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 \( EEP(95) \)