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Supplementary Information for

Past and future decline of tropical pelagic biodiversity

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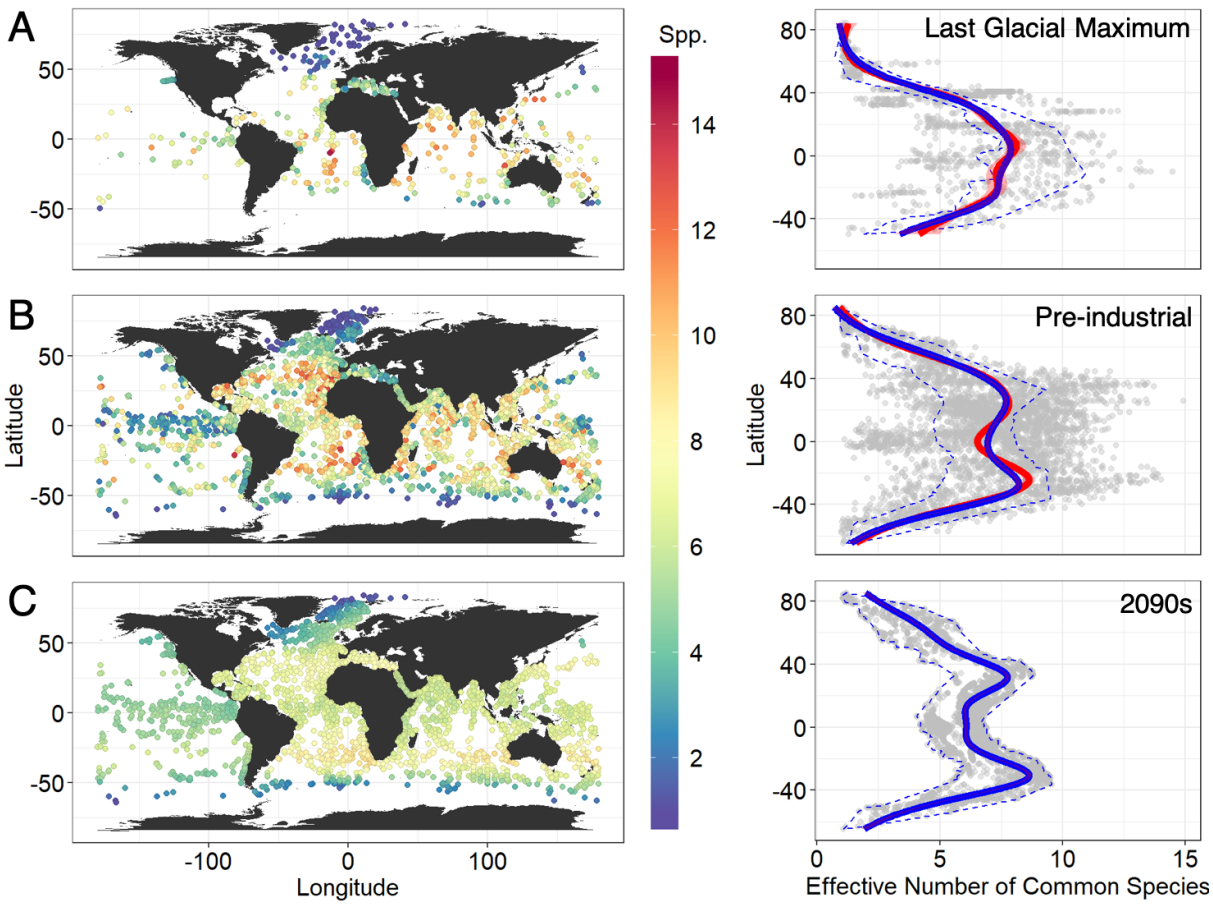


**Fig. S1.** As for Figure 1 except that diversity is based on effective numbers of common species estimated from Hill numbers of order q = 1.

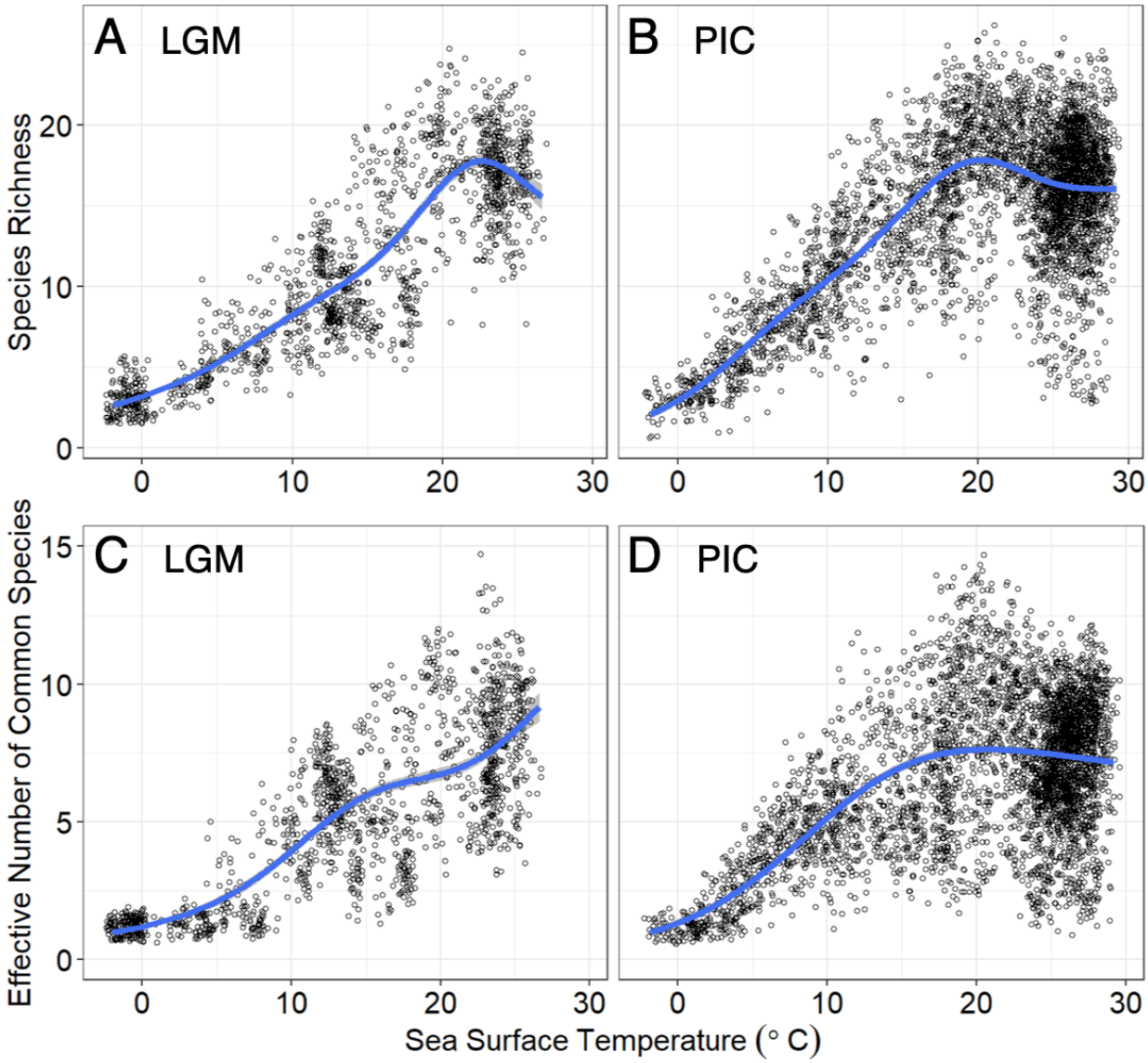


**Fig. S2.** Relationship of species diversity vs. temperature during the LGM and pre-industrial control (PIC). Diversity is shown as species richness based on Hill numbers of order q = 0 (*A-B*), and effective numbers of typical (common) species based on Hill numbers of order q = 1 (*C-D*). Blue lines with shaded areas show GAM fit to the data and 95% confidence interval. Shaded areas are small and not visible in B and D.

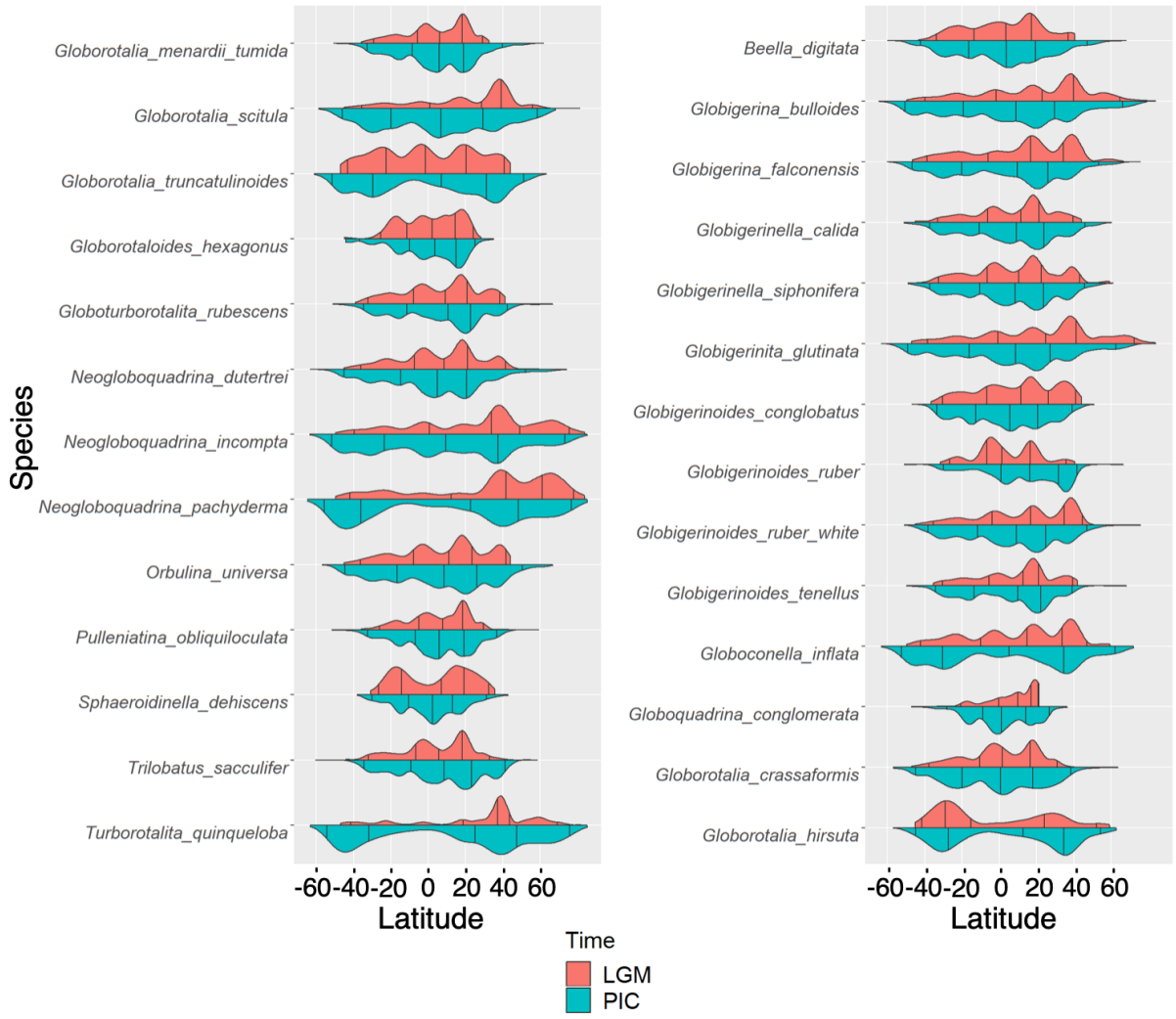


**Fig. S3.** Latitudinal occurrence of planktonic foraminiferal species during the LGM (red) and the pre-industrial control (PIC) (blue). The bean plot shows the kernel density estimation of each foraminiferal species' occurrence along the latitudinal gradient. Only the 27 species which occurred both during the LGM and PIC and contributed >1% of the total occurrences are shown. The five vertical lines (from left to right) within each half bean plot represent the 2.5, 25, 50, 75, and 97.5 percentiles of the distribution, respectively. The width of each bean plot was scaled relative to its maximum width (density), so each bean plot has the same maximum width.

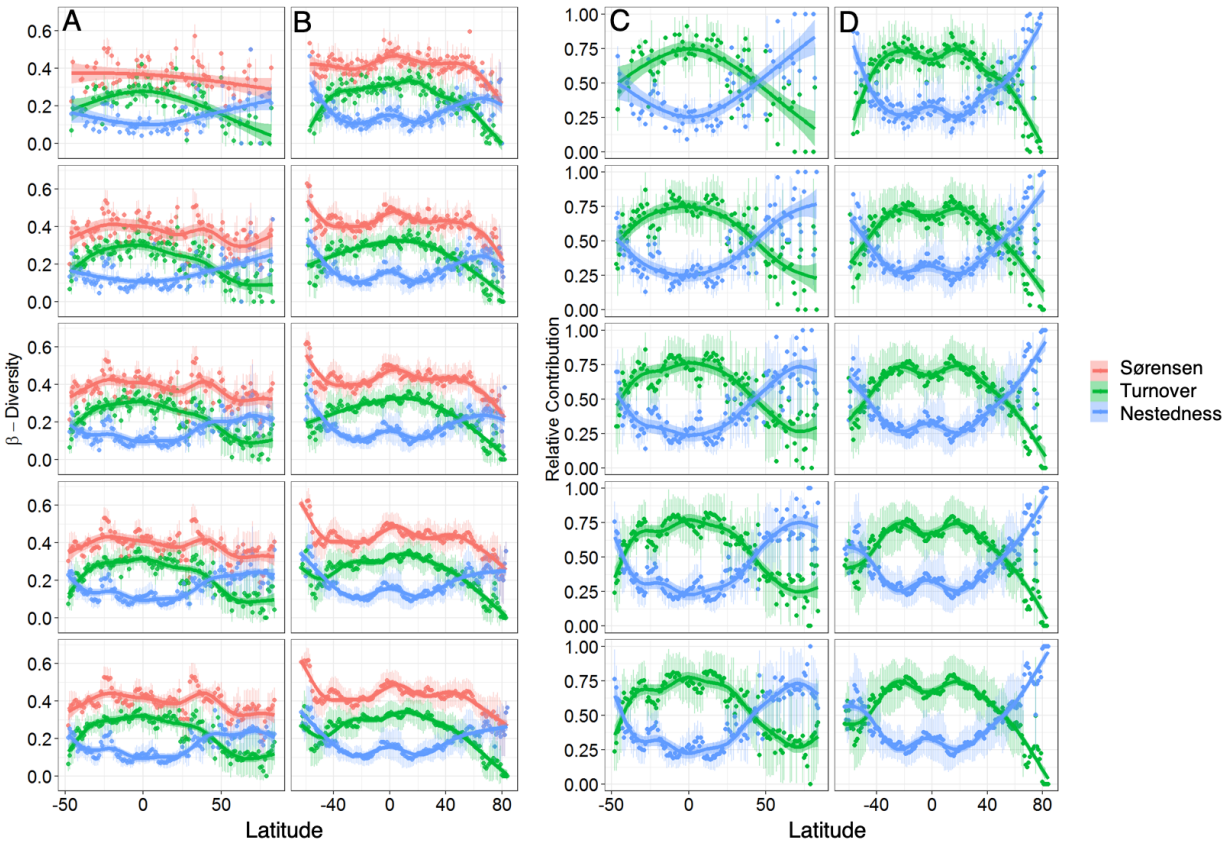


**Fig. S4.** The latitudinal gradients in beta diversity during (*A*) the LGM and (*B*) pre-industrial periods. The total beta-diversity, i.e. Sørensen dissimilarity (red), was separated into turnover (green) and nestedness (blue) components. Panels (*C*) and (*D*) show the relative contribution of the turnover (green) and nestedness (blue) components to total dissimilarity for the LGM and pre-industrial periods, respectively. The panels from top to bottom shows the same analyses using one- to five-degree-latitude moving windows.

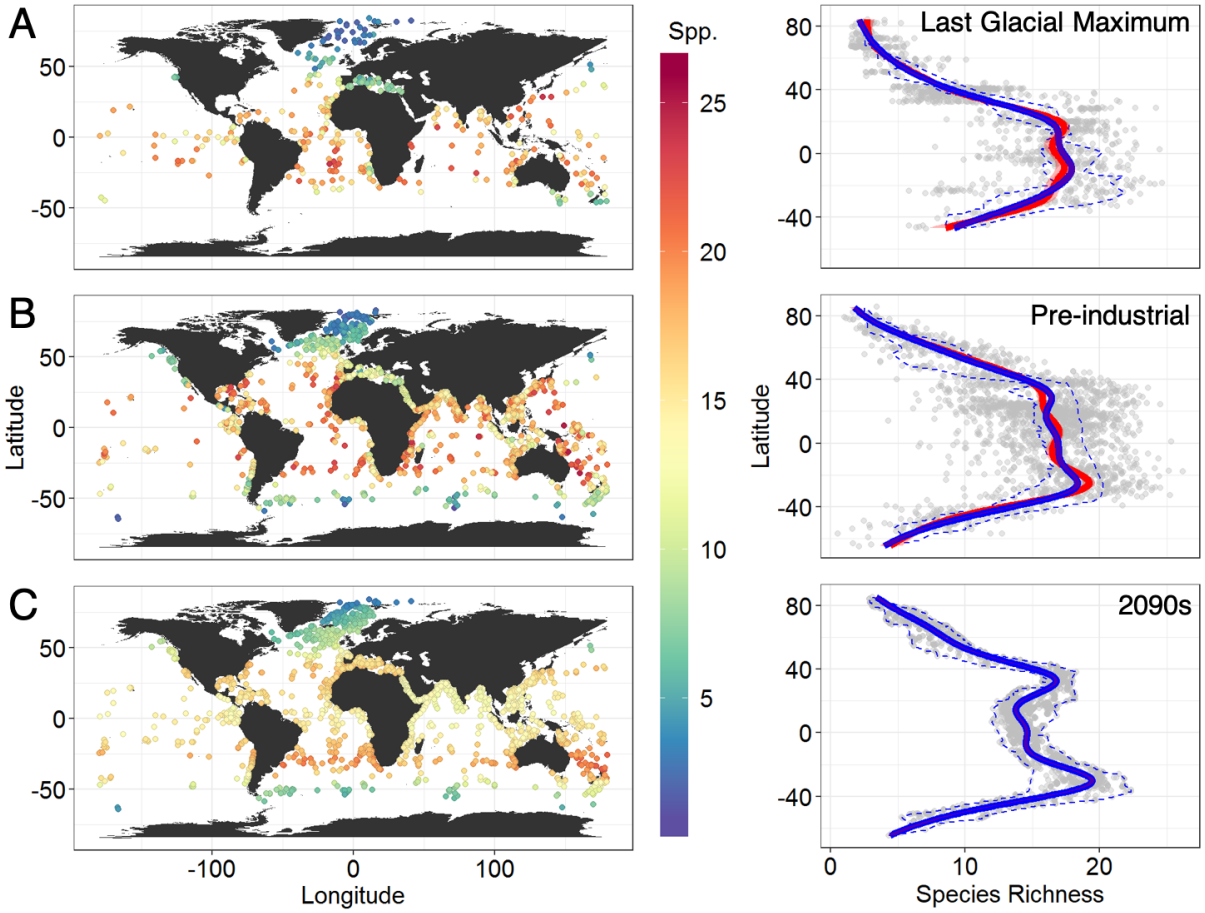


**Fig. S5.** As for Figure 1, but using the shallow-depth subset, i.e., the samples with water depth less than 3000 m only.

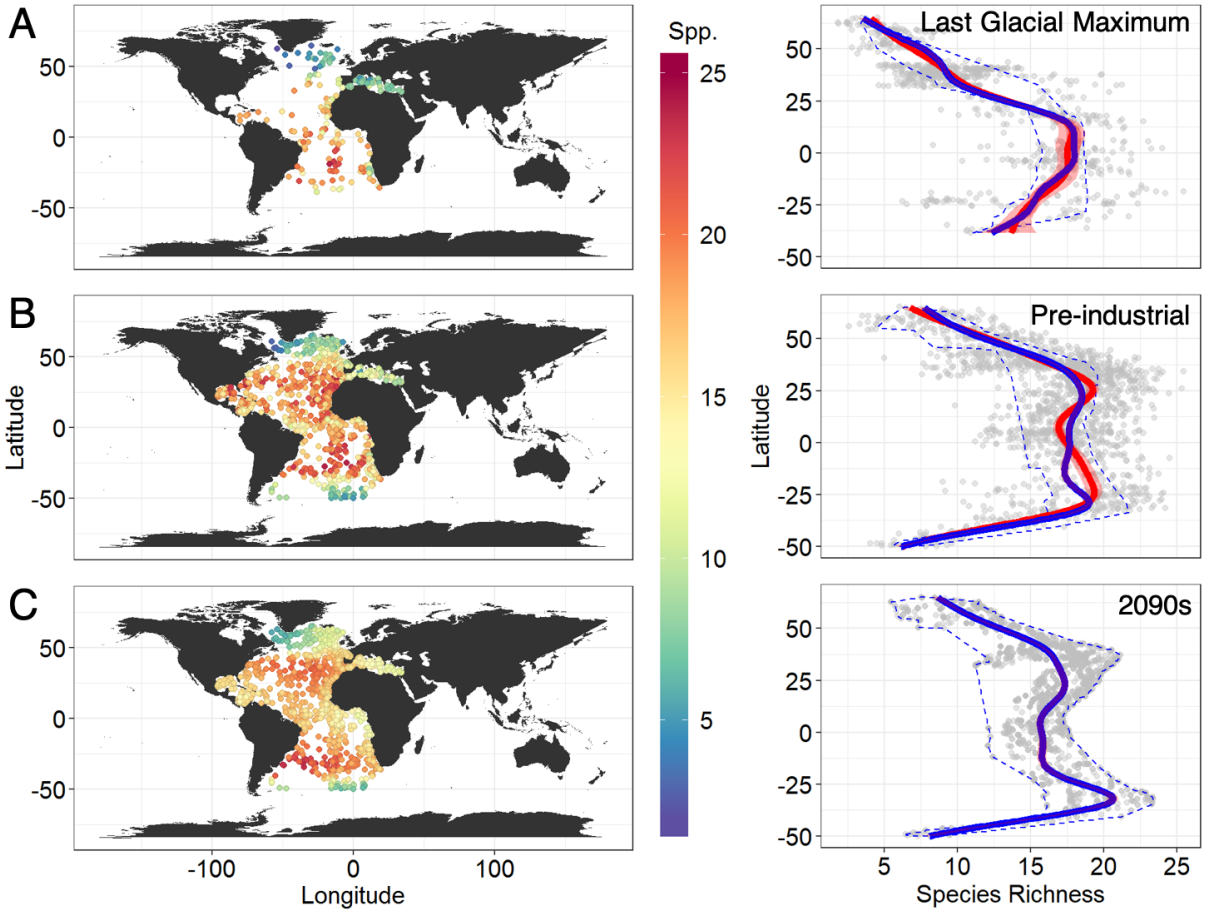


**Fig. S6.** As for Figure 1, but using the Atlantic-only subset of the samples.

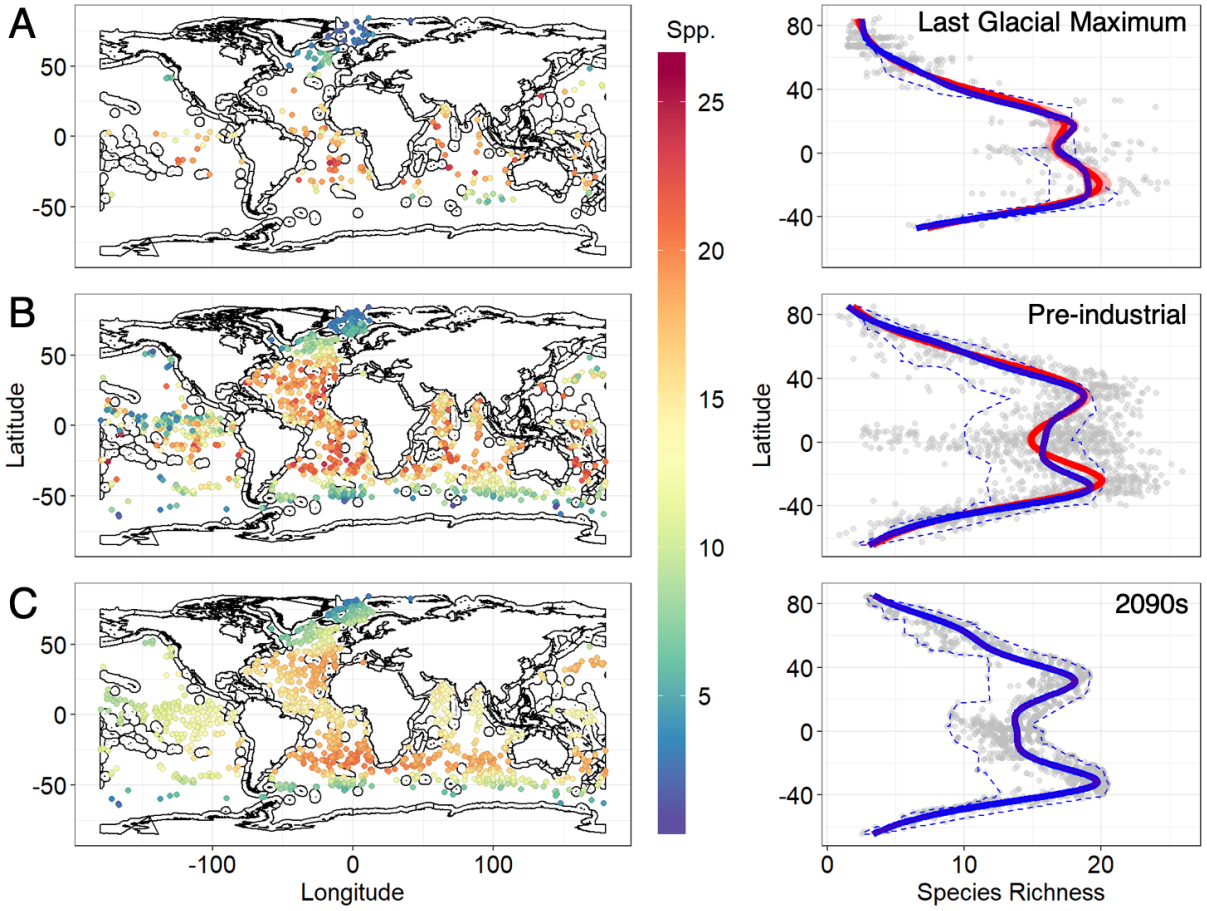


**Fig. S7.** As for Figure 1, but excluding coastal ecoregions and upwelling areas.

**Table S1.** Outputs of Generalize Additive Model (GAM) based on Hill numbers (q = 0). The GAM formula is: Diversity ~ s(Temperature) + s(Latitude, Longitude) + Ocean + Time. Asterisk indicates statistical significance (p-value < 0.05).

| Parametric coefficients: | Estimate | Std. Error | t value | p-value |
|---|---|---|---|---|
| (Intercept) | 2.517606 | 0.037435 | 67.253 | < 2e-16 * |
| Ocean (Arctic-Atlantic) | 0.013694 | 0.038753 | 0.353 | 0.72382 |
| Ocean (Arctic-Indian) | -0.06844 | 0.041035 | -1.668 | 0.09541 |
| Ocean (Arctic-Pacific) | -0.123828 | 0.041818 | -2.961 | 0.00308 * |
| Ocean (Arctic-Southern) | -0.11124 | 0.047527 | -2.341 | 0.01929 * |
| Time (LGM - PIC) | 0.097964 | 0.007942 | 12.335 | < 2e-16 * |

| Predictor terms: | edf | Ref.df | F | p-value |
|---|---|---|---|---|
| s(Temperature) | 3.966 | 3.999 | 1160.5 | <2e-16 * |
| s(Latitude, Longitude) | 3.934 | 3.997 | 134.9 | <2e-16 * |

Note: GAM adjust $R^2$ = 0.673, Deviance explained = 70.8%, n = 5560

**Table S2.** Outputs of Generalize Additive Model (GAM) based on Hill numbers (q = 1). The GAM formula is: Diversity ~ s(Temperature) + s(Latitude, Longitude) + Ocean + Time. Asterisk indicates statistical significance (p-value < 0.05).

| Parametric coefficients: | Estimate | Std. Error | t value | p-value |
|---|---|---|---|---|
| (Intercept) | 1.94452 | 0.05099 | 38.139 | < 2e-16 * |
| Ocean (Arctic-Atlantic) | -0.12632 | 0.05281 | -2.392 | 0.0168 * |
| Ocean (Arctic-Indian) | -0.3539 | 0.05607 | -6.311 | 2.98e-10 * |
| Ocean (Arctic-Pacific) | -0.48247 | 0.0574 | -8.406 | < 2e-16 * |
| Ocean (Arctic-Southern) | -0.45266 | 0.06797 | -6.66 | 3.01e-11 * |
| Time (LGM - PIC) | 0.09135 | 0.01107 | 8.254 | < 2e-16 * |

| Predictor terms: | edf | Ref.df | F | p-value |
|---|---|---|---|---|
| s(Temperature) | 3.968 | 3.999 | 530.3 | <2e-16 * |
| s(Latitude, Longitude) | 3.933 | 3.997 | 143.5 | <2e-16 * |

Note: GAM adjust $R^2$ = 0.51, Deviance explained = 56.9%, n = 5560