

## **Additional file 1: Linear relationships between ecological parameters and viability metrics**

### ***I. Linear relationships between times to extinction ( $T_D$ , $T_G$ and $T_{DG}$ ) and ecological input data***

In the following Survival model tables, estimates of the coefficients of regression are provided with standard errors ( $sd$ ), Z statistics ( $Z$ ) and p-value ( $P$ ). In generalized linear model (GLM) tables, estimates of the coefficients of regression are provided with standard errors ( $sd$ ), Student statistics ( $T$ ) and p-value ( $P$ ). In hierarchical partitioning (HP) tables, the independent proportion of variance explained by each explanatory variable ( $R^2$ ) is provided with a p-value ( $P$ ) obtained from a randomization test (1000 iterations, see Mac Nally 2002, Walsh & Mac Nally 2003).

The dependent variables were the demographic ( $T_D$ ), genetic ( $T_G$ ) or demo-genetic ( $T_{DG}$ ) median times to extinction. Explanatory variables were the dispersal rate ( $m$ ), the overall carrying capacity ( $K_t$ ), number of patches ( $N$ ), individual fecundity ( $F$ ), per generation frequency of perturbations ( $P$ ) and coefficient of correlation of perturbations among patches ( $C_p$ ). Interactions between explanatory variables were not considered. In all cases,  $T_D$ ,  $T_G$  and  $T_{DG}$  were log-transformed. Other data transformations are directly indicated in tables.

#### **1) Constancy of extinction rates over time**

Exponential and Weibull survival models assuming right censored extinction events were fitted to examine the relationship between extinction times and ecological input parameters, considering all 1476 scenarios (Cox and Oakes 1984). The Weibull and exponential models were compared to describe whether extinction rates were constant over time or not (Crawley, 2007). The analysis indicated that extinction rates were not constant across time for the demographic ( $T_D$ ), genetic ( $T_G$ ) and demo-genetic ( $T_{DG}$ ) median times to extinction (Table I.1.1 below). In all cases, extinction rates increased with time (the log(scale) estimate was significantly different from zero and negative in all Weibull regressions, see Tables I.2.1, I.3.1 and I.4.1 below). All subsequent survival models (subsections 2 to 4) are based on a Weibull distribution of extinction times.

*Table I.1.1 Comparison between exponential and Weibull models (ANOVA) for  $T_D$ ,  $T_G$  and  $T_{DG}$ .*

| Dependant variable | $\chi^2$ | d.f. | P          |
|--------------------|----------|------|------------|
| $T_D$              | 847.1394 | 1    | $<10^{-4}$ |
| $T_G$              | 253.7302 | 1    | $<10^{-4}$ |
| $T_{DG}$           | 767.465  | 1    | $<10^{-4}$ |

## 2) The demographic time to extinction ( $T_D$ )

*Table I.2.1 Relationships between ecological input data and Log( $T_D$ ) (Survival model)*

$n=1476$  datasets; model log-likelihood=-2068.5;  $\chi^2=1691.18$ ; d.f.=6;  $P<10^{-4}$

| Variable | Estimate | sd   | Z    | P          |
|----------|----------|------|------|------------|
| $m$      | 2.67     | 0.34 | 7.83 | $<10^{-4}$ |

|                            |       |      |        |            |
|----------------------------|-------|------|--------|------------|
| $N$                        | -0.01 | 0.00 | -4.19  | $<10^{-4}$ |
| $\text{Log}(K_t)$          | 0.17  | 0.01 | 16.06  | $<10^{-4}$ |
| $F$                        | 1.39  | 0.07 | 20.68  | $<10^{-4}$ |
| $P$                        | -9.68 | 0.22 | -44.87 | $<10^{-4}$ |
| $C_p$                      | -0.41 | 0.03 | -15.47 | $<10^{-4}$ |
| $\text{Log}(\text{scale})$ | -1.07 | 0.03 | -37.51 | $<10^{-4}$ |

*Table I.2.2 Relationships between ecological input data and  $\text{Log}(T_D)$  (GLM)*

$n=770$  datasets, overall adjusted  $R^2=0.69$

| Variable          | Estimate | $sd$ | $T$    | $P$        |
|-------------------|----------|------|--------|------------|
| $m$               | 9.01     | 1.13 | 8.00   | $<10^{-4}$ |
| $N$               | -0.05    | 0.00 | -12.81 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.82     | 0.03 | 23.69  | $<10^{-4}$ |
| $F$               | 6.07     | 0.22 | 27.66  | $<10^{-4}$ |
| $P$               | -18.26   | 0.87 | -21.07 | $<10^{-4}$ |
| $C_p$             | -0.75    | 0.09 | -8.38  | $<10^{-4}$ |

*Table I.2.3 Relationships between ecological input data and  $\text{Log}(T_D)$  (HP)*

$n=770$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | 0.002 | 0.01       |
| $N$               | 0.15  | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.07  | $<10^{-4}$ |
| $F$               | 0.17  | $<10^{-4}$ |

|       |       |            |
|-------|-------|------------|
| $P$   | 0.28  | $<10^{-4}$ |
| $C_p$ | 0.004 | 0.001      |

### 3) The genetic time to extinction ( $T_G$ )

*Table I.3.1 Relationships between ecological input data and  $\text{Log}(T_G)$  (Survival model)*

$n=1476$  datasets; model log-likelihood=-2597;  $\chi^2=1352.8$ ; d.f.=6;  $P<10^{-4}$

| Variable                   | Estimate | $sd$ | $Z$    | $P$        |
|----------------------------|----------|------|--------|------------|
| $m$                        | 6.03     | 0.56 | 10.80  | $<10^{-4}$ |
| $N$                        | -0.03    | 0.00 | -14.40 | $<10^{-4}$ |
| $\text{Log}(K_t)$          | 0.53     | 0.02 | 29.40  | $<10^{-4}$ |
| $F$                        | 1.24     | 0.11 | 11.70  | $<10^{-4}$ |
| $P$                        | -7.48    | 0.34 | -21.90 | $<10^{-4}$ |
| $C_p$                      | 0.73     | 0.05 | 15.30  | $<10^{-4}$ |
| $\text{Log}(\text{scale})$ | -0.44    | 0.02 | -17.80 | $<10^{-4}$ |

*Table I.3.2 Relationships between ecological input data and  $\text{Log}(T_G)$  (GLM)*

$n=990$  datasets, overall adjusted  $R^2=0.87$

| Variable          | Estimate | $sd$ | $T$    | $P$        |
|-------------------|----------|------|--------|------------|
| $m$               | 17.13    | 0.77 | 22.39  | $<10^{-4}$ |
| $N$               | -0.11    | 0.00 | -39.05 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 1.75     | 0.03 | 68.37  | $<10^{-4}$ |
| $F$               | 4.75     | 0.14 | 32.75  | $<10^{-4}$ |

|       |       |      |       |            |
|-------|-------|------|-------|------------|
| $P$   | -4.54 | 0.50 | -9.12 | $<10^{-4}$ |
| $C_p$ | -0.39 | 0.06 | -6.39 | $<10^{-4}$ |

*Table I.3.3 Relationships between ecological input data and  $\text{Log}(T_G)$  (HP)*

$n=990$  datasets

| Variable          | $R^2$ | $P$         |
|-------------------|-------|-------------|
| $m$               | 0.03  | $<10^{-4}$  |
| $N$               | 0.51  | $<10^{-4}$  |
| $\text{Log}(K_t)$ | 0.18  | $<10^{-4}$  |
| $F$               | 0.01  | $<10^{-4}$  |
| $P$               | 0.12  | $<10^{-4}$  |
| $C_p$             | 0.01  | $2.10^{-4}$ |

#### 4) The demo-genetic time to extinction ( $T_{DG}$ )

*Table I.4.1 Relationships between ecological input data and  $\text{Log}(T_{DG})$  (Survival model)*

$n=1476$  datasets; model log-likelihood=-2218.9;  $\chi^2=1751.7$ ; d.f.=6;  $P<10^{-4}$

| Variable          | Estimate | $sd$  | $Z$    | $P$        |
|-------------------|----------|-------|--------|------------|
| $m$               | 1.45     | 0.34  | 4.32   | $<10^{-4}$ |
| $N$               | -0.01    | 0.001 | -4.21  | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.14     | 0.01  | 13.43  | $<10^{-4}$ |
| $F$               | 0.80     | 0.07  | 11.82  | $<10^{-4}$ |
| $P$               | -11.00   | 0.21  | -52.34 | $<10^{-4}$ |
| $C_p$             | -0.14    | 0.03  | -5.29  | $<10^{-4}$ |

|            |       |      |        |            |
|------------|-------|------|--------|------------|
| Log(scale) | -0.92 | 0.03 | -34.10 | $<10^{-4}$ |
|------------|-------|------|--------|------------|

*Table I.4.2 Relationships between ecological input data and Log( $T_{DG}$ ) (GLM)*

$n=927$  datasets, overall adjusted  $R^2=0.74$

| Variable     | Estimate | <i>sd</i> | <i>T</i> | <i>P</i>   |
|--------------|----------|-----------|----------|------------|
| <i>m</i>     | 4.54     | 0.59      | 7.66     | $<10^{-4}$ |
| <i>N</i>     | -0.03    | 0.00      | -11.78   | $<10^{-4}$ |
| Log( $K_t$ ) | 0.63     | 0.02      | 34.37    | $<10^{-4}$ |
| <i>F</i>     | 4.01     | 0.12      | 34.46    | $<10^{-4}$ |
| <i>P</i>     | -6.12    | 0.46      | -13.17   | $<10^{-4}$ |
| $C_p$        | -0.39    | 0.05      | -8.47    | $<10^{-4}$ |

*Table I.4.3 Relationships between ecological input data and Log( $T_{DG}$ ) (HP)*

$n=927$  datasets

| Variable     | $R^2$ | <i>P</i>   |
|--------------|-------|------------|
| <i>m</i>     | NA    | ns         |
| <i>N</i>     | 0.29  | $<10^{-4}$ |
| Log( $K_t$ ) | 0.05  | $<10^{-4}$ |
| <i>F</i>     | 0.06  | $<10^{-4}$ |
| <i>P</i>     | 0.33  | $<10^{-4}$ |
| $C_p$        | 0.005 | 0.05       |

## ***II. Linear relationships between the ratios of the times to extinction and ecological input data***

In the following Generalized Linear Model (GLM) tables, estimates of the coefficients of regression are provided with standard errors (*sd*), Student statistics (*T*) and p-value (*P*). In hierarchical partitioning (HP) tables, the independent proportion of variance explained by each explanatory variable ( $R^2$ ) is provided with a p-value (*P*) obtained from a randomization test (1000 iterations, see Mac Nally 2002, Walsh & Mac Nally 2003).

The dependent variables were the ratios of the times to extinction demographic ( $T_G/T_D$ ,  $T_{DG}/T_D$  and  $T_{DG}/T_G$ ). Explanatory variables were the dispersal rate ( $m$ ), the overall carrying capacity ( $K_t$ ), number of patches ( $N$ ), individual fecundity ( $F$ ), per generation frequency of perturbations ( $P$ ) and coefficient of correlation of perturbations among patches ( $C_p$ ).

Interactions between explanatory variables were not considered. In all cases,  $T_D$ ,  $T_G$  and  $T_{DG}$  were log-transformed (i.e., the dependent variables are the ratios of  $\text{Log}(\text{time to extinction})$ ). Other data transformations are directly indicated in tables.

### **1) The ratio ( $T_G/T_D$ )**

*Table II.1.1 Relationships between ecological input data and  $\text{Log}(T_G)/\text{Log}(T_D)$  (GLM)*

$n=695$  datasets, overall adjusted  $R^2=0.78$

| Variable          | Estimate | <i>sd</i> | <i>T</i> | <i>P</i>    |
|-------------------|----------|-----------|----------|-------------|
| $m$               | 1.53     | 0.17      | 9.09     | $<10^{-4}$  |
| $N$               | -0.02    | 0.00      | -27.52   | $<10^{-4}$  |
| $\text{Log}(K_t)$ | 0.21     | 0.01      | 38.68    | $<10^{-4}$  |
| $F$               | 0.11     | 0.03      | 3.40     | $7.10^{-4}$ |

|       |      |      |       |            |
|-------|------|------|-------|------------|
| $P$   | 1.60 | 0.12 | 12.97 | $<10^{-4}$ |
| $C_p$ | 0.07 | 0.01 | 5.78  | $<10^{-4}$ |

*Table II.1.2 Relationships between ecological input data and  $\text{Log}(\mathbf{T}_G)/\text{Log}(\mathbf{T}_D)$  (HP)*

$n=695$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | 0.02  | $<10^{-4}$ |
| $N$               | 0.23  | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.44  | $<10^{-4}$ |
| $F$               | NA    | ns         |
| $P$               | 0.06  | $<10^{-4}$ |
| $C_p$             | 0.02  | $<10^{-4}$ |

## 2) The ratio ( $\mathbf{T}_{DG}/\mathbf{T}_D$ )

*Table II.2.1 Relationships between ecological input data and  $\text{Log}(\mathbf{T}_{DG})/\text{Log}(\mathbf{T}_D)$  (GLM)*

$n=770$  datasets, overall adjusted  $R^2=0.41$

| Variable          | Estimate | $sd$  | $T$     | $P$        |
|-------------------|----------|-------|---------|------------|
| $m$               | -0.610   | 0.072 | -8.426  | $<10^{-4}$ |
| $N$               | 0.001    | 0.000 | 4.293   | $<10^{-4}$ |
| $\text{Log}(K_t)$ | -0.006   | 0.002 | -2.479  | 0.013      |
| $F$               | -0.166   | 0.014 | -11.769 | $<10^{-4}$ |
| $P$               | 0.997    | 0.056 | 17.919  | $<10^{-4}$ |
| $C_p$             | 0.051    | 0.006 | 8.813   | $<10^{-4}$ |

Table II.2.2 Relationships between ecological input data and  $\text{Log}(\mathbf{T}_{\text{DG}})/\text{Log}(\mathbf{T}_{\text{D}})$  (HP)

$n=770$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | 0.047 | $<10^{-4}$ |
| $N$               | 0.010 | $<10^{-4}$ |
| $\text{Log}(K_i)$ | NA    | ns         |
| $F$               | 0.071 | $<10^{-4}$ |
| $P$               | 0.233 | $<10^{-4}$ |
| $C_p$             | 0.047 | $<10^{-4}$ |

### 3) The ratio ( $\mathbf{T}_{\text{DG}}/\mathbf{T}_{\text{G}}$ )

Table II.3.1 Relationships between ecological input data and  $\text{Log}(\mathbf{T}_{\text{DG}})/\text{Log}(\mathbf{T}_{\text{G}})$  (GLM)

$n=794$  datasets, overall adjusted  $R^2=0.19$

| Variable          | Estimate | $sd$  | $T$     | $P$        |
|-------------------|----------|-------|---------|------------|
| $m$               | -8.566   | 5.100 | -1.679  | ns         |
| $N$               | 0.149    | 0.019 | 7.882   | $<10^{-4}$ |
| $\text{Log}(K_i)$ | -1.744   | 0.169 | -10.298 | $<10^{-4}$ |
| $F$               | -6.353   | 0.964 | -6.589  | $<10^{-4}$ |
| $P$               | -1.283   | 3.848 | -0.333  | ns         |
| $C_p$             | -0.060   | 0.384 | -0.156  | ns         |

Table II.3.2 Relationships between ecological input data and  $\text{Log}(\mathbf{T}_{\text{DG}})/\text{Log}(\mathbf{T}_{\text{G}})$  (HP)

$n=794$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | NA    | ns         |
| $N$               | 0.058 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.091 | $<10^{-4}$ |
| $F$               | 0.038 | $<10^{-4}$ |
| $P$               | NA    | ns         |
| $C_p$             | NA    | ns         |

### ***III. Appendix S3: Linear relationships between the residuals of regression models involving $T_D$ , $T_G$ and $T_{DG}$ and ecological input data***

In the following Generalized Linear Model (GLM) tables, estimates of the coefficients of regression are provided with standard errors (*sd*), Student statistics (*T*) and p-value (*P*). In hierarchical partitioning (HP) tables, the independent proportion of variance explained by each explanatory variable ( $R^2$ ) is provided with a p-value (*P*) obtained from a randomization test (1000 iterations, see Mac Nally 2002, Walsh & Mac Nally 2003).

The dependent variables were the residuals of univariate regression models involving  $T_D$ ,  $T_G$  and  $T_{DG}$ . Explanatory variables were the dispersal rate (*m*), the overall carrying capacity ( $K_t$ ), number of patches (*N*), individual fecundity (*F*), per generation frequency of perturbations (*P*) and coefficient of correlation of perturbations among patches ( $C_p$ ). Interactions between explanatory variables were not considered. In all cases,  $T_D$ ,  $T_G$  and  $T_{DG}$  were log-transformed. Other data transformations are directly indicated in tables.

#### **1) Residuals of the regression of $\text{Log}(T_{DG})$ by $\text{Log}(T_D)$**

$T_{DG}$  and  $T_D$  were positively correlated and  $T_D$  explained 68% of the variance in  $T_{DG}$ . The analysis of residuals is presented below.

*Table III.1.1 Relationships between ecological input data and residuals (GLM)*

*n*=770 datasets, overall adjusted  $R^2$ =0.26

| Variable          | Estimate | <i>sd</i> | <i>T</i> | <i>P</i>   |
|-------------------|----------|-----------|----------|------------|
| <i>m</i>          | -2.487   | 0.470     | -5.287   | $<10^{-4}$ |
| <i>N</i>          | -0.003   | 0.002     | -1.617   | ns         |
| $\text{Log}(K_t)$ | 0.159    | 0.014     | 10.956   | $<10^{-4}$ |

|       |       |       |       |            |
|-------|-------|-------|-------|------------|
| $F$   | 0.240 | 0.092 | 2.614 | 0.009      |
| $P$   | 2.323 | 0.362 | 6.420 | $<10^{-4}$ |
| $C_p$ | 0.261 | 0.038 | 6.961 | $<10^{-4}$ |

*Table III.1.2 Relationships between ecological input data and residuals (HP)*

$n=770$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | 0.012 | ns         |
| $N$               | 0.081 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.434 | $<10^{-4}$ |
| $F$               | 0.031 | 0.001      |
| $P$               | 0.045 | 0.009      |
| $C_p$             | 0.011 | ns         |

## 2) Residuals of the regression of $\text{Log}(T_{DG})$ by $\text{Log}(T_G)$

$T_{DG}$  and  $T_G$  were positively correlated and  $T_G$  explained 65% of the variance in  $T_{DG}$ . The analysis of residuals is presented below.

*Table III.2.1 Relationships between ecological input data and residuals (GLM)*

$n=796$  datasets, overall adjusted  $R^2=0.17$

| Variable          | Estimate | $sd$  | $T$    | $P$        |
|-------------------|----------|-------|--------|------------|
| $m$               | -1.854   | 0.472 | -3.925 | $<10^{-4}$ |
| $N$               | 0.011    | 0.002 | 6.363  | $<10^{-4}$ |
| $\text{Log}(K_t)$ | -0.060   | 0.016 | -3.844 | 0.0001     |
| $F$               | 1.468    | 0.089 | 16.434 | $<10^{-4}$ |

|       |        |       |         |            |
|-------|--------|-------|---------|------------|
| $P$   | -4.314 | 0.357 | -12.101 | $<10^{-4}$ |
| $C_p$ | -0.144 | 0.036 | -4.037  | $<10^{-4}$ |

*Table III.2.2 Relationships between ecological input data and residuals (HP)*

$n=796$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               |       | ns         |
| $N$               |       | ns         |
| $\text{Log}(K_t)$ |       | ns         |
| $F$               | 0.228 | $<10^{-4}$ |
| $P$               | 0.121 | $<10^{-4}$ |
| $C_p$             |       | ns         |

#### ***IV. Complementary results (use of an alternative protocol to model environmental perturbations)***

In the results presented below, environmental perturbations were assumed to reduce the local carrying capacities of patches for the demographic and demo-genetic models (the genetic model was as in the main results).

In the following Survival model tables, estimates of the coefficients of regression are provided with standard errors ( $sd$ ), Z statistics ( $Z$ ) and p-value ( $P$ ). In generalized linear model (GLM) tables, estimates of the coefficients of regression are provided with standard errors ( $sd$ ), Student statistics ( $T$ ) and p-value ( $P$ ). In hierarchical partitioning (HP) tables, the independent proportion of variance explained by each explanatory variable ( $R^2$ ) is provided with a p-value ( $P$ ) obtained from a randomization test (1000 iterations, see Mac Nally 2002, Walsh & Mac Nally 2003).

The dependent variables were the demographic ( $T_D$ ), genetic ( $T_G$ ) or demo-genetic ( $T_{DG}$ ) median times to extinction. Explanatory variables were the dispersal rate ( $m$ ), the overall carrying capacity ( $K_t$ ), number of patches ( $N$ ), individual fecundity ( $F$ ), per generation frequency of perturbations ( $P$ ) and coefficient of correlation of perturbations among patches ( $C_p$ ). Interactions between explanatory variables were not considered. In all cases,  $T_D$ ,  $T_G$  and  $T_{DG}$  were log-transformed. Other data transformations are directly indicated in tables.

##### **A. Constancy of extinction rates over time**

Exponential and Weibull survival models assuming right censored extinction events were fitted to examine the relationship between extinction times and ecological input parameters, considering all 1476 scenarios (Cox and Oakes 1984). The Weibull and exponential models

were compared to describe whether extinction rates were constant over time or not (Crawley, 2007). The analysis indicated that extinction rates were not constant across time for the demographic ( $T_D$ ) and demo-genetic ( $T_{DG}$ ) median times to extinction (Table IV.A.1.1 below). In all cases, extinction rates increased with time (the Log(scale) estimate was significantly different from zero and negative in all Weibull regressions, see Tables IV.B.1.1 and IV.B.2.1 below). All subsequent survival models (subsection B) are based on a Weibull distribution of extinction times.

*Table IV.A.1.1 Comparison between exponential and Weibull models (ANOVA) for  $T_D$  and  $T_{DG}$ .*

| Dependant variable | $\chi^2$ | d.f. | P          |
|--------------------|----------|------|------------|
| $T_D$              | 572.7    | 1    | $<10^{-4}$ |
| $T_{DG}$           | 1022.6   | 1    | $<10^{-4}$ |

## **B. Linear relationships between times to extinction ( $T_D$ and $T_{DG}$ ) and ecological input data**

### **B.1) The demographic time to extinction ( $T_D$ )**

*Table IV.B.1.1 Relationships between ecological input data and Log( $T_D$ ) (Survival model)*

$n=1476$  datasets; model log-likelihood=-2126;  $\chi^2=1281.13$ ; d.f.=6;  $P<10^{-4}$

| Variable     | Estimate | $sd$  | $Z$    | $P$        |
|--------------|----------|-------|--------|------------|
| $m$          | 5.38     | 0.47  | 11.50  | $<10^{-4}$ |
| $N$          | -0.02    | 0.00  | -10.50 | $<10^{-4}$ |
| Log( $K_t$ ) | 0.38     | 0.015 | 25.84  | $<10^{-4}$ |
| $F$          | 1.11     | 0.08  | 13.45  | $<10^{-4}$ |
| $P$          | -7.50    | 0.26  | -28.62 | $<10^{-4}$ |

|            |       |      |        |            |
|------------|-------|------|--------|------------|
| $C_p$      | -0.19 | 0.03 | -5.66  | $<10^{-4}$ |
| Log(scale) | -0.87 | 0.03 | -29.91 | $<10^{-4}$ |

*Table IV.B.1.2 Relationships between ecological input data and Log( $T_D$ ) (GLM)*

$n=703$  datasets, overall adjusted  $R^2=0.64$

| Variable     | Estimate | $sd$  | $T$     | $P$        |
|--------------|----------|-------|---------|------------|
| $m$          | 12.140   | 1.427 | 8.508   | $<10^{-4}$ |
| $N$          | -0.099   | 0.005 | -19.547 | $<10^{-4}$ |
| Log( $K_t$ ) | 1.397    | 0.046 | 30.228  | $<10^{-4}$ |
| $F$          | 3.132    | 0.267 | 11.713  | $<10^{-4}$ |
| $P$          | -8.651   | 0.939 | -9.212  | $<10^{-4}$ |
| $C_p$        | -0.985   | 0.109 | -9.061  | $<10^{-4}$ |

*Table IV.B.1.3 Relationships between ecological input data and Log( $T_D$ ) (HP)*

$n=703$  datasets

| Variable     | $R^2$ | $P$        |
|--------------|-------|------------|
| $m$          | 0.008 | 0.010      |
| $N$          | 0.173 | $<10^{-4}$ |
| Log( $K_t$ ) | 0.383 | $<10^{-4}$ |
| $F$          | 0.046 | $<10^{-4}$ |
| $P$          | 0.024 | $<10^{-4}$ |
| $C_p$        | 0.015 | $<10^{-4}$ |

## **B.2) The demo-genetic time to extinction ( $T_{DG}$ )**

*Table IV.B.2.1 Relationships between ecological input data and Log( $T_{DG}$ ) (Survival model)*

$n=1476$  datasets; model log-likelihood=-2540.4;  $\chi^2=1255.85$ ; d.f.=6;  $P<10^{-4}$

| Variable     | Estimate | <i>sd</i> | <i>Z</i> | <i>P</i>   |
|--------------|----------|-----------|----------|------------|
| <i>m</i>     | 1.71     | 0.31      | 5.45     | $<10^{-4}$ |
| <i>N</i>     | -0.01    | 0.001     | -6.07    | $<10^{-4}$ |
| Log( $K_t$ ) | 0.19     | 0.01      | 19.32    | $<10^{-4}$ |
| <i>F</i>     | 1.04     | 0.06      | 16.52    | $<10^{-4}$ |
| <i>P</i>     | -5.48    | 0.20      | -27.60   | $<10^{-4}$ |
| $C_p$        | 0.39     | 0.03      | 13.54    | $<10^{-4}$ |
| Log(scale)   | -0.92    | 0.02      | -40.69   | $<10^{-4}$ |

*Table IV.B.2.2 Relationships between ecological input data and Log( $T_{DG}$ ) (GLM)*

$n=1122$  datasets, overall adjusted  $R^2=0.74$

| Variable     | Estimate | <i>sd</i> | <i>T</i> | <i>P</i>   |
|--------------|----------|-----------|----------|------------|
| <i>m</i>     | 5.050    | 0.583     | 8.659    | $<10^{-4}$ |
| <i>N</i>     | -0.041   | 0.002     | -18.111  | $<10^{-4}$ |
| Log( $K_t$ ) | 0.749    | 0.018     | 40.573   | $<10^{-4}$ |
| <i>F</i>     | 4.504    | 0.115     | 39.106   | $<10^{-4}$ |
| <i>P</i>     | -3.104   | 0.396     | -7.843   | $<10^{-4}$ |
| $C_p$        | -0.328   | 0.048     | -6.815   | $<10^{-4}$ |

*Table IV.B.2.3 Relationships between ecological input data and Log( $T_{DG}$ ) (HP)*

$n=1122$  datasets

| Variable | $R^2$ | <i>P</i> |
|----------|-------|----------|
| <i>m</i> | 0.006 | 0.003    |

|                   |       |            |
|-------------------|-------|------------|
| $N$               | 0.081 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.324 | $<10^{-4}$ |
| $F$               | 0.318 | $<10^{-4}$ |
| $P$               | 0.014 | $<10^{-4}$ |
| $C_p$             | 0.004 | 0.030      |

***C: Linear relationships between the ratios of the times to extinction and ecological input data***

**C.1) The ratio ( $T_G/T_D$ )**

*Table IV.C.1.1 Relationships between ecological input data and  $\text{Log}(T_G)/\text{Log}(T_D)$  (GLM)*

$n=689$  datasets, overall adjusted  $R^2=0.79$

| Variable          | Estimate | $sd$  | $T$     | $P$        |
|-------------------|----------|-------|---------|------------|
| $m$               | 0.865    | 0.118 | 7.308   | $<10^{-4}$ |
| $N$               | -0.011   | 0.000 | -26.899 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.125    | 0.004 | 32.105  | $<10^{-4}$ |
| $F$               | 0.494    | 0.022 | 22.720  | $<10^{-4}$ |
| $P$               | 0.249    | 0.076 | 3.270   | 0.001      |
| $C_p$             | 0.106    | 0.009 | 12.076  | $<10^{-4}$ |

*Table IV.C.1.2 Relationships between ecological input data and  $\text{Log}(T_G)/\text{Log}(T_D)$  (HP)*

$n=689$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | 0.010 | 0.001      |
| $N$               | 0.225 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.292 | $<10^{-4}$ |

|       |       |            |
|-------|-------|------------|
| $F$   | 0.136 | $<10^{-4}$ |
| $P$   | 0.024 | $<10^{-4}$ |
| $C_p$ | 0.103 | $<10^{-4}$ |

### C.2) The ratio ( $T_{DG}/T_D$ )

Table IV.C.2.1 Relationships between ecological input data and  $\text{Log}(T_{DG})/\text{Log}(T_D)$  (GLM)

$n=703$  datasets, overall adjusted  $R^2=0.35$

| Variable          | Estimate | $sd$  | $T$     | $P$        |
|-------------------|----------|-------|---------|------------|
| $m$               | -0.693   | 0.101 | -6.885  | $<10^{-4}$ |
| $N$               | 0.004    | 0.000 | 12.289  | $<10^{-4}$ |
| $\text{Log}(K_t)$ | -0.036   | 0.003 | -11.084 | $<10^{-4}$ |
| $F$               | 0.092    | 0.019 | 4.850   | $<10^{-4}$ |
| $P$               | 0.461    | 0.066 | 6.953   | $<10^{-4}$ |
| $C_p$             | 0.063    | 0.008 | 8.254   | $<10^{-4}$ |

Table IV.C.2.2 Relationships between ecological input data and  $\text{Log}(T_{DG})/\text{Log}(T_D)$  (HP)

$n=703$  datasets

| Variable          | $R^2$ | $P$        |
|-------------------|-------|------------|
| $m$               | 0.024 | $<10^{-4}$ |
| $N$               | 0.121 | $<10^{-4}$ |
| $\text{Log}(K_t)$ | 0.084 | $<10^{-4}$ |
| $F$               | 0.043 | $<10^{-4}$ |
| $P$               | 0.038 | $<10^{-4}$ |
| $C_p$             | 0.050 | $<10^{-4}$ |

### C.3) The ratio ( $T_{DG}/T_G$ )

Table IV.C.3.1 Relationships between ecological input data and  $\text{Log}(T_{DG})/\text{Log}(T_G)$  (GLM)

$n=989$  datasets, overall adjusted  $R^2=0.19$

| Variable             | Estimate | <i>sd</i> | <i>T</i> | <i>P</i>   |
|----------------------|----------|-----------|----------|------------|
| <i>m</i>             | -8.519   | 4.431     | -1.923   | 0.05       |
| <i>N</i>             | 0.146    | 0.016     | 8.885    | $<10^{-4}$ |
| $\text{Log}(K_t)$    | -1.711   | 0.148     | -11.565  | $<10^{-4}$ |
| <i>F</i>             | -6.210   | 0.839     | -7.398   | $<10^{-4}$ |
| <i>P</i>             | 1.045    | 2.881     | 0.363    | ns         |
| <i>C<sub>p</sub></i> | 0.021    | 0.354     | 0.060    | ns         |

Table IV.C.3.2 Relationships between ecological input data and  $\text{Log}(T_{DG})/\text{Log}(T_G)$  (HP)

$n=989$  datasets

| Variable             | $R^2$ | <i>P</i>   |
|----------------------|-------|------------|
| <i>m</i>             | 0.003 | ns         |
| <i>N</i>             | 0.059 | $<10^{-4}$ |
| $\text{Log}(K_t)$    | 0.092 | $<10^{-4}$ |
| <i>F</i>             | 0.038 | $<10^{-4}$ |
| <i>P</i>             | 0.000 | ns         |
| <i>C<sub>p</sub></i> | 0.002 | ns         |

### References for Additional file 1

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