

Electronic Supplementary Material

Evidence for dispersal syndromes in freshwater fishes

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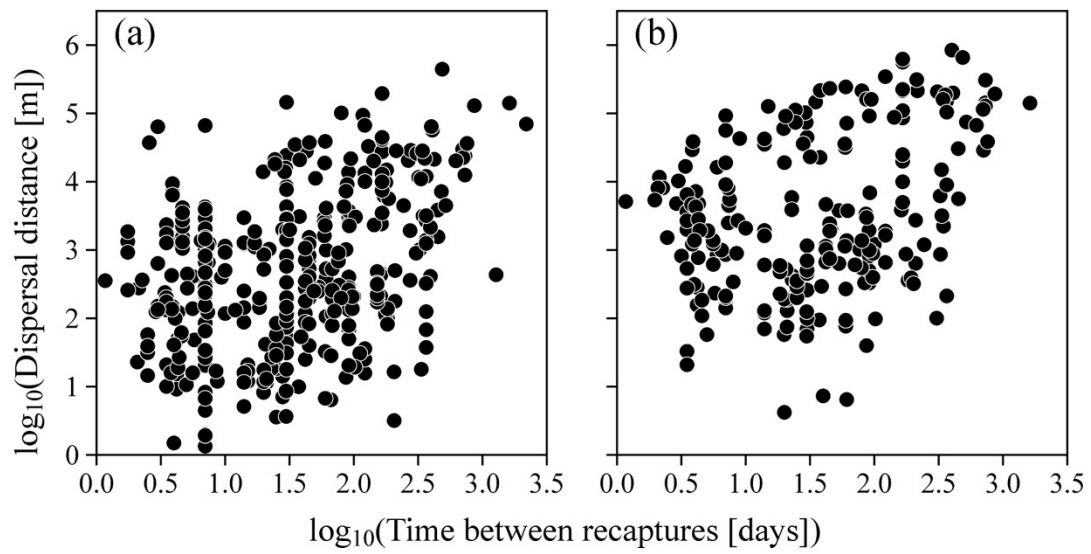


Figure S1. Relationships between empirical dispersal distances and time between recaptures when considering the (a) mean and (b) maximum recorded distances across all species and locations included in the final dataset.

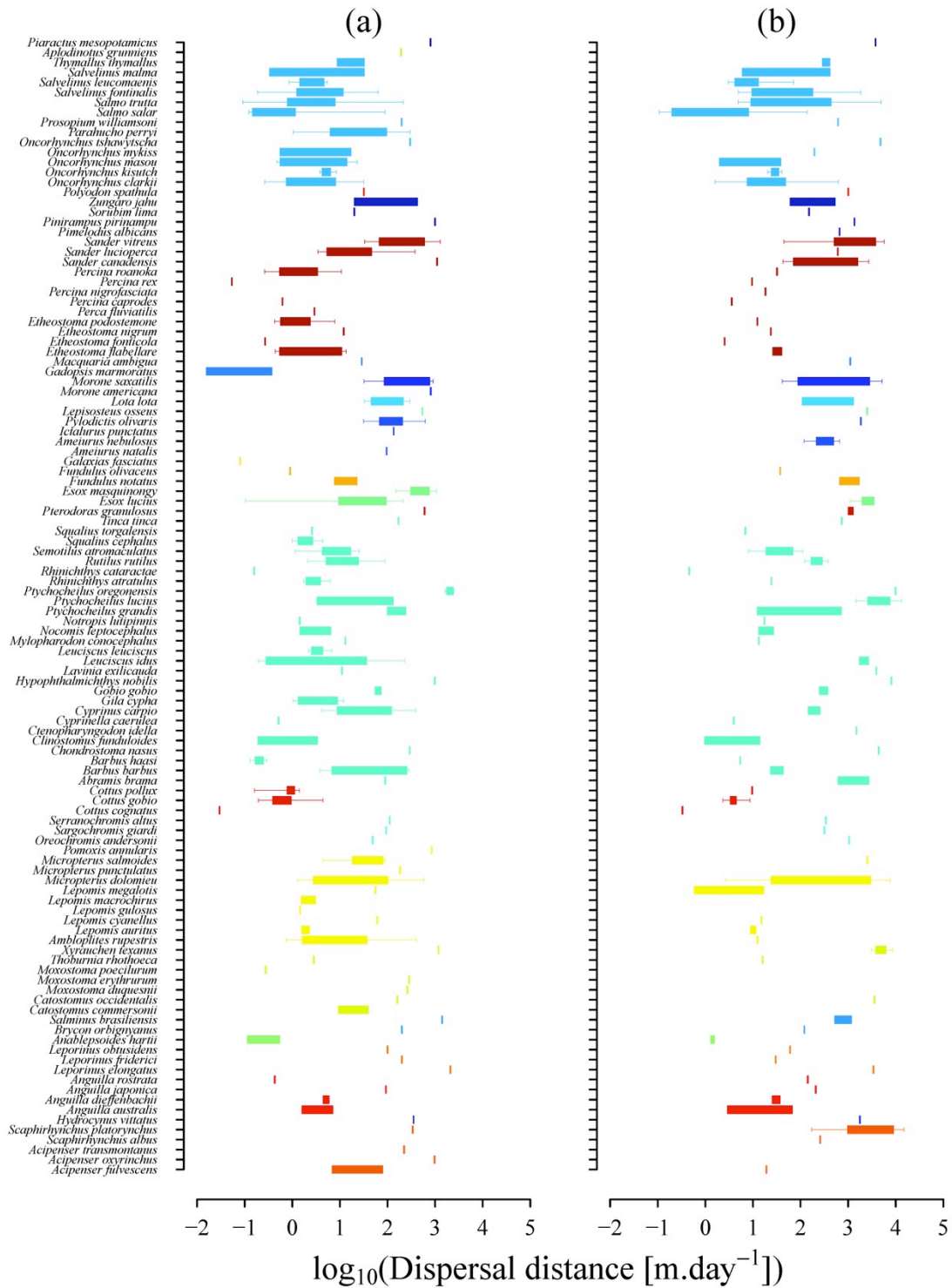


Figure S2. Boxplots of (a) mean and (b) maximum empirical dispersal distances for each species included in the final dataset. Different colours represent species belonging to different families.

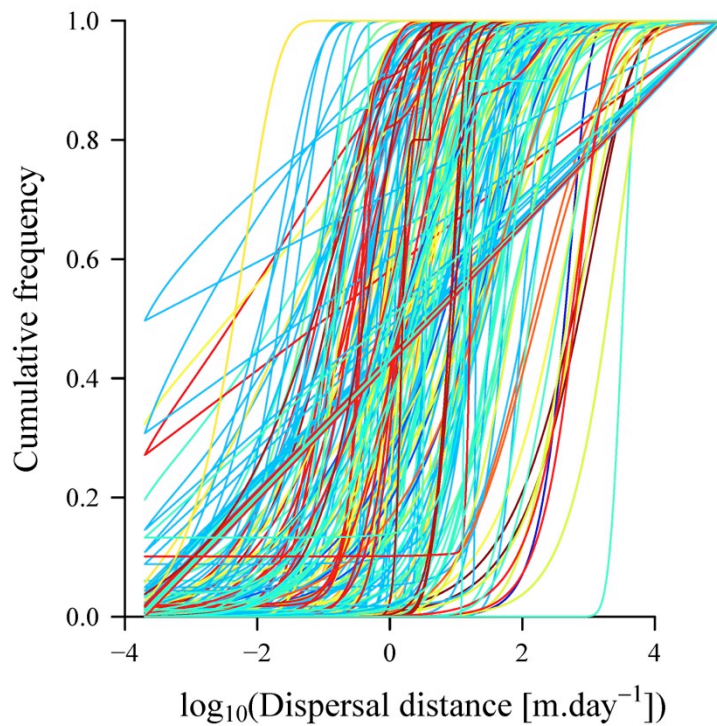


Figure S3. Cumulative probability distributions of dispersal distance fitted for each species \times location included in the final dataset. Different colours represent species belonging to different families.

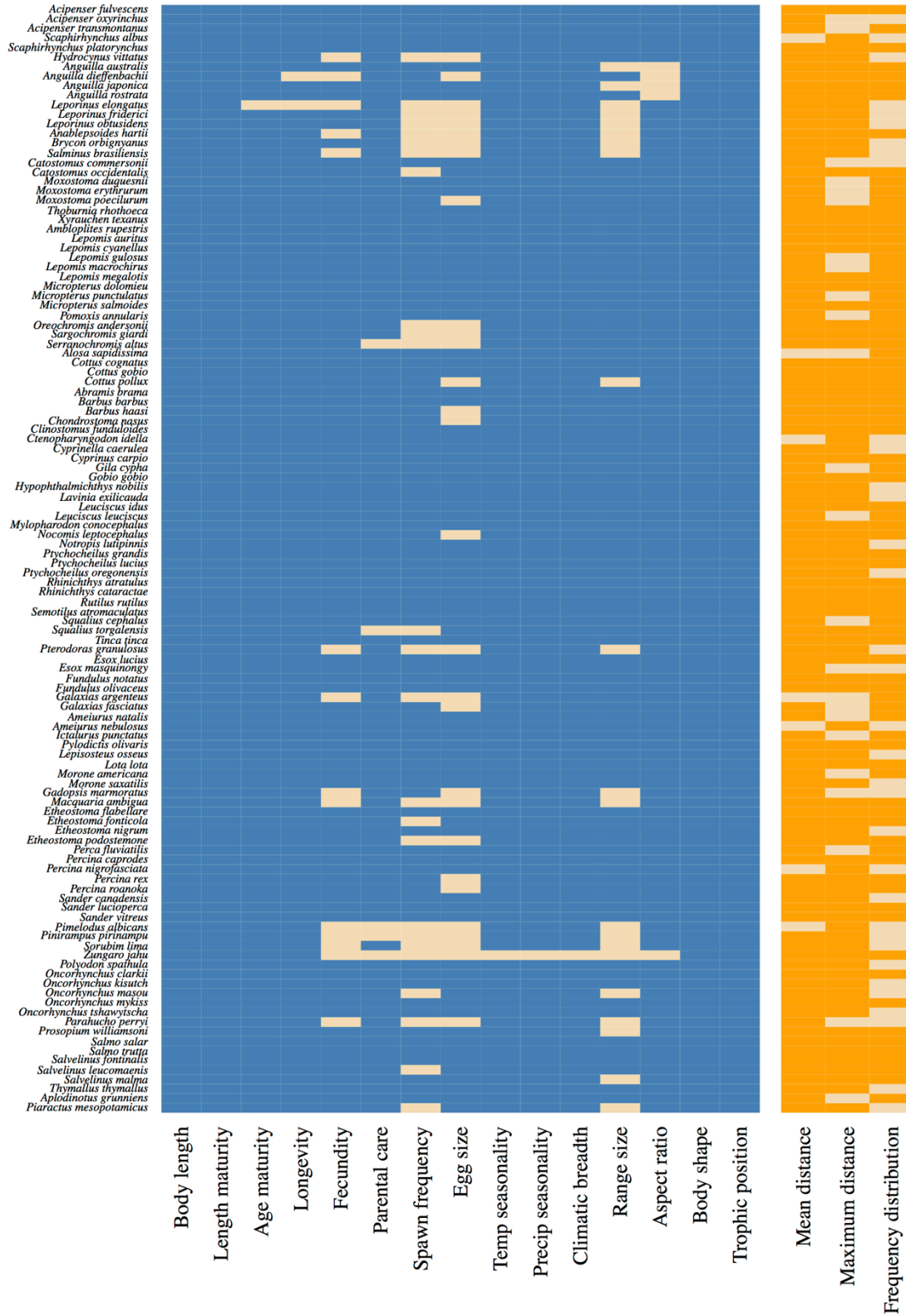


Figure S4. Availability of species' traits (blue) and dispersal (orange) data in the final dataset with beige indicating missing data.

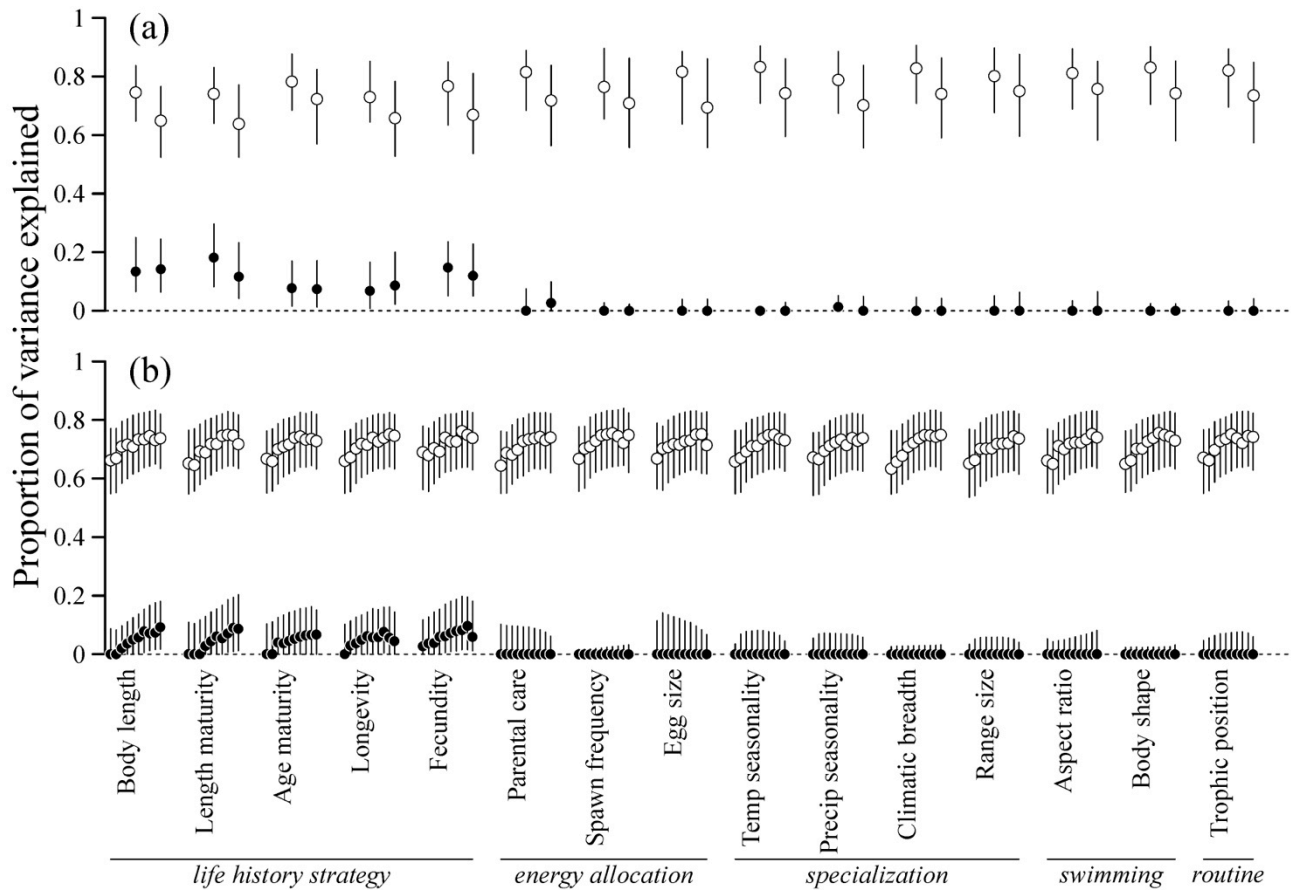


Figure S5. Proportion of variance explained in the (a) empirical and (b) fitted dispersal distances by the models with separate slopes calculated for both the fixed and random effects (conditional R^2 ; white dots) or only the fixed effects (marginal R^2 ; solid dots). Results are sorted from left to right according to the mean and maximum empirical dispersal distances and increasing percentiles (10, 20, 30, 40, 50, 60, 70, 80, 90, 99th), respectively. Dots and associated bars are the posterior modes and 95% credible intervals.

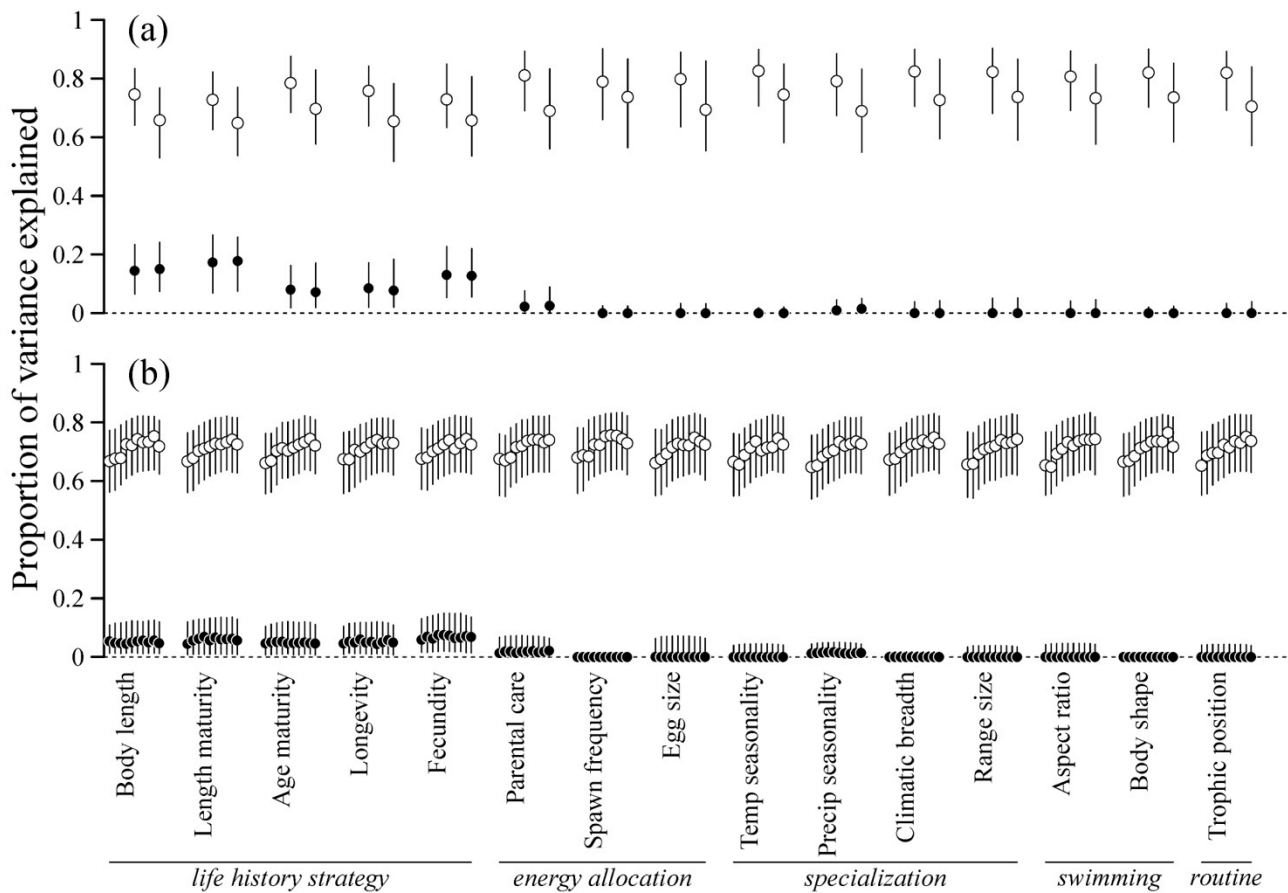


Figure S6. Proportion of variance explained in the (a) empirical and (b) fitted dispersal distances by the models including a common slope calculated for both the fixed and random effects (conditional R^2 ; white dots) or only the fixed effects (marginal R^2 ; solid dots). Results are sorted from left to right according to the mean and maximum empirical dispersal distances and increasing percentiles (10, 20, 30, 40, 50, 60, 70, 80, 90, 99th), respectively. Dots and associated bars are the posterior modes and 95% credible intervals.

Table S1. Selection of distribution functions using the Aikake Information Criterion corrected for small sample size (AICc) relative to the number of cumulative probability distributions of dispersal distance fitted for each species \times location (N_{CDF}) or the number of species (N_{Species}) included in the final dataset (total numbers in bold). Note that as several dispersal kernels might be selected for a given species, total N_{Species} does not equal the number of species considered in the study ($N = 82$).

| Cumulative distribution function | N_{CDF} | N_{Species} |
|---|------------------------------------|--|
| <i>Cauchy</i> | 1 | 1 |
| <i>Exponential</i> | 12 | 10 |
| <i>Gaussian</i> | 2 | 2 |
| <i>Gaussian-mixture</i> | 31 | 20 |
| <i>Logistic</i> | 0 | 0 |
| <i>Lognormal</i> | 66 | 39 |
| <i>Weibull</i> | 110 | 53 |
| | 222 | 125 |

Table S2. List and characteristics of the species' traits considered in this study. Unless specified, traits were collected using the scientific literature [e.g. 1] and Fishbase [2].

| | type | unit | transformation |
|------------------------------------|------------|--|-------------------|
| <i>Life-history strategy</i> | | | |
| Body length (maximum) | continuous | mm | log ₁₀ |
| Length at first maturity (female) | continuous | mm | log ₁₀ |
| Age at first maturity (female) | continuous | years | log ₁₀ |
| Longevity (maximum) | continuous | years | log ₁₀ |
| Fecundity | continuous | Total number of eggs or offspring per breeding season | log ₁₀ |
| <i>Energy allocation</i> | | | |
| Parental care | ordinal | 1 = open substratum 2 = brood hiders 3 = nest guarders | - |
| Spawning frequency | ordinal | 1 = once per season 2 = more than once per season | - |
| Egg size | continuous | mean diameter of mature [fully yolked] ovarian oocytes in mm | - |
| <i>Specialization</i> | | | |
| Temperature seasonality | continuous | Coefficient of variation of monthly mean temperature [†] across species range [§] | - |
| Precipitation seasonality | continuous | Coefficient of variation of monthly cumulated precipitation [∞] across species range [§] | log ₁₀ |
| Climatic niche breadth | continuous | Index of tolerance from an Outlying Mean Index (OMI) analysis based on four temperature [mean warmest and coldest quarters] [†] and precipitation [cumulated precipitation of the driest and wettest quarters] [∞] variables across species range [§] | - |
| Range size | continuous | Area of species range [§] in km ² | log ₁₀ |
| <i>Swimming skill</i> | | | |
| Aspect ratio (of the caudal fin) | continuous | $A = h^2/s$, h = height of the caudal fin; s = surface area of fin | |
| Body shape | ordinal | 1 = deep/short 2 = fusiform/normal 3 = elongated | - |
| <i>Routine (feeding) behaviour</i> | | | |
| Trophic position | continuous | - | - |

[†] Monthly mean air surface temperatures were obtained from the Climatic Research Unit [3] for the period 1970-2000 at a 0.5° × 0.5° grid resolution, converted to water temperatures using previously derived nonlinear regressions for the different climate zones [4] and averaged over the entire period.

[∞] Monthly cumulated precipitations were obtained from Wordclim for the period 1970-2000 at a 5' × 5' grid resolution.

[§] Species ranges were obtained from the IUCN Red List of threatened species [5] completed by occurrence records for 25 species from the GBIF aggregated at a 1° × 1° grid resolution. Note that range sizes were calculated only for the IUCN range maps.

Table S3. Comparison between multivariate models with or without separate slopes relating the dispersal estimates and individual species' traits. Shown are the averages [ranges] of the differences in Deviance Information Criterion (ΔDIC) over the three chains ($DIC_{\text{separate}} - DIC_{\text{common}}$). $\Delta DIC \leq 4$ indicates substantial support for the model with separate slopes, $4 < \Delta DIC \leq 7$ considerably less support and $\Delta DIC > 10$ essentially no support.

| ΔDIC | fitted | empirical |
|---------------------------|------------------|---------------------|
| body length | 3.95 [4.09;3.76] | 0.61 [0.33;0.82] |
| length maturity | 4.70 [4.88;4.45] | 0.05 [-0.11;0.24] |
| age maturity | 5.05 [5.17;4.93] | 0.95 [0.82;1.11] |
| longevity | 5.55 [5.66;5.41] | 1.01 [0.81;1.22] |
| fecundity | 5.25 [5.51;5.10] | 1.07 [0.97;1.25] |
| parental care | 5.70 [5.91;5.48] | 1.50 [1.40;1.57] |
| spawn frequency | 5.22 [5.41;5.02] | 1.44 [1.34;1.54] |
| egg size | 3.80 [3.85;3.73] | -0.17 [-0.38;0.05] |
| temperature seasonality | 4.19 [4.46;3.78] | 0.90 [0.67;1.14] |
| precipitation seasonality | 6.97 [7.21;6.77] | 0.98 [0.77;1.14] |
| climatic breadth | 6.01 [6.14;5.86] | 0.73 [0.49;1.15] |
| range size | 6.39 [6.68;6.13] | 1.33 [1.24;1.48] |
| aspect ratio | 6.34 [6.59;6.13] | -1.57 [-1.87;-1.35] |
| body shape | 5.48 [5.60;5.29] | 1.17 [1.05;1.26] |
| trophic position | 6.78 [6.89;6.70] | 1.09 [0.71;1.35] |

References

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2. Froese R, Pauly D. 2015 FishBase. See www.fishbase.org.
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5. IUCN. 2016 IUCN Red List of Threatened Species™. <<http://www.iucnredlist.org>>. Downloaded 27 January 2016.