

Statistical Estimation of Maxima: *Racing Sceloporus Occidentalis*

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The purpose of this project was to, given a distribution of average speeds of racing lizards, determine an accurate model for predicting each lizard's maximum running speed

By racing 8 lizards 100 times each, finding each one's average speed, and subtracting that value from their individual performances, I got a distribution of residuals that I could group together. The rationale for this aggregation of data is that the distribution, it has been shown, of each lizard can be shown to come from the same parent distribution.

The resulting distribution had a maximum of 1.3584, meaning that the greatest positive deviation for any lizard above their mean speed was 1.3584 meters per second.

Fitting a normal curve to the distribution of residuals gave a curve fit with an r-value of .999. Using the parameters of that curve, a residual of 1.3584 or greater had a 0.0001 chance of occurring. Because we know that the true distribution of residuals must be bounded; i.e., there is a maximum and minimum running speed, this normalized probability merely gives an indication of how close we are to a maximum in a bounded environment. The simple solution was to multiply 1.3584 by $1/(1-0.0001)$, and use this estimate for a maximum as the population maximum.

By adding the resulting "maximum" residual, 1.3585, to the means of each lizard, we could predict what their maximum speed would be in an ideal situation. When each lizard's sample mean was subtracted from their maximum, then divided by 1.3585, a value between zero and one was given that indicated how close each lizard got, on a scale from 0 to 1, to the predicted maximum.

When graphed against their means, this indicator value was shown to have a positive linear correlation of .5028. There was a single outlier, which, when excluded, gave a correlation of .78. Thus, this method of predicting maxima seems to be more accurate for faster lizards. Further work could involve more lizards, and fewer runs each, as the final assay performed was hamstrung by lack of individuals.

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