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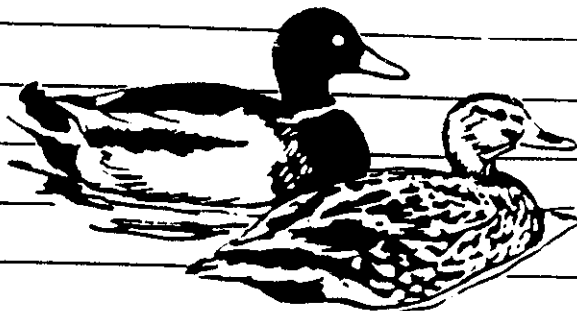
Information bulletin

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A Simple Morphometric Method to Distinguish Tule and Pacific Subspecies of Greater White-fronted Geese

The Pacific Flyway population of greater white-fronted geese (*Anser albifrons*) consists of two recognized subspecies: the Pacific (*A. a. frontalis*) and the Tule (*A. a. gambelli*). The Pacific subspecies nests primarily on the Yukon–Kuskokwim River Delta of western Alaska and the Tule subspecies nests in the region near Trading and Redoubt bays of the Cook Inlet in south-central Alaska. Both subspecies are found in the same areas of the Central Valley of California during winter, but Tule geese have a strong affinity for feeding and roosting in wetland habitats, whereas Pacific geese feed predominantly in agricultural fields.

The Tule subspecies is the smallest population of North American geese, composing less than 3% of the estimated 230,000 greater white-fronted geese in the Pacific Flyway. Conservation and management of this population are complicated by the difficulty in distinguishing Tule geese from the Pacific subspecies. Although Tule geese are generally larger and darker than Pacific geese, biologists with little or no experience applying these qualitative characteristics may have difficulty separating the two subspecies in the hand. Resource managers, however, need to be able to positively identify Tule geese from Pacific geese to determine both breeding distribution and harvest rates of the different subspecies in their local area. We present an improved method of using simple body measurements to distinguish the Tule and Pacific subspecies of greater white-fronted geese.

Body Measurements Were Compiled From Live Specimens

We compiled body measurements from 650 adult greater white-fronted geese captured during research projects conducted in the Pacific Flyway. The six measurements common to these research projects included total tarsus, culmen-1 length, bill height, bill width, body weight, and diagonal tarsus. A multivariate analysis of variance showed that males and females had significantly different body measurements. Therefore, to distinguish Tule and Pacific geese, we used separate stepwise discriminant function analyses for each sex.

We verified the subspecies of each goose in the dataset through comparisons with morphometrics of geese captured at the major Pacific Flyway nesting areas of Cook Inlet (Tule) and the Yukon–Kuskokwim Delta (Pacific). The measurement dataset was divided into training and test groups selected randomly before conducting

analyses. The large training dataset ($n = 590$) was used in the discriminant function analysis to produce the best measurement model for separating the subspecies. The smaller test dataset ($n = 60$) was used to examine misclassification error rates of the final model.

Discriminant Function Models Were Used to Separate Subspecies

The multivariate analysis of variance test indicated that culmen 1 ($C1$), bill width (BW), and bill height (BH) measurements (Figure) separated the subspecies. The best-fitting discriminant function models were obtained for each sex. Tule goose males were correctly classified 90% of the time and females were properly identified 96% of the time with the training dataset. Similar success was achieved in correctly identifying the Pacific subspecies, and a highly significant proportion of both males (94%) and females (97%) were correctly classified. The error rate determined with the test datasets indicated 0% of the male and female Tule geese and 5% of male and female Pacific geese were misclassified. Thus, the correct subspecies was determined for more than 95% of the sampled geese.

Bill Measurements Provide a Simple Method to Identify Tule Geese

Our method to separate adult Tule from Pacific geese requires a simple, three-step process: (1) determine sex by using a standard cloacal examination, (2) measure the bill width and bill height (males) or bill width and culmen 1 (females) with vernier calipers (Figure), and (3) calculate an index (Y) from the following equations:

$$Y_{Male} = 1.692 \, (BW) + 0.986 \, (BH) - 70.417$$

$$Y_{Female} = 2.479 \, (BW) + 0.889 \, (C1) - 108.045$$

A greater white-fronted goose with a positive index ($Y > 0$) verifies the individual is a Tule goose with 95% certainty. Conversely, a negative index ($Y < 0$) confirms the bird is a Pacific goose.

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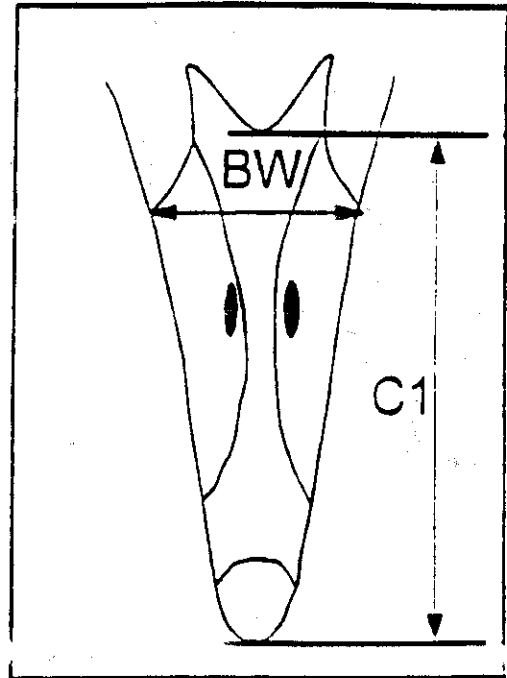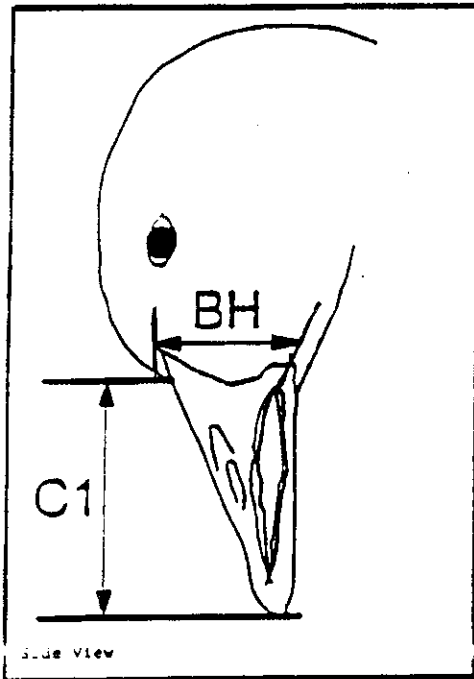6924 Tremont Road
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Figure. Location of culmen 1 ($C1$), bill height (BH), and bill width (BW) measurements to separate greater white-fronted goose subspecies.