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SEX AND AGE CRITERIA IN THE SLATE-COLORED JUNCO

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INTRODUCTION

The Slate-colored Junco (*Junco hyemalis*) has always been a difficult species for bird banders to sex and age (Blake, 1962, 1964, 1967; Wood, 1969). The characters most used to sex and age the Slate-colored Junco are: (1) the color of the iris, (2) the length of the wing chord, (3) ossification of the skull, and (4) the degree of brownness (or lack of brownness) in the plumage. These characters vary from specimen to specimen, both between and within sexes and ages, and no dependable methods for sexing and ageing all live Slate-colored Juncos have yet been devised.

The objective of the present study was to examine the sex and age characteristics of the Slate-colored Junco in late Fall and Winter in a southern part of its wintering range—at Raleigh, North Carolina.

METHODS AND MATERIALS

Seventy-one specimens were collected on the Dorothea Dix farms near Raleigh, North Carolina, between late November 1968 and late February 1969. These specimens were all prepared as study skins, but the skulls were removed and kept separate (Grant, 1971). All measurements of the length of the chord of the folded wing were in millimeters. The plumage colors were objectively judged as: no brown, trace of brown, slight brown, somewhat brown, rather brown, quite brown, and very brown, and are those used by Blake (1964).

The iris of immature birds is gray usually until the October after hatching and is the most reliable age criterion, according to Blake (1962). Few Slate-colored Juncos arrive in North Carolina before November; therefore, iris color as the method of ageing is of no value in the southern portion of its wintering range.

The amount of white in the outer rectrices was not measured in

TABLE 1. WING-CHORD LENGTH AND COLOR RANGE IN SEVENTY-ONE SEXED AND AGED SLATE-COLORED JUNCOS. ALL WING MEASUREMENTS ARE IN MILLIMETERS. SAMPLE SIZE IS GIVEN IN PARENTHESIS, IN COLUMN HEADINGS

Character	Females (31)		Males (40)	
	Skulls not ossified (9)	Skulls ossified ^a (22)	Skulls not ossified (11)	Skulls ossified ^b (29)
Least wing length	70.0	71.0	77.0	73.0
Greatest wing length	77.5	78.0	80.5	82.0
Mean wing length	73.6	73.6	78.3	78.3
Standard deviation, wing length	2.4	1.9	1.3	2.2
Color range (from Blake, 1964)	very brown to quite brown	very brown to somewhat brown	rather brown to trace of brown	somewhat brown to no brown

^aTen specimens that fall into the very brown to somewhat brown categories are probably birds of the year with recently ossified skulls.

^bSome specimens with shorter wing lengths in this group are probably birds of the year with recently ossified skulls.

this study because it is extremely variable (Blake, *pers. com.*) and because rectrices lost during the winter are replaced by those which would ordinarily be present in the next plumage (Wood, 1951). Wood (1969) found the amount of white in the inner third rectrice to increase with age.

RESULTS

The wing lengths and color ranges in our sample appear in Table 1. The mean wing length of females with unossified skulls and those with ossified skulls was 73.6 mm in both groups and ranged from 70.0 mm to 78.0 mm for all females (mean 73.6 mm, standard deviation 2.0). The mean wing length of males with unossified skulls and with ossified skulls was 78.3 mm in both groups and ranged from 73.0 mm to 82.0 mm for all males (mean 78.3 mm, standard deviation 2.0). Thus, the difference in mean wing length between the sexes was 4.7 mm.

The distribution of wing-chord lengths by sexes in our sample appears in Table 2. Twelve females (wings 70.0 to 72.5 mm) (38.7% of all females) and 20 males (wings 79.0 to 82.0 mm) (50% of all males) were sexable by wing length alone. We were thus able to sex a total of 32 specimens (45.1%) out of our sample of 71 by wing length.

TABLE 2. WING-LENGTH DISTRIBUTION BY SEX IN 71 WINTERING SLATE-COLORED JUNCOS

Wing length, mm	Number of females	Number of males
70.0	1	
70.5		
71.0	2	
71.5	2	
72.0	2	
72.5	5	
73.0	4	1
73.5	3	
74.0	3	
74.5	1	
75.0	2	1
75.5		3
76.0	1	1
76.5	2	1
77.0	1	5
77.5	1	4
78.0	1	4
78.5		
79.0		7
79.5		4
80.0		4
80.5		1
81.0		1
81.5		2
82.0		1
Number of birds	31	40
Mean	73.6	78.3
Standard Deviation	2.0	2.0

The plumage color of females ranged from very brown to somewhat brown while that of males ranged from rather brown to no brown. Much overlap occurred in the rather brown and somewhat brown groups.

Sixty-five specimens in this Junco sample were randomly collected by mist net and gun. Forty (61.5%) from this random sample of 65 were males.

DISCUSSION

The skulls of many passerines become ossified about six months after hatching. Nero (1951) found ossification in the House Sparrow (*Passer domesticus*) to be completed between 181 and 221 days, and Serventy, Nicholls, and Farnar (1967) found the process to be completed between 138 and 160 days in the Zebra Finch (*Taeniopygia castanotis*). Thus, by December the process of ossification in many passerines is complete, and ageing by skull is of little use later in the winter (Baird, 1964; Wood, 1969). In our study, we could not separate skulls recently ossified from those that had been ossified for twelve months or more.

Ridgway (1901) found the difference in mean wing length between the sexes in the Slate-colored Junco to be 4.3 mm. Blake (1964) determined the sexual difference in wing length to be about 4 mm. These measurements compare favorably with our determination of 4.7 mm. The greatest wing length of our 31 females was 78.0 mm and the least wing length of the 40 males was 73.0 mm, suggesting that those with wing length greater than 78 mm are males and those with wings less than 73 mm are females. Wood (1969) stated that those birds with wings 72 mm or less are usually females, and those birds with wings 78 mm or more are usually males. The intermediate wing lengths were too variable to be used with dependable accuracy, but we were able to sex 45.1% of our sample by wing length alone. In many cases of intermediate birds, color range used in conjunction with wing length should make the percentage of sexable birds greater.

The color range appeared to progress from very brown in immature females to no brown in adult males. Those specimens judged to be very brown and quite brown were females in all cases, and those judged to be slight brown, trace of brown, and no brown were males in all cases. However, those specimens judged as somewhat brown and rather brown were either adult females or immature males. Thus, plumage characters could be used at either extreme with accuracy but could not be used in the intermediate range.

Blake (1964) suggested that Juncos wintering at Hillsborough, North Carolina may be predominately male. Of 65 Juncos randomly collected in our sample, 61.5% were males. This means, as Blake (1964) stated, that we would expect a larger percentage of females present in some other parts of the winter range.

The mean wing lengths for our Juncos with unossified skulls and those with ossified skulls were the same within each sex. This finding in our case was probably due to our small sample size and to some immature specimens with recently ossified skulls being included in the skull-ossified groups.

More work needs to be done to identify characteristics and devise keys which could be used readily by banders on this difficult species. In order to utilize the best ageing characters (grayish iris of the immature bird, and the skull condition), more specimens should be collected and analyzed early in the fall in the northern portion of the winter range.

SUMMARY

Seventy-one Slate-colored Juncos (*Junco h. hyemalis*) were collected at Raleigh, North Carolina during the winter of 1968-1969 and were prepared as study skins, for the purpose of studying sex and age characteristics in a southern part of this species' non-breeding range.

The wing lengths were measured and the plumage colors were objectively judged according to the amount of brown present. We found that, in the Raleigh region: (1) Slate-colored Juncos with wing lengths less than 73.0 mm are females, (2) Juncos with

wing lengths greater than 78.0 mm are males, (3) those birds very brown to quite brown are females, (4) those from slight brown to no brown are males, (5) the intermediate wing lengths and color ranges alone are too variable to be used with accuracy, but used in conjunction should increase the percentage of sexable birds, and (6) we could sex 45.1% of our sample by wing length alone (38.7% of the females and 50% of the males).

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LITERATURE CITED

- BAIRD, JAMES. 1964. Ageing birds by skull ossification. *EBBA Workshop Manual*, **3**: 1-2.
- BLAKE, C. H. 1962. Wing length of Slate-colored Junco. *Bird Banding*, **33**: 97-99.
- BLAKE, C. H. 1964. Color and wing length in the Slate-colored Junco. *Bird Banding*, **35**: 125-127.
- BLAKE, C. H. 1967. More on the wing length of the Slate-colored Junco. *Bird-Banding*, **38**: 234.
- GRANT, G. S. 1971. Removal of cranium during preparation of study skins for later studies of ossification. *Bird-Banding*, **42**: in press.
- NERO, R. W. 1951. Pattern and rate of cranial "ossification" in the House Sparrow. *Wils. Bull.*, **63**: 84-88.
- RIDGWAY, R. 1901. Birds of North and Middle America. Bulletin 50, U. S. National Museum.
- SERVENTY, D. L., C. A. NICHOLLS, and D. S. FARNER. 1967. Pneumatization of the cranium of the Zebra Finch, *Taeniopygia castanotis*. *Ibis*, **109**: 570-578.
- WOOD, H. B. 1951. Development of white in tails of Juncos, *Junco hyemalis*. *Auk*, **68**: 522-523.
- WOOD, M. 1969. A Bird-bander's Guide to Determination of Age and Sex of Selected Species. Pennsylvania State University, University Park.

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