QUANTIFYING BODY CONDITION OF SONGBIRDS AT A MIGRATION STOPOVER SITE IN COASTAL SOUTHERN NEW ENGLAND

BY

MEGAN L. WHITMAN

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ABSTRACT

Songbirds primarily use their fat reserves to fuel the energetic cost of migration, although protein reserves are also used. To date, researchers have few accurate, nondestructive techniques with which to estimate body composition dynamics in migratory songbirds. We evaluated three nondestructive techniques, total body electrical conductivity (TOBEC), dilution of isotope-labeled water, and fat score, for estimating lean and/or fat mass in four species of migratory songbird (mass range 9–29g): Black-throated Blue Warblers (*Dendroica caerulescens*; n = 12), Yellow-rumped Warblers (*Dendroica coronata*; n = 15), Red-eyed Vireos (*Vireo olivaceus*; n = 17), and White-throated Sparrows (*Zonotrichia albicollis*; n = 16). To determine the accuracy and precision of each technique, we built linear or nonlinear regression models for estimating lean and fat mass for each species (intraspecific models) as well as for all species combined (interspecific models). Although TOBEC was ineffective at estimating body composition of the smallest species, for the other three songbird species, intraspecific models given TOBEC and structural measures estimated lean and fat mass within 0.3–1.1g (or 2–7% and 18–75% relative error, respectively). The interspecific model given TOBEC and structural measures estimated lean mass within 0.4–0.8g (or 3–5%). Using deuterium dilution, we estimated lean and fat mass within 0.2–0.9g (or 2–5% and 26–34%, relative error, respectively) using intraspecific models, and fat mass within 0.4–0.6g (or 16–49%) using the interspecific model. Using fat score, we estimated fat mass within 0.2–0.5g (or

13–36%) using intraspecific models. In general, interspecific models given only fat score estimated fat mass less accurately compared to the intraspecific models. Because of the error of these interspecific models using only fat score, we recommend using deuterium to estimate fat mass. Using TOBEC to estimate lean mass and deuterium to estimate fat mass, we estimated lean mass within 0.8–1.1g (or 5–7%) and fat mass within 0.2–0.9g (or 26–34%.

In summary, the interspecific models were usually at least as accurate and precise as the intraspecific models for estimating the body composition of these four species of songbird. These results suggest that species-specific predictive models are not necessarily required for nondestructively estimating the body composition dynamics of migratory birds. Also, given that the lean and fat mass of migratory songbirds can change as much as 40% and 80%, respectively, the use of TOBEC to estimate lean mass and deuterium dilution to estimate fat mass offers a reasonable "dual" approach for measuring body composition dynamics of songbirds during their migration.