WING LENGTH, HOOD COLORATION, AND SEX RATIO IN DARK-EYED JUNCOS WINTERING IN NORTHERN UTAH

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Dark-eyed Juncos (*Junco hyemalis*) do not show clearcut sexual dimorphism, although several workers have noted small differences between males and females in wing length and in plumage coloration (Ridgway, 1901; Miller, 1941; Blake, 1964, 1967; Grant and Quay, 1970; and others). Efforts to develop criteria for determining sex are particularly complicated by the species' extensive geographic variation. The purpose of this paper is to report on the use of wing length and hood coloration as a means for determining sex in Dark-eyed Juncos wintering in northern Utah, and to present evidence for an unbalanced sex ratio in a population at Logan, Utah.

METHODS

Data were collected from a wintering population of migratory Dark-eyed Juncos in Logan, Utah, from November through February of 1972-3 and 1973-4. A total of 306 individuals were trapped, marked, and measured. The wing was held half open and measured along the chord to the nearest mm. Notations were made of hood coloration, qualitatively classifying birds as "dark" (black or charcoal hood, with or without brown or grayish tips on some feathers), "light" (dull brownish gray hood), or "other" (hood either intermediate between "dark" and "light" or clear gray). Of these birds, 51 were removed from the population for behavior studies in captivity and were later identified as to sex by gonadal examination. The total sample, although subject to an undetermined amount of bias due to differences in the trapability of individuals, was assumed to be representative of the population wintering in this locality. However, the captive subsample was nonrandom in that it contained relatively high, approximately equal numbers of very long-winged and very short-winged birds, to assure adequate representation by both sexes for the behavior experiments.

RESULTS

Wing lengths of all captives averaged 77.6 mm (n = 51; SD = 3.11). Males averaged 79.3 mm (n = 35; SD = 1.97), whereas females averaged 73.9 mm (n = 16; SD = 1.53). Mean wing lengths for males and females were significantly different ($t = 9.67$; $P < 0.001$). Overlap between wing lengths of males and of females was confined to the region between 75 and 77 mm (Table 1). Males and females also differed in hood coloration: of 35 males, 32 were recorded as "dark," one as "light," and two as "other;" whereas of 16 females, 15 were recorded as "light" and one as "other."

TABLE 1.
Relationship between wing chord and hood coloration in Dark-eyed Juncos wintering in northern Utah.

		Wing chord (mm)												
		71	72	73	74	75	76	77	78	79	80	81	82	83
Group	Hood coloration	Number of birds												
Captive — males[1]	Dark	0	0	0	0	1	1	5	3	7	6	3	4	2
(n = 35)	Light	0	0	0	0	0	0	0	0	1	0	0	0	0
	Other	0	0	0	0	0	0	0	1	1	0	0	0	0
Captive — females[1]	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0
(n = 16)	Light	1	1	5	3	3	1	1	0	0	0	0	0	0
	Other	0	0	0	0	1	0	0	0	0	0	0	0	0
Free-living	Dark	0	1	0	3	10	14	37	49	33	26	11	3	3
(n = 255)	Light	2	1	12	6	5	7	3	1	2	2	1	1	0
	Other	0	0	1	0	0	0	2	6	4	5	1	1	2

[1]Sex ascertained by gonadal examination.

Wing lengths of free-living birds averaged 77.8 mm (n = 255; SD = 2.34); of these, 151 (59%) fell exclusively within the range of known males ($\geq$ 78 mm), and 26 (10%) fell exclusively within the range of known females ($\leq$ 74 mm). Within the free-living group, 190 birds (74%) had dark hoods, whereas 43 (17%) had light hoods. If the number of "dark" birds with wing lengths between the extremes for known males (75-83 mm) is compared to that of " light" birds with wing lengths between the extremes for known females (71-77 mm), the ratio of estimated males to estimated females in the free-living group is 186:36 or 5.2:1, with 33 birds (13%) falling into neither category. If these figures are combined with those for the captive group, the ratio of males to females in the total sample becomes 221:52 or 4.2:1, with 33 birds remaining unclassified. Within the total sample, wing lengths of birds classified as males averaged 78.4 mm (n = 221; SD = 1.77), whereas those of birds classified as females averaged 74.1 mm (n = 52; SD = 1.58). The two means are significantly different (t = 16.03; $P < 0.001$).

There is a substantial discrepancy between the sex ratio among captive birds and that estimated for the free-living group due to the nonrandom selection of birds for experiments in captivity. The effect of this selectivity can be reduced by eliminating from consideration 20% of measurements at either extreme of the frequency distribution of wing lengths in captive birds. Among captives yielding intermediate wing measurements (n = 31), the ratio of males to females was 4.2:1, which agrees with the sex ratio estimated for the total sample.

DISCUSSION

These results suggest that wing length may be used in conjunction with hood coloration to determine sex accurately in more than 80% of Dark-eyed Juncos wintering in Logan, Utah. Wing length and plumage coloration have been used previously with some success to determine sex in juncos wintering in the eastern United States (Grant and Quay, 1970; and references cited therein). The difference between mean wing lengths of males and females in the present study was 4.3 mm, which is in keeping with findings for several junco populations (Ridgway, 1901; Miller, 1941; Blake, 1964; Grant and Quay, 1970).

Apparently male Dark-eyed Juncos are more than four times as abundant as females during the winter in Logan. One factor contributing to this imbalance may be differential mortality among males and females, assuming the primary sex ratio to be 1:1. Differential mortality might conceivably occur at any or several of various stages in the annual cycle. Some findings by Fretwell (1969) can be interpreted to indicate differential mortality in males and females of this species during the winter. He found that long-winged juncos wintering in North Carolina were generally dominant to short-winged individuals. Dominant birds showed higher body weights, lower adrenal weights, and higher survival rates calculated from recapture rates, than did subordinate birds.

He attributed disappearances both to mortality within the home flock and to dispersal to marginal habitats. One might logically infer from these results that females' chances for survival through the winter were reduced by the presence of conspecific males. I was unable to document differential mortality through the winter in free-living juncos in Logan because of the bias introduced by my removing birds periodically from the population for behavior studies. However, in my observations of captive birds, males were more successful in the acquisition of several resources than were females.

A second, more important reason for an unbalanced sex ratio among Dark-eyed Juncos wintering in Logan may be geographic differentiation in the migratory habits of the sexes. This phenomenon has been documented in several birds including fringillids such as White-crowned Sparrows (*Zonotrichia leucophrys*) (King et al., 1965) and Chaffinches (*Fringilla coelebs*) (Deelder, 1949). Blake (1964, 1967) and Grant and Quay (1970) found a preponderance of males in populations of Dark-eyed Juncos wintering in North Carolina, and they predicted that a preponderance of females should be present in some other parts of the winter range. Although to my knowledge this prediction has not been confirmed, I would suggest that intersexual competition for essential resources might exert selective pressure on females of this species to migrate to wintering regions not occupied by males. Geographic segregation of the sexes could function to minimize intersexual competition and hence to reduce female losses in periods of resource scarcity.

SUMMARY

The objective of this paper was to report on the use of wing length and hood coloration as a means for determining sex in Dark-eyed Juncos wintering in northern Utah, and to present evidence for an unbalanced sex ratio in a population at Logan, Utah. Sex was determined on the basis of wing length and hood coloration in more than 80% of birds examined. The ratio of males to females was estimated to be 4.2:1. This unbalanced sex ratio may be attributable to differential mortality between males and females, to geographic differentiation in the migratory habits of the sexes, or to both of these factors. It is suggested that intersexual competition for essential resources might exert selective pressure on females of this species to migrate to wintering regions not occupied by males.

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