Wing-length Change in the First Postnuptial Molt of Gambel's White-crowned Sparrows

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INTRODUCTION

As an age group, adult Gambel's White-crowned Sparrows (*Zonotrichia leucophrys gambelii*) have longer wings than immatures (Fugle and Rothstein 1985, Mewaldt and King 1986). This wing-length difference is a consequence of the first postnuptial molt, which occurs on the breeding grounds and precedes the second fall migration (Chilgren 1978, Morton *et al.* 1969). Mewaldt (1973) described first postnuptial wing-length change in inclusive age samples of White-crowned Sparrows (*Z.l. pugetensis* and *Z.l. gambelii*). Changes in wing-length associated with this molt have been noted in other *Zonotrichia* (Piper and Wiley 1991), and are well-documented in other passerine species (Alatalo *et al.* 1984, Stewart 1963).

In this study, we describe first postnuptial wing-length change in samples of Gambel's White-crowned Sparrows from California and Arizona. We use measurements obtained from inclusive age samples of sparrows (*i.e.*, paired immature and adult wing-chord measurements from the *same* birds) to compare wing-length change at three widely-separated geographic locations.

METHODS

We measured wing-length (unflattened chord, recorded to the nearest 1.0 mm using a steel rule with bend-of-wing stop at zero) in immature (HY, SY) and adult (AHY, ASY) White-crowned Sparrows. Sparrows were captured and banded at three locations: Alviso, California (37° 26'N, 121° 56'W), Bakersfield, California (35° 21'N, 119° 09'W), and Tucson, Arizona (32° 10'N, 110° 40'W). Site descriptions and sampling methods are published elsewhere (Barrentine *et al.* 1990).

Measurements reported in this study were obtained from banded immature sparrows that were recaptured as returning adults in a subsequent winter season, 1985-90. That is, we reference paired immature and adult wing-length measurements from the *same* birds. All measurements were made at the time of first capture and first recapture for immatures and returning adults, respectively.

We compare mean wing-length change for samples at each location using two-tailed, paired-sample *t* tests (reject *Ho*: $\mu_a - \mu_i = 0$ if $|t| > t_{0.05(2),v}$). The Kruskal-Wallis test is used to test the *Ho*: wing-length change is the same for the three sample locations (reject *Ho*: $\mu_1 = \mu_2 = \mu_3$ if $|H_c| > \chi^2_{0.05,2}$). Statistical procedures used in this study are described by Zar (1984).

RESULTS AND DISCUSSION

Paired immature and adult wing-length measurements were obtained from a total of 507 White-crowned Sparrows (Table 1). Mean wing-length increase in the first postnuptial molt was statistically significant ($P < 0.001$) for samples at each location (Table 2), and this increase was similar for all three samples ($H_c = 2.29$, df = 2, $P > 0.25$,

Table 1.	Wing-length frequency distributions for inclusive age samples (immature and adult) of White-crowned Sparrows at Alviso, CA; Bakersfileld, CA; and Tucson, AZ.							
	LOCATION							
	Alviso, California		Bakersfield, Calif.		Tucson, Arizona		Combined Locs	
Wing length (mm)	Immat.	Adult	Immat.	Adult	Immat.	Adult	Immat.	Adult
	N	N	N	N	N	N	N	N
82		2				1		3
81		0				4		4
80	1	3		5	2	15	3	23
79	3	10	2	9	6	28	11	47
78	6	9	9	25	22	28	37	62
77	8	17	17	18	21	22	46	57
76	24	21	22	18	32	26	78	65
75	17	17	22	12	33	27	72	56
74	19	14	15	13	23	31	57	58
73	13	10	15	14	41	28	69	52
72	9	13	12	7	35	25	56	45
71	9	9	7	5	18	9	34	23
70	13	5	6	1	13	2	32	8
69	6	1	1	1	1	1	8	3
68	4	1					4	1
x (mm)	73.77	75.03	74.58	75.76	74.28	75.64	74.22	75.51
SD (mm)	2.79	2.80	2.28	2.48	2.45	2.76	2.52	2.72
N	132		128		247		507	

Kruskal-Wallis test, corrected for tied ranks). Overall, mean wing-length increased by 1.3 mm (or 1.7 %) in the first postnuptial molt.

Our observations of wing-length change compare favorably with the findings of three other studies. Mewaldt (1973) found mean wing-length increases of 1.1 to 1.5 mm (changes ranged from -2 mm to +5 mm) in inclusive age samples of *Z.l. gambelii* and *Z.l. pugetensis* from San Jose, California. Fugle and Rothstein (1985) found that the mean wing-length of adults was 1.4 mm (or 1.9 %) longer than immatures in mutually exclusive age samples of *Z.l. gambelii* from Santa Barbara, California. Finally, Mewaldt and King (1986) found that the mean wing-length of adult *Z.l. gambelii* was 1.2 and 1.4 mm (or 1.6 and 1.9%) longer than immatures in mutually exclusive age samples from Tucson, Arizona, and San Jose, California, respectively.

SUMMARY

We document wing-length change in the first postnuptial molt of 507 Gambel's White-crowned Sparrows wintering at Alviso and Bakersfield, California, and Tucson, Arizona. We use paired immature and adult wing-length measurements from the *same* birds to show that (1) mean wing-length increases significantly (1.7%) in the first postnuptial molt, and that (2) this increase in mean wing-length is similar for birds sampled at the three widely-sepa-

rated geographic locations. This study corroborates and extends earlier observations of wing-length change for this subspecies.

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Table 2. Frequency distribution of wing-length change in first postnuptial molt for inclusive age samples of White-crowned Sparrows at Alviso, CA; Bakersfield, CA; and Tucson, AZ.

Wing-length change (mm)	LOCATION			
	Alviso, CA	Bakersfield, CA	Tucson, AZ	Comb. Loc.
	N	N	N	N
+5	3		3	6
+4	11	3	12	26
+3	17	10	34	61
+2	22	33	71	126
+1	34	49	59	142
0	27	27	45	99
-1	14	6	17	37
-2	4		6	10
$\bar{x}$ (mm)	+1.26	+1.18	+1.36	+1.29
SD(mm)	1.63	1.08	1.42	1.40
N	132	128	247	507
t	8.87	12.41	15.08	20.81
(P)	*(P<0.001)*	*(P<0.001)*	*(P<0.001)*	*(P<0.001)*

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