

Supplementary Data legend

Supplementary Data 1. Species list, ecological traits and environmental variables for all chelonians.

Supplementary Data 2. Results of univariate phylogenetic generalized least squares models for predicting the risk of extinction in chelonians using the combined Red List assessment. The analyses were further conducted for aquatic and terrestrial species and species in each biogeographic realm. The t values were calculated through pooling the results from 100 imputed species trait datasets. The analysis was not conducted for species in marine due to the limited sample size. To minimize the impact of any changes in the threat status of species on our findings, we categorized species into threatened (1) and non-threatened (0) groups and reformed the analyses (phylogenetic logistic regression). The results were adjusted using Rubin's rule, which modifies the standard errors and provides more accurate parameter estimates by incorporating both within-dataset and between-dataset variance.

Supplementary Data 3. The results rank all combinations of these variables based on AICc values. For the 335 data-sufficient chelonians, we built models using various combinations of these variables and ranked all models using the information-theoretic approach based on Akaike's information criterion corrected for small sample sizes (AICc). We used the Akaike weight (w_i) to compare model performance. Abbreviations: df, Degree of freedom; logLik, Log-likelihood; delta, the difference between the AICc

value of a given model and the smallest AICc value among all compared models; weight, Akaike weight.

Supplementary Data 4. Model-averaged parameter estimates (Mean), unconditional standard errors (SE), within-dataset variance, and between-dataset variance across 100 datasets for each variable in the 95% confidence set for each species group. The model-averaged estimates from 100 datasets identified key extinction risk correlates in global chelonians using phylogenetic least squares. For ordinal risk categories (05, from LC to EX), significant variables ($p < 0.05$, two-sided) within the 95% confidence set are presented with model-averaged estimates and adjusted unconditional standard errors (error bars), incorporating both within-dataset and between-dataset variance. Binary risk analysis (01, 0 = non-threatened, 1 = threatened) complemented results for all species. The analysis was not conducted for species in the Palearctic region due to the limited sample size.

Supplementary Data 5. The risk probability of non-assessed (DD + NE) species in the updated Red List. At the species level, we fitted a logistic regression model on the extinction risk of all data-sufficient chelonians using the significant variables identified through the model-average analysis. We then used this model fit to predict the probability of DD and NE species becoming threatened (1) or unthreatened (0) status using the `predict.glm()` function. The model predicted the probability of the DD and NE species having a threatened status (1), which ranged from 0 to 1.