New Effect Sizes: Acclimation Response Ratio (ARR)

ARR (Acclimation Response Ratio)

Point estimate and definition

$$\mathrm{ARR} = \frac{\mathrm{CT}_{\max[T_2]} - \mathrm{CT}_{\max[T_1]}}{T_2 - T_1},$$

where T stands for temperature in Celsius and $T_2 > T_1$.

Sampling variance for AAR

Independent case

$$s^2(\mathrm{AAR}) = \left(\frac{1}{T_2 - T_1}\right)^2 \left(\frac{sd^2_{[T_1]}}{n_{[T_1]}} + \frac{sd^2_{[T_2]}}{n_{[T_2]}}\right).$$

Dependent case

$$s^2(\mathrm{AAR}) = \left(\frac{1}{T_2 - T_1}\right)^2 \left(\frac{sd^2_{[T_1]} + sd^2_{[T_2]} - r_{[T_1T_2]} sd_{[T_1]} sd_{[T_2]}}{n}\right).$$

Basics about variance

See https://en.wikipedia.org/wiki/Variance

Adding a constant (a) does not change the variance of a random variable X.

$$\mathrm{Var}(X + a) = \mathrm{Var}(X)$$

Multiplying a constant (a) does increase the variance of X by a^2.

$$\mathrm{Var}(aX) = a^2 \,\mathrm{Var}(X)$$

When we consider two random variables X and Y, we need to know their covariance.

$$\mathrm{Var}(aX \pm bY) = a^2 \,\mathrm{Var}(X) + b^2 \,\mathrm{Var}(Y) \pm 2ab \,\mathrm{Cov}(X, Y)$$