

COMMENTARY

ON THE ALLOMETRIC RELATIONSHIP BETWEEN SIZE AND COMPOSITION OF AVIAN EGGS: A REASSESSMENT

TODD W. ARNOLD^{1,3} AND ANDY J. GREEN²

¹*Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, 1980 Folwell Avenue, St. Paul, MN 55108*

²*Department of Applied Biology, Estación Biológica de Doñana, Avda. Maria Luisa s/n, E-41013, Sevilla, Spain*

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³ E-mail: arnol065@umn.edu

Abstract. Numerous investigators have used allometric regression to characterize the relationship between proportional egg composition and egg size, which is a potentially important characterization for assessing maternal investment in reproduction. Herein, we document two important shortcomings of this approach. First, regressing log component mass against log egg mass involves regressing Y on itself, since each component (Y) is necessarily a part of the whole egg (X). This creates correlated errors, which leads to biased estimates of the regression slope. To circumvent this problem, we recommend regressing egg component masses on a relatively inert component like total water mass. Secondly, investigators routinely use ordinary least squares regression to estimate the slope of allometric relationships, which assumes that all error resides in Y. We demonstrate that this assumption is false, but so are the underlying error assumptions of commonly used alternatives such as reduced major axis and major axis regression. Because each egg is unique and determining composition involves destructive sampling, there is no obvious way to assess measurement error in Y versus X. As a solution, we recommend that investigators analyze multiple eggs per clutch whenever possible and fit a reduced major axis based on the among-female component of variability.

Key words: allometry, egg composition, egg size, ordinary least squares regression, reduced major axis regression.