—	35	0
	max.	10	10	50	20	15	40	25	40	—	45	0
Fourth rectrix,	min.	0	0	0	0	0	0	0	0	—	0	0
	max.	0	0	0	0	0	0	0	0	—	0	0

or 95.4 per cent were male. Of the 71 birds labelled male, 60 individuals or 84.5 per cent were "dark." The majority of the 11 individuals or 15.5 per cent "pale" males were labelled "juv." or "imm." by the collectors. Among the 22 birds labelled female, 19 individuals or 86.4 per cent were judged to be "pale." Therefore, it would seem that one is relatively safe in calling a "dark" bird a male, but a "pale" bird (11 "pale" males and 19 "pale" females) could be of either sex. Dow (1966) treats this matter in considerably more detail.

Recognizing that only "pale" birds with wing chords of 73 mm or less may be safely called females and only "dark" birds with wing chords of 78 mm or more may be safely called males, it appears that females average 7-8 per cent white area in the third rectrix compared to 24 per cent white area in the males' third rectrix. The females' second rectrix averages 74 per cent white area compared to the males' 90 per cent.

Since the wing chord samples of 74 to 77 mm consist of birds of both sexes, it is possible that the upward slopes of the lines in Figure 2 are the result of "pale" males increasing the "pale" curve and the "dark" females depressing the "dark" curve. This infers that within a given sex group, the amount of white in these rectrices may be nearly constant and independent of wing length. An examination of a more extensive series of birds of known sex is needed to ascertain whether this is the case.

Whereas small differences appear to exist between the amounts of spotting in males and females, the variability in white area from bird to bird might negate the significance of the differences noted, thereby precluding the use of tail spotting as a reliable sexing criterion.

This matter is under further investigation, for in 1970 banding of a breeding population of Slate-colored Juncos was begun near Corinth, New York in the foothills of the Adirondack Mountains about 40 miles north of where the present data were gathered. It is hoped that sufficient return data will be available on birds of known age and sex to allow a more refined examination of tail spotting to age and/or sex determination. Additional museum work is planned with regard to wing length and intensity of gray of the body plumage. Tail spotting could not be accurately determined on the museum skins, because it was not possible to examine the basal portions of the rectrices without risking damaging the skins.

D. *Tail Spotting as an Aid to Age Determination* — Wood (1951) describes changes in the white area of the third rectrix of return juncos in Pennsylvania indicating that older birds possess more white than do first-year birds. In one case an HY bird had 18 per cent white in its first fall, and it replaced this third rectrix with one that was 40 per cent white. No change was found during each of the following two winters. In other cases of birds of unknown age, a

rectrix with 16 per cent white was replaced during the same winter with a rectrix having 70 per cent white; one of 20 per cent white was replaced by one of 40 per cent white; one of 27 per cent became 34 per cent the following year; and another of 13 per cent became 34 per cent the following year.

The data at hand are in general agreement with Wood's thesis that older birds exhibit more white in the tail. Spring birds of mixed ages show more white than first-year fall birds. However, specific conclusions based on a comparison of spring and fall data are difficult to draw, because of the unknown age and sex distribution of the spring sample. The differences in the amount of white between spring and fall birds for each respective rectrix and wing length sample in Figures 1 and 3 do not appear to be significant.

There is reason to believe that the spring and fall samples considered here may be quite different from one another in age and/or sex composition. In the spring the junco is a common migrant. Of the total catch of 635 individuals, 61.7 per cent occurred in April. It is not uncommon to see small bands of juncos moving northerly through the banding area and adjoining yards during March, April and May. In the fall the junco is far less conspicuous. October is second to April in the month of most captures (17.2 per cent). In seven years, the number of juncos banded in the period of March through May has exceeded those banded in the period of September through November by 2.6 : 1. In no case has one of the October or April migrants been recaptured in a subsequent migration. A very few of the birds banded in November, and a modest number of those banded in December, have been retaken in subsequent months indicating that these were wintering birds. A few January and February banded birds have been retaken in later months also.

CONCLUSIONS

An examination of the average amounts of white area in the outer three rectrices of spring-plumaged Slate-colored Juncos of mixed ages revealed: (a) from 96 to 100 per cent of the first rectrix is white; (b) males ("dark" gray birds with wing chords of 78 mm or more) averaged 90 per cent white area in the second rectrix compared to 74 per cent in females ("pale" gray birds with wing chords of 73 mm or less); (c) males averaged 24 per cent white area in the third rectrix compared to 7-8 per cent in females.

Fall hatching-year birds averaged slightly less white area than spring birds (mixed ages) with the difference being greatest in the third rectrix of the male.

Considerable variation and overlap in the amounts of white areas of individuals raise questions on the validity of tail spotting as a useful means of determining age and/or sex in the Slate-colored Junco. Work is in progress on a breeding population in an attempt to present a more refined assessment of the value of this plumage characteristic.

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Received 19 April 1971, accepted 26 January 1972.