Appendix D. Intraclass correlation coefficient (ICC) and R^2 equations for mixed models.

Equation to estimate intraclass correlation (ICC) for random intercept model

After Goldstein et al. (2002), we calculate the ICC for a random intercept only model as:

$$ICC_{\gamma|\delta} = \frac{\sigma^2_{\gamma|\delta}}{\sigma^2_{\gamma|\delta} + \sum_{l=1}^{u} \sigma_l^2 + \sigma_e^2} \qquad \text{Eq. D.1}$$

where $\sigma^2_{\gamma|\delta}$ is the *Year* or *Cohort* random intercept variance, *u* is the number of random effects in the model, σ_l^2 is the variance component for the *l*th random effect and σ_e^2 is the residual variance.

R^2 for mixed effects models

Describing the amount of variance explained by mixed effects models has proven a difficult task due to complex variance structures (see discussion in Nakagawa and Schielzeth 2013). Here we employ and present two R^2 metrics (calculated on models fit with REML) defined for mixed effects models by Nakagawa and Schielzeth (2013). The first, called the marginal R^2, describes the proportion of variance explained by fixed effects alone:

$$R^2_{LMM(m)} = \frac{\sigma_F^2}{\sigma_F^2 + \sum_{l=1}^{u} \sigma_l^2 + \sigma_e^2} \qquad \text{Eq. D.2}$$

where σ_F^2 is the variance calculated from the fixed effect component of the linear mixed model. The second, called the conditional R^2, describes the proportion of variance explained by fixed and random effects combined:

$$R^2_{LMM(c)} = \frac{\sigma_F^2 + \sum_{l=1}^{u} \sigma_l^2}{\sigma_F^2 + \sum_{l=1}^{u} \sigma_l^2 + \sigma_e^2} \qquad \text{Eq. D.3}$$

Goldstein, H., W. J. Browne, and J. Rasbash. 2002. Partitioning variation in multilevel models. Understanding Statistics **1**:223-232.

Nakagawa, S., and H. Schielzeth. 2013. A general and simple method for obtaining R^2 from generalized linear mixed-effects models. Methods in Ecology and Evolution **4**:133-142.