

Short Communications

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Specimen Shrinkage in Cinnamon Teal

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ABSTRACT.—Body size measurements from freshly collected birds and dried museum specimens were used to evaluate specimen shrinkage in Cinnamon Teal (*Anas cyanoptera*). Six of seven body measurements of female Cinnamon Teal differed significantly after specimen drying, whereas five of seven male body measurements differed. The largest amount of shrinkage was in bill height, bill width, and tarsus length. Bill length at nares showed no significant shrinkage suggesting it is a more conservative measurement than exposed culmen and, therefore, a more reliable method for accurately measuring bill length. Correction values for body size measurements are reported for future waterfowl studies combining measurements of both live birds and museum specimens. Received 1 March 2007. Accepted 6 September 2007.

Specimen shrinkage during the process of drying is common. Shrinkage can cause analytical problems if not properly corrected in studies involving live or freshly killed birds and museum specimens (e.g., Winker 1996). Correction for shrinkage is needed before applying to live birds when developing classification criteria for gender, subspecies, or species based on morphological features from museum specimens (Greenwood 1979, Jenni and Winkler 1989, Winker 1993). For example, Mueller (1990) reported that a shrinkage value of 1.72% would comprise 34% of wing length differences between male and female Northern Saw-whet Owls (*Aegolius acadicus*). In addition, the amount of shrinkage varies among body parts and species (Winker 1993).

Shrinkage values from one taxon may have limited use outside that particular taxon or similar morphological species because of the morphological diversity of birds and variety of preparation techniques (Jenni and Winkler 1989, Winker 1993). Specimen shrinkage in waterfowl has yet to be investigated. This pa-

per reports shrinkage values for Cinnamon Teal (*Anas cyanoptera*), which may be used to develop correction values for similar size (~350–550 g) waterfowl.

METHODS

Cinnamon Teal are widespread throughout the Western Hemisphere and five subspecies currently are recognized (Snyder and Lumsden 1951, Delacour 1956, AOU 1957, Johnsgard 1978, Gammonley 1996). The three most widespread subspecies of Cinnamon Teal (*A. c. cyanoptera*, *A. c. orinotus*, and *A. c. septentrionalium*; 26 females, 80 males) were collected in Argentina (2003), Peru (2002), and western United States (2002–2003) as part of a larger population genetic and morphological study. Even though subspecies are distinct in overall body size, there is overlap in measurements among subspecies (R. E. Wilson, unpubl. data). Therefore, different subspecies were pooled for each gender to ascertain the extent of shrinkage for each measurement.

Seven body measurements were recorded for each bird (± 0.1 mm unless otherwise indicated; Baldwin et al. 1931): wing chord length (carpal joint to longest primary feather unflattened; ± 1 mm), tail length (± 1 mm), exposed culmen length (edge of forehead feathers to posterior edge of nail), bill length at nares (posterior edge of nares to posterior edge of nail), total tarsus length (top of bent knee to bottom of foot), bill height (height of upper mandible at nares), and bill width (width of upper mandible at nares). Measurements were taken the same day specimens were collected prior to preparation as museum specimens (fresh measurements), and subsequently 9 months to 2 years after preparation (dry measurements from standard museum round skins) by the same individual (R. E. Wilson) with the same set of calipers. The right wing and tarsus were used for fresh and dry measurements of each specimen. Voucher

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TABLE 1. Effects of shrinkage on body measurements of Cinnamon Teal with correction values from dried specimens to live birds.

Gender	n	Mean length (mm)				<i>t</i> ^a	P	Shrinkage %	SE	Correction factor
		Fresh	SE	Dry	SE					
Males										
Wing chord	80	194.51	1.57	191.00	1.49	8.44	<0.001	2.12	0.25	1.018
Total tarsus	80	41.92	0.26	40.46	0.23	11.21	<0.001	3.43	0.30	1.036
Tail	80	83.04	0.74	93.66	0.95	-0.91	0.366	-0.83	0.83	0.887
Bill nares	80	35.07	0.20	35.08	0.19	-0.04	0.968	-0.03	0.18	1.000
Bill culmen	80	45.63	0.23	45.10	0.26	4.29	<0.001	1.16	0.27	1.012
Bill height	80	13.72	0.09	12.97	0.10	8.01	<0.001	5.36	0.66	1.058
Bill width	80	16.89	0.08	15.95	0.11	11.98	<0.001	6.44	0.54	1.059
Females										
Wing chord	26	189.69	2.88	185.46	2.59	5.25	<0.001	2.17	0.39	1.023
Total tarsus	26	41.56	0.42	39.89	0.42	4.64	<0.001	3.94	0.84	1.042
Tail	26	81.54	1.58	84.49	1.89	-2.35	0.027	-3.73	1.53	0.965
Bill nares	26	32.79	0.28	32.7	0.30	0.71	0.483	0.28	0.38	1.003
Bill culmen	26	43.04	0.38	42.55	0.38	2.54	0.018	1.11	0.44	1.012
Bill height	26	13.06	0.17	12.6	0.20	2.48	0.020	3.45	1.42	1.037
Bill width	26	16.34	0.19	15.3	0.20	5.29	<0.001	6.21	1.15	1.068

^a *t*-value from paired sample *t*-test.

specimens are archived at the University of Alaska Museum (Fairbanks). A paired *t*-test was used to compare differences between fresh and dry measurements. Pearson correlation values were used to examine the relationship between body mass and percent shrinkage.

RESULTS

Five of the seven measurements for males had significant differences after drying (Table 1). There was no significant change in tail length or bill length at nares, but both measurements showed an increase after drying. All other measurements had >1% decrease with bill height and bill width having the largest shrinkage. Percent shrinkage of total tarsus length (Pearson correlation = 0.255, *P* = 0.023) and culmen length (Pearson correlation = -0.356, *P* = 0.001) had a significant relationship with body mass.

Six of the seven body measurements for females had significant differences after drying (Table 1). Bill length at nares had no significant difference. All measurements except tail length decreased after drying with bill width and total tarsus having the greatest amount of shrinkage. There were no significant relationships between any of the shrinkage measurements and body mass.

DISCUSSION

Cinnamon Teal had significant changes after specimen preparation for most measurements. Specimen preparation may have contributed to differences between measurements besides the drying process. The bills of specimens were tied to keep them closed during the drying process in the field. Tying of bills may have squeezed the bill together, slightly decreasing bill width. Tail length increased after drying for House Sparrows (*Passer domesticus*) and was attributed to the retraction of the intercalaminal skin (Bjorndal 1983).

Bill length is an important descriptor for studying feeding ecology (Borras et al. 2000) and subspecies classification (e.g., Ridgway 1902, Hall 1996). Therefore, it is critical to have a bill measurement that is repeatable and accurate. There are several ways to measure bill length with the three main alternatives being total culmen length, exposed culmen length, and length from the nares (Baldwin et al. 1931). Fjelds  (1980) suggested the amount of shrinkage of the exposed culmen will vary according to bill anatomy and, thus, one universal correction factor would not be applicable to all bird species. This has led to the suggestion that bill length from the posterior edge of the nares is the most reliable

bill measurement as both end points are easily defined (Winker 1998, Borrás et al. 2000). This study confirms the recommendation, in particular for waterfowl, that bill length should be measured from the nares, especially if no correction factors are available.

The range of shrinkage values of -3.73 to 6.44% for Cinnamon Teal is comparable to other studies, which report values ranging from -1.5 to 4.0% depending on the body measurement. Correction values to convert dry measurements ranged from 1.000 to 1.068 for measurements that decreased and 0.887 (males, not significant) and 0.965 (females) for tail lengths which increased (Table 1). Winker (1993) suggested correction values that ranged from 0.960 to 0.996 (fresh to dry) which converts to 1.004 – 1.040 (dry to fresh). No previous data describing specimen shrinkage have been reported for waterfowl to our knowledge; the values reported here provide general correction factors for future studies of morphology in similar sized waterfowl.

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