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WING MORPHOLOGY VARIES WITH AGE BUT NOT MIGRATORY HABIT IN AMERICAN DIPPERS

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ABSTRACT.—We investigated variation in morphology of American Dippers (*Cinclus mexicanus*) in the Chilliwack River watershed, British Columbia in relation to gender, age and migratory habit. Male dippers had linear dimensions that were 2–9% longer and, on average, were 16% heavier than females. Adults (AHY) were the same structural size as yearlings (HY). Yearlings, however, had shorter and more rounded wings than adults providing support for the hypothesis that an increased vulnerability to predation may lead to selection for traits that improve take-off performance and maneuverability. Yearlings also had shorter tails suggesting other selective pressures shape tail morphology. Dippers in this population may be sedentary or migrate short distances to breed at higher elevations. We found no evidence that wing or tail morphology varied with migratory habit or that sedentary dippers, that have higher reproductive success, are larger or heavier than migrants. *Received 1 November 2007. Accepted 11 May 2008.*

Migration can impose strong selection pressure on traits that influence speed and efficiency of long-distance flight, and may have a major role in maintaining inter- and intraspecific variation in wing morphology (Alerstam and Lindström 1990, Alerstam 1991). Aerodynamic theory suggests that costs of long-distance flight are reduced if wings are longer and more pointed, and tails are relatively short (Rayner 1988, 1990; Norberg 1990, 1995). Comparative studies have confirmed that migratory species typically have more pointed wings than sedentary species (Marchetti et al. 1995, Mocific differences in wing morphology can evolve rapidly. For example, House Finches (*Carpodacus mexicanus*) introduced into eastern North America in 1940 soon became migratory (Able and Belthoff 1998) and, by 2002, had more pointed wings than sedentary House Finches in western North America (Eg-

TABLE 2. Morphological variation of American Dippers ($\bar{x} \pm$ SD) in relation to gender and age. Gender and age effects are the change in the variance ratio (Δ v.r.) when age or gender is dropped from general linear models containing significant main effects.

Character	Male		Female		Gender effect		Age effect	
	Yearling	Adult	Yearling	Adult	Δ v.r.	*P*	Δ v.r.	*P*
Head-bill length, mm	47.3 ± 0.8	47.6 ± 0.9	45.9 ± 0.6	45.8 ± 0.8	182.7	<0.001	2.4	0.12
Tarsus length, mm	34.6 ± 0.9	34.8 ± 0.8	32.6 ± 0.8	32.4 ± 0.9	258.9	<0.001	0.02	0.88
Wing chord, mm	90.7 ± 2.5	91.7 ± 2.7	83.8 ± 1.6	84.4 ± 1.9	357.2	<0.001	5.4	0.02
Tail length, mm	49.0 ± 2.4	51.1 ± 2.6	45.8 ± 1.9	47.3 ± 2.1	89.5	<0.001	25.7	<0.001
Mass, g	57.0 ± 5.1	57.2 ± 6.4	49.3 ± 4.7	48.6 ± 5.1	95.4	<0.001	0.2	0.69
n	44	61	38	27				
Wing size, *w*C1	1.5 ± 2.0	1.8 ± 2.0	−3.2 ± 1.3	−3.3 ± 1.8	151.4	<0.001	0.05	0.83
Wing pointedness, *w*C2	0.0 ± 0.4	−0.2 ± 0.3	0.2 ± 0.3	−0.2 ± 0.5	1.3	0.27	12.3	<0.001
Wing convexity, *w*C3	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.1	0.0 ± 0.2	0.7	0.41	0.6	0.45
n	24	28	18	11				

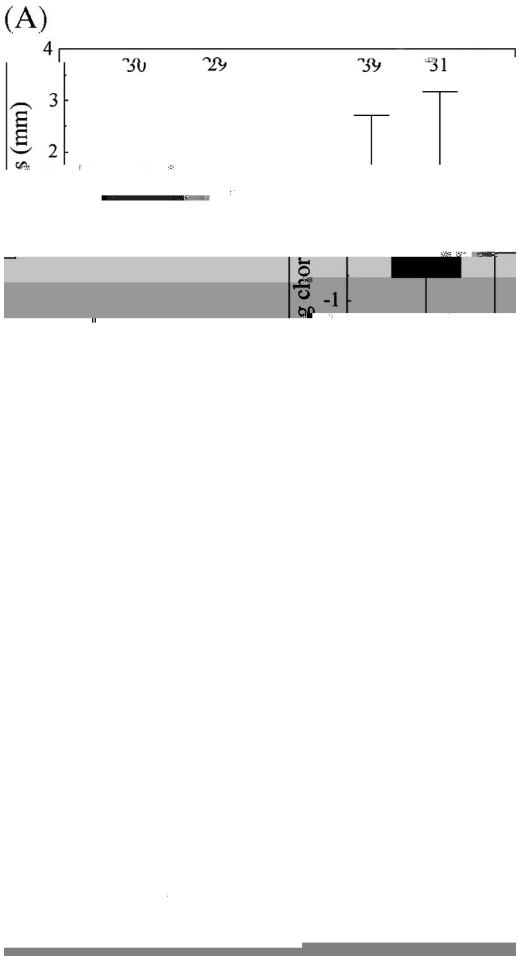

FIG. 1. Relationship between age and (A) residual wing chord length ± SD and (B) wing pointedness ± SD of migratory and sedentary American Dippers. Migrants are represented by black bars, residents by white bars. Wing chord residuals are unstandardized residuals after controlling for gender. Numbers denote sample sizes for each category.

chord length (Fig. 1A), tail length and overall wing size of an individual, after controlling for gender and age effects, were all unrelated to their migratory habit (Table 3). Sedentary dippers also had the same wing shape as migratory dippers; neither wing pointedness (Fig. 1B), nor wing convexity varied with migratory habit (Table 3).

DISCUSSION

Inter- and intra-specific studies have shown that migration can influence wing length and

velopment (van Balen 1967). We are currently unable to rule out this hypothesis.

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