The adequacy of aging techniques in vertebrates for rapid estimation of population mortality rates from age distributions

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Appendix S6: Key mathematical notation

**General notation**

- \( F \): distribution functions
- \( f \): (probability) density functions
- \( \Phi(z) \): standard normal distribution function
- \( \varphi(z) \): standard normal density function

**Birth and survival related notation**

- \( S \): survival time
- \( F_S(s) \): the distribution function of survival time \( S \)
- \( f_S(s) \): the density function of survival time \( S \)
- \( T \): time of birth of a random individual from the population
- \( f_T(t) \): the density function of time of birth \( T \)
- \( \tau \): the maximum possible age an individual from the population can attain

**Linear regression related notation**

- \( X \): age proxy
- \( X_1, \ldots, X_n \): independent and identically distributed copies of \( X \)
- \( x_1, \ldots, x_n \): realization of the random variables \( X_1, \ldots, X_n \)
- \( Y \): age
- \( f_Y(y) \): density function of the age of an individual at time 0
- \( g(y) \): regression function relating age proxy to age
- \( \alpha \): intercept for linear regression of age proxy against age
- \( \beta \): slope for linear regression of age proxy against age
- \( \sigma \): standard deviation of the error in the regression model
- \( \varepsilon \): standardized error in the regression model
- \( f_\varepsilon(z) \): density function for \( \varepsilon \)
- \( F_\varepsilon(z) \): distribution function for \( \varepsilon \)
\( n \): sample size, i.e., the number of sampled individuals of which the age proxy is measured

*Mortality rate related notation*

\( m \): mortality rate

\[ \lambda = -\ln(1 - m) \]: rate parameter of exponential distribution

\( \beta / \sigma \): the crucial indicator for the variation in estimated mortality rate

\[ \mu = \sigma \lambda / |\beta| \]: proxy coefficient

\( \hat{\mu}_n \): asymptotically efficient estimator of \( \mu \)

\( I(m) \): Fisher information for mortality rate \( m \)

\( J(\mu) \): Fisher information for \( \mu \)

\( CR(95) \): 95\% confidence range

\( EP(95) \): theoretical 95\% error percentage for mortality rate \( m \)

\( EEP(95) \): empirical 95\% error percentage for mortality rate \( m \)

\( \hat{m}_n \): efficient estimator for mortality rate \( m \)

\[ \frac{1}{m \sqrt{I(m)}} \]: the basic factor used in the calculation of 95\% error percentage \( EEP(95) \)