Using Weight-Length Relationships to Assess Physical Condition of Cottontail Rabbits in Northcentral Oklahoma

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We analyzed weight-length relationships for a population (n=536) of cottontail rabbits (*Sylvilagus floridanus*) collected in July and January, between 1986 and 1992, in Payne County, northcentral Oklahoma. A method for indexing physical condition (CI) of cottontails based on these relationships is described. A similar method developed by Bailey (*1*) for this species in Illinois has been widely used to evaluate physical condition throughout its range. However, well-documented geographical variations in the body sizes of *S. floridanus* (*2*) may invalidate Bailey's method for northtcentral Oklahoma populations.

Our definition of physical condition follows that of Bailey (*1*), a measure of slenderness or heaviness of an individual relative to skeletal structure. Therefore, our CI is an index of a cottontail's physical condition, whether it is the result of extrinsic factors such as food availability, climatic condition, and season, or intrinsic factors such as parasitic infestation and disease. One important difference in our technique is that we measure "length" as the distance from the tip of the nose to the last caudal vertebra, whereas Bailey (*1*) measured from nose tip to the end of the extended hind foot.

Cottontails were collected shortly after sunset with a shotgun and spotlight. Carcasses were packed on ice, returned to the laboratory, and necropsied within 24 h, or frozen until a necropsy could be performed. Weight and length were recorded for each individual; values were rounded to the nearest centigram and millimeter. For the analysis, lengths were expressed in decimeters, as recommended by Bailey (*1*). The weight of testicles and of the products of pregnancy was not subtracted from the body weight of an adult. Juveniles (nonreproductively active individuals with body weight less than 800 g) were also included in the analysis to provide a more robust index applicable to all cottontails inhabiting northcentral Oklahoma. Data for males and females were combined because the weight-length relationship is reported to be negligibly different for them (*1*), and because this negligible difference between sexes is supported by our study.

In developing our CI, we first regressed body weight W against length cubed L^3 and generated a weight-predictor equation (Fig. 1):

$$W = 251.09 + 12.35\ L^3.$$

This regression equation, linear in L^3 , results in a coefficient of determination (r^2=0.66) which is not improved by a quadratic (in L^3) regression (Fig. 1) (r^2 = 0.69).

Since the coefficient of determination from the quadratic regression was not significantly better, the simpler linear regression equation was developed into a CI. The linear weight-predictor equation was converted to an equation for predicting a cottontail's physical condition:

$$CI = (W - 251.09)/L^3$$

by allowing the regression coefficient (i.e., 12.35) to represent the CI of an *average* cottontail and solving the weight-predictor

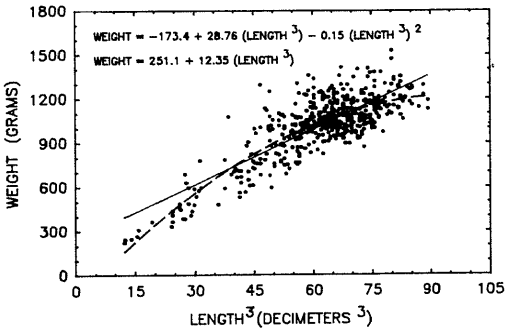

Figure 1. Linear (——) and quadratic (— —) regressions of weight versus length^3 for 536 cottontail rabbits collected in northcentral Oklahoma from 1986 to 1992.

equation for this coefficient. A CI greater than 12.35 suggests that an individual is heavier than average for its length, while a CI lower than 12.35 suggests the opposite. Bailey's (*1*) CI had an average CI value of 5.48.

Weights of the smallest cottontails were more accurately estimated by the quadratic regression equation (dashed line in Fig. 1). Therefore, if a more accurate assessment of the physical condition of juveniles is necessary, the quadratic weight-predictor equation should be used. The actual weight of an individual is divided by the estimated weight from the quadratic weight-predictor equation. Resulting values above 1.0 indicate that the individual is in good physical condition, while values below 1.0 suggest the opposite.

There was <5% (26 of 536 individuals) discrepancy between the CI and quadratic weight-predictor equations, with 50% (13 of 26) of this discrepancy attributable to classifying juveniles as being "in poor physical condition" by the simpler CI equation. Similarity in the results of these methods suggests that our CI equation provides an accurate and easily applied means for assessing the physical condition of cottontails.

An average CI of 12.22 in our study suggests that many cottontails weighed less than normal during our collections. Cottontails collected during July were in better condition than those taken in January (July average CI = 12.37; January average CI = 12.02). However, both July and January appear to be periods of physical stress for many cottontails in northcentral Oklahoma; individuals in both months had CI values less than 12.35.

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