Extended Data File for

Size spectra in freshwater streams are consistent across temperature and resource supply

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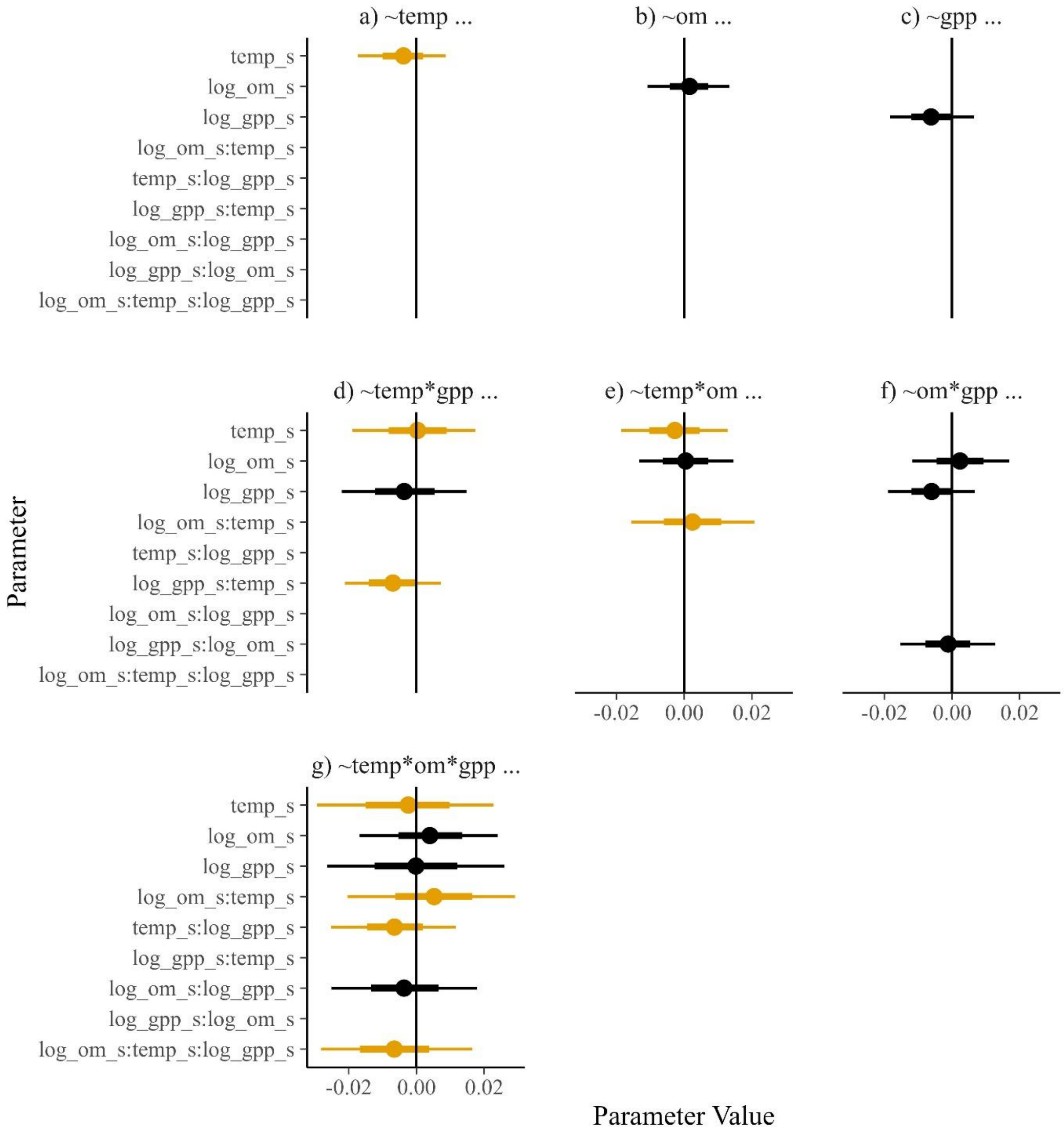
Extended Data Table 1. Parameters of four simulation scenarios of factors that explain lambda: Predator Prey Mass Ratio (PPMR), Trophic Efficiency (TE), Metabolic Scaling Coefficient (MS), and Ecological Subsidies.

Parameter	Model	Constant	Mean	Median	SD
PPMR (α)	1) Standard Model	No	10^7	10^5	4E+08
TE (β)		No	0.1	0.1	0.04
MS (ε)		Yes	0.75	0.75	0
Subsidies (δ)		Yes	0	0	0
PPMR (α)	2) Standard Model + Shallow Metabolic Scaling	No	10^7	10^5	4E+08
TE (β)		No	0.1	0.1	0.04
MS (γ)		No	0.4	0.4	0.09
Subsidies (δ)		Yes	0	0	0
PPMR (α)	3) Standard Model + Subsidies	No	10^7	10^5	4E+08
TE (β)		No	0.1	0.1	0.04
MS (γ)		Yes	0.75	0.75	0
Subsidies (δ)		No	0.4	0.4	0.08
PPMR (α)	4) Standard Model + Shallow Metabolic Scaling + Subsidies	No	10^7	10^5	4E+08
TE (β)		No	0.1	0.1	0.04
MS (γ)		No	0.4	0.4	0.09
Subsidies (δ)		No	0.4	0.4	0.08

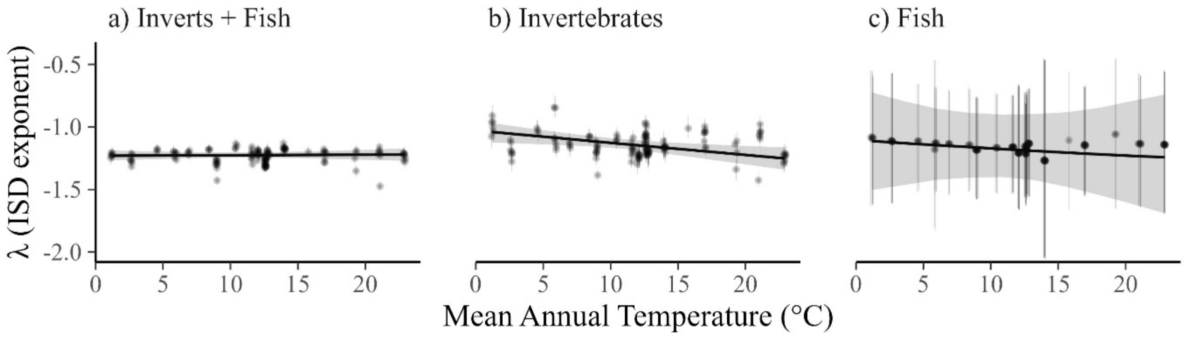
The mean, median, and sd are derived from 10,000 simulations for each parameter with the following probability distribution functions in R: PPMR = rlnorm(10000, 12, 3), TE = rbeta(10000, 7, 60), MS = rbeta(10000, 12, 25), Subsidies = rbeta(10000, 14, 15). In models 1-3, at least one parameter is fixed (e.g., MS is assumed to be 0.75 in models 1 and 3).

Extended Data Table 2. List of NEON data product used in this work. See Supplementary Information for the bibliography of the sources. Macroinvertebrates and fish were used to obtain body sizes and densities. Temperature, stream discharge and oxygen were used to estimate Gross Primary Production. Temperature was also used to estimate mean annual temperature. Organic matter was measured directly using samples from the NEON Biorepository.

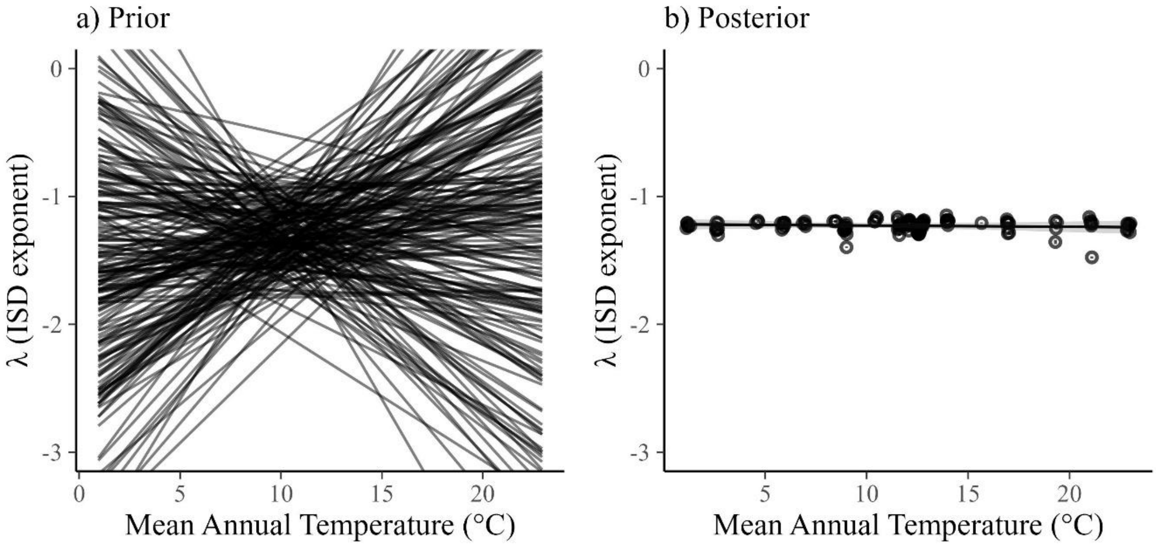
NEON ID	Description	Link	Source
DP1.20120.001	Macroinvertebrates	https://data.neonscience.org/data-products/DP1.20120.001	[7]
DP1.20107.001	Fish	https://data.neonscience.org/data-products/DP1.20107.001	[8]
DP1.20053.001	Temperature	https://data.neonscience.org/data-products/DP1.20053.001	[9]
DP4.00130.001	Stream Discharge	https://data.neonscience.org/data-products/DP4.00130.001	[10]
DP1.20288.001	Oxygen	https://data.neonscience.org/data-products/DP1.20288.001	[11]
Biorepository	Organic matter	https://biorepo.neonscience.org/portal/misc/cite.php	[12]



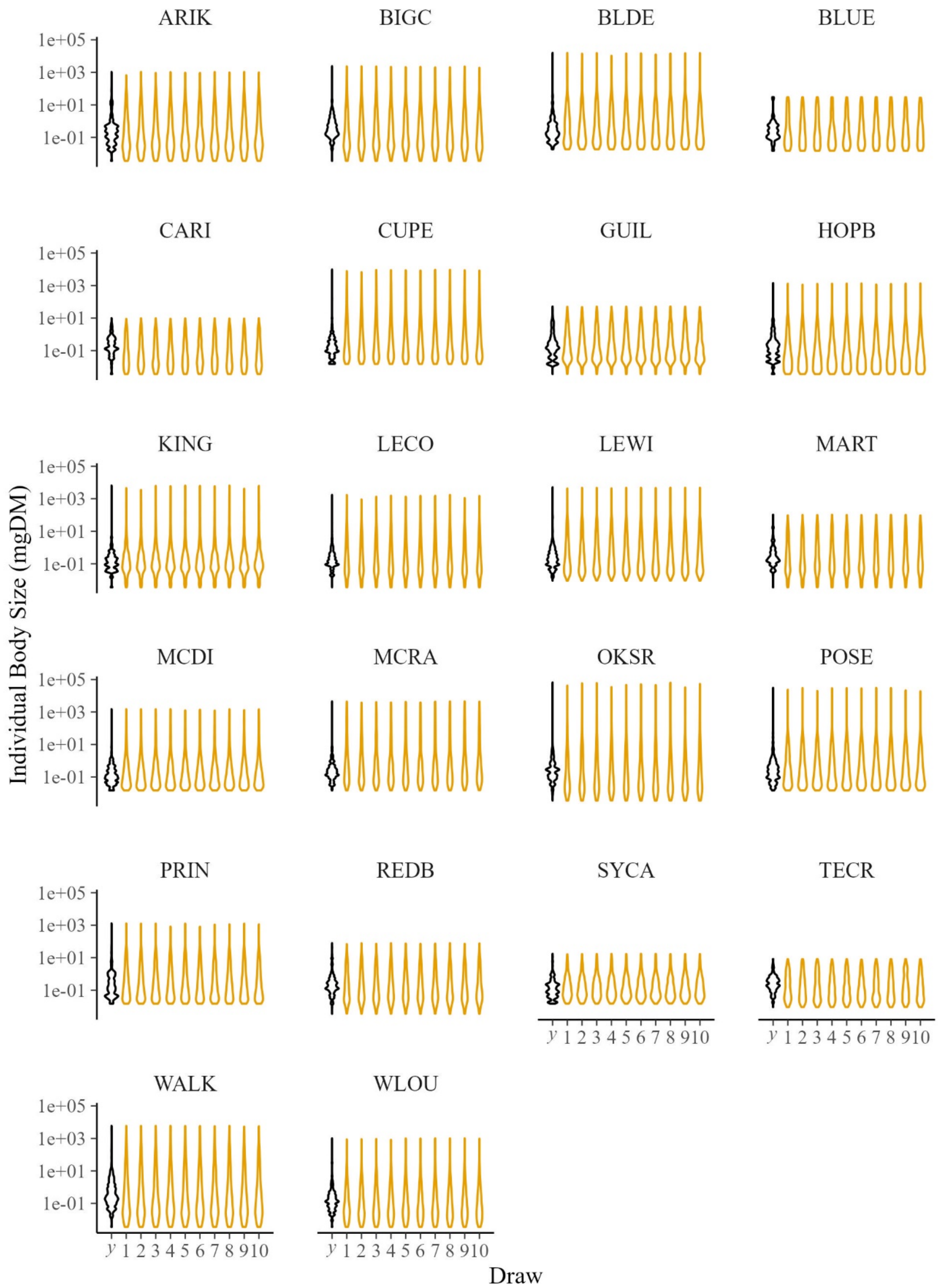
Extended Data Fig. 1. Posterior distributions of fixed effects parameters from seven models estimating change in λ across environmental predictors. *Models contain either univariate (a-c), two-way interactions (d-f), or a three-way interaction (g) of temperature ("temp"), gross primary production ('gpp") or organic matter standing stock ("om"). All variables were standardized with z-scores prior to analysis. GPP add organic matter were log10 transformed prior to standardization. Parameters containing temperature are highlighted in yellow. All models contained variating intercepts of year, site, and sample, which is abbreviated with elipses (…). The median, 50, and 95% Credible Intervals are shown by the dot, thick bar, and thin bar, respectively.*



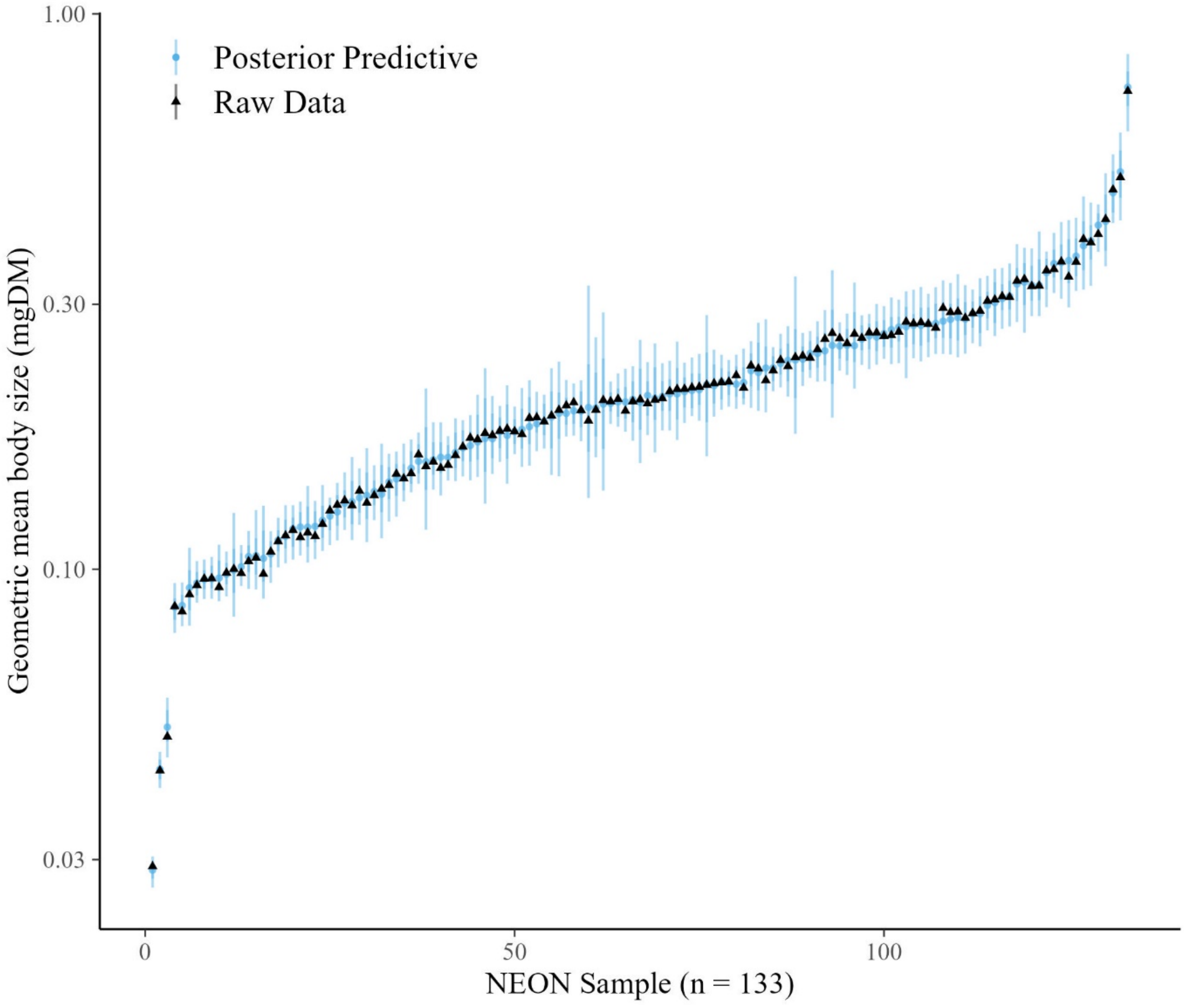
Extended Data Fig. 2. Community-wide results differ from individual taxa results. *a-c) Invariance of the ISD for the food web (a) does not hold when only analyzed for invertebrates (b) and for fish (c). Both models show the relationship between λ and temperature with GPP and organic matter set to their median values. Here, we checked the implications of our priors using prior predictive simulation. The level of replication (number of individual fish per sample) is lower, and the relationship more uncertain than a or b. Lines are posterior medians and shading is the 95% Credible interval. Dots in a-c are sample-specific lambdas predicted from varying intercepts in each model.*



Extended Data Fig. 3. Two-hundred simulations from the prior predictive distribution compared to the fitted posteriors. *Both models such as the prior predictive distribution (a) and the fitted posteriors (b) show the relationship between λ and temperature with GPP and organic matter set to their median values. Here, we checked the implications of our priors using prior predictive simulation. The results indicate that the priors largely limit λ to values between ~-2 to -1 but allow for a wide range of possible relationships with mean annual temperature. By comparison, the posterior (see Extended Data Fig. 1b.) remains in a much more constricted space. The difference between the prior and posterior is an index of how much information was learned from the data.*



Extended Data Fig. 4. Posterior predictive checks. *Distributions of raw data (black violins) compared to n = 10 simulated datasets from the joint posterior distribution (orange violins). Data are plotted by site, averaging over variation among years and samples within sites.*



Extended Data Fig. 5. Posterior predictive checks. *Geometric mean body sizes from the raw data compared to the posterior predictive distributions for all 133 samples. Raw data have a single value. Posterior predictions show the median ± 95% credible intervals.*