Ecography

ECOG-05280
Qian, H., Cao, Y., Li, D., Chu, C., Sandel, B. and Wang, X. 2020. Geographic patterns and environmental correlates of phylogenetic relatedness and diversity for freshwater fish assemblages in North America. – Ecography doi: 10.1111/ecog.05280

Supplementary material

Appendix 1

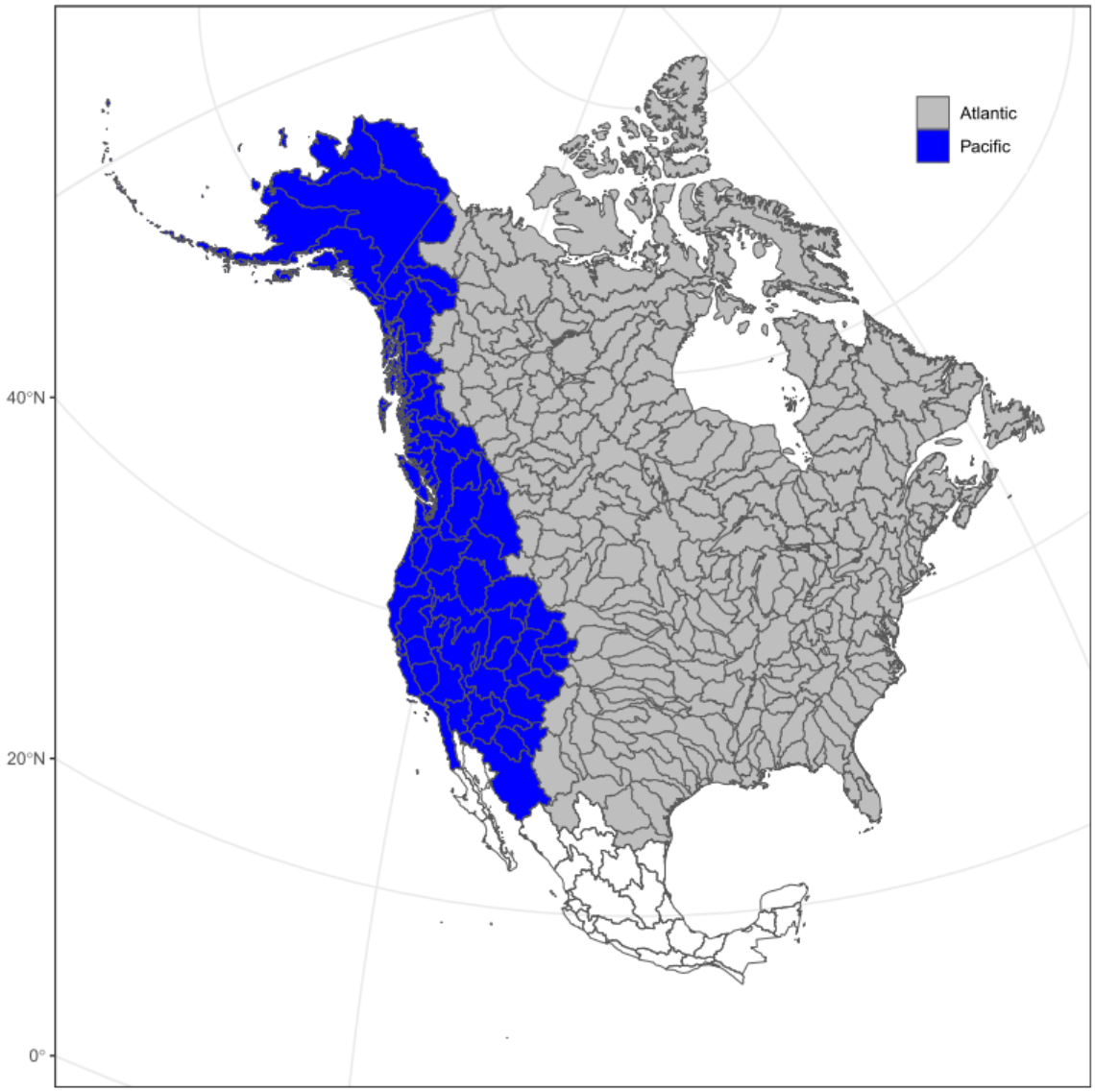

Figure A1. Division of the study area into two biogeographic realms of freshwater fish communities in North America, primarily along the Continental Divide.

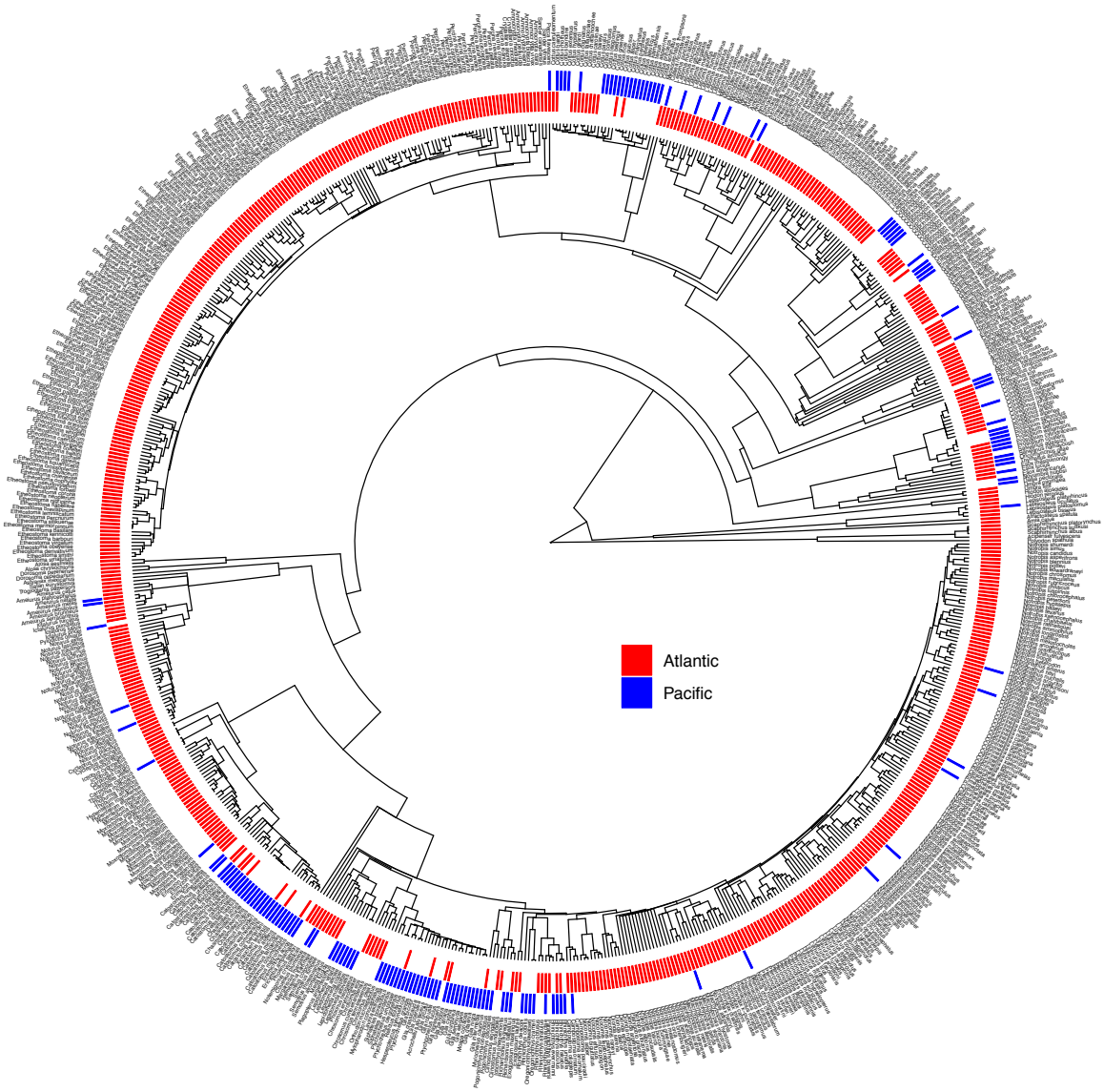

Figure A2. Phylogeny of the 749 freshwater fish species used in this study, and their presences in the two biogeographic realms (Atlantic and Pacific; see Figure S1).

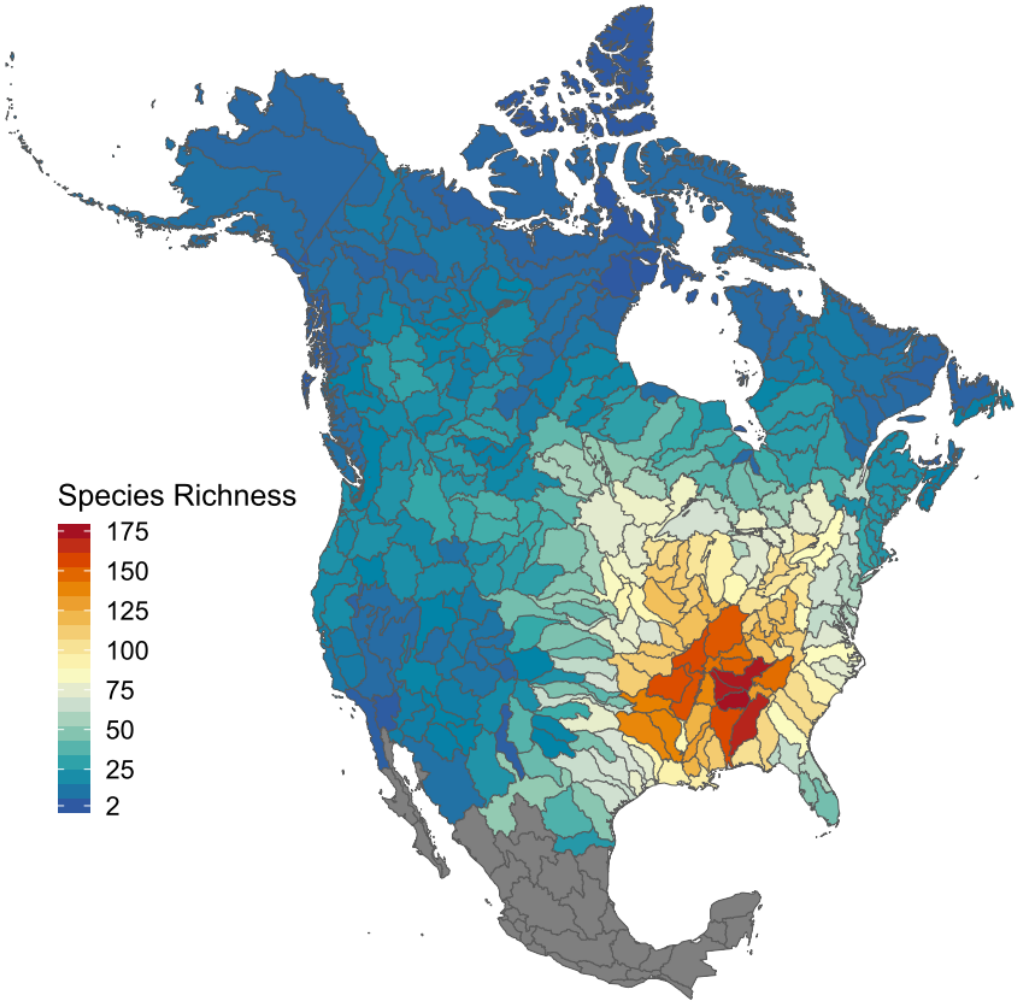

Figure A3. Variation of species richness of freshwater fishes among the watersheds included in this study.

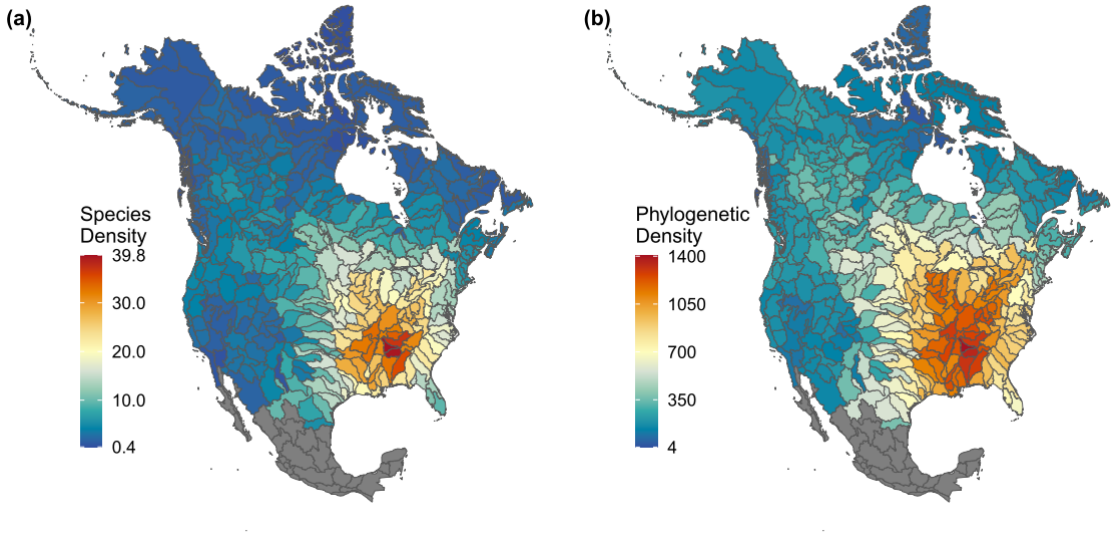

Figure A4. Species richness (left) and Faith's phylogenetic diversity (right) of freshwater fishes in watersheds after accounting for watershed area (i.e. each measure was divided by $\log_{10}$-transformed water area).

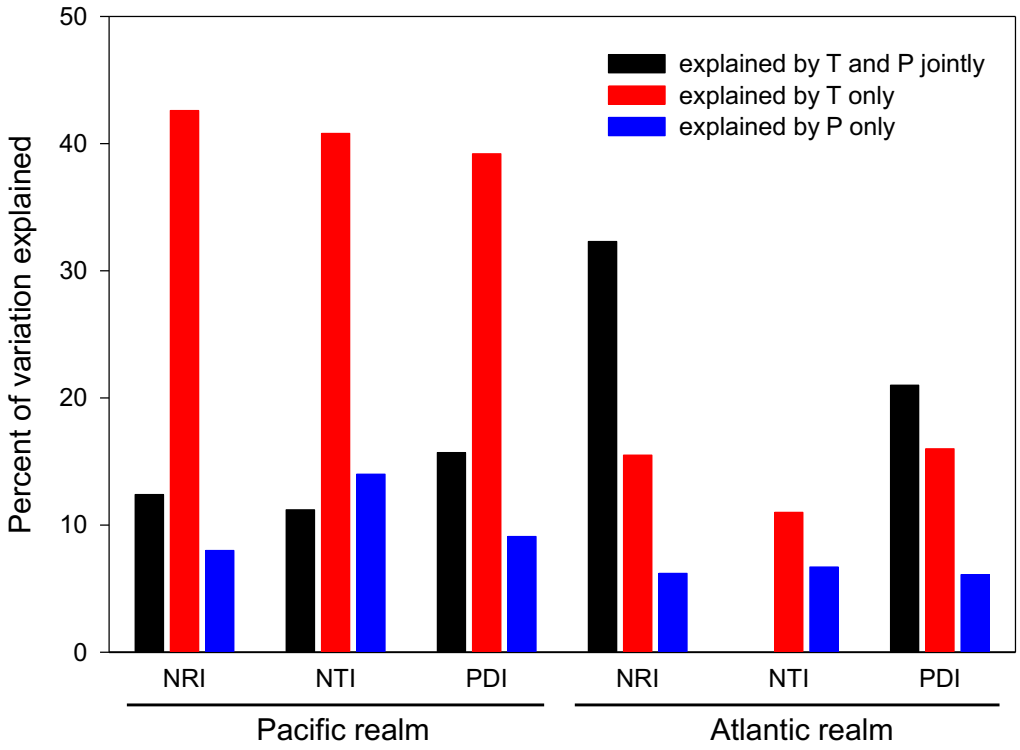

Figure A5. Variation in each of the three phylogenetic metrics (net relatedness index, NRI; nearest taxon index, NTI; phylogenetic diversity index, PDI) of freshwater fish assemblages in each of the two biogeographic realms (Pacific and Atlantic) in North America explained only by temperature-based variables (T), only by precipitation-based variables (P), or jointly by temperature-based and precipitation-based variables. Temperature-based variables included WorldClim bio1, bio6, bio5 and bio4; precipitation-based variables included WorldClim bio12, bio14, bio13 and bio15 (http://www.worldclim.org/bioclim). See Methods for details.

Table A1. Pearson's correlation coefficient between each of phylogenetic metrics of freshwater fish assemblages (net relatedness index, NRI; nearest taxon index, NTI; phylogenetic diversity index, PDI; and Faith's phylogenetic diversity, PD) and each of the 15 measures of the environment for all watersheds in North America (n = 360).

Environmental variable	NRI	NTI	PDI	PD
General environmental condition				
Mean annual temperature	-0.276	-0.028	0.205	0.540
Min. temperature of coldest month	-0.195	0.027	0.104	0.441
Max. temperature of warmest month	-0.286	-0.059	0.249	0.550
Annual precipitation	-0.423	-0.163	0.280	0.481
Precipitation of driest month	-0.390	-0.254	0.324	0.504
Precipitation of wettest month	-0.341	-0.071	0.175	0.322
Actual evapotranspiration	-0.626	-0.290	0.524	0.798
Potential evapotranspiration	0.032	0.151	-0.044	0.231
Climate seasonality				
Temperature seasonality	-0.013	-0.152	0.095	-0.225
Precipitation seasonality	0.252	0.167	-0.226	-0.437
Habitat heterogeneity				
Topographic heterogeneity	0.599	0.404	-0.559	-0.514
Temperature heterogeneity	0.583	0.405	-0.558	-0.424
Precipitation heterogeneity	0.276	0.361	-0.395	-0.255
Quaternary climate change				
Temperature anomaly	-0.393	-0.301	0.423	0.358
Precipitation anomaly	0.027	-0.227	0.135	-0.126

Table A2. Standardized regression coefficients resulting from spatial autoregressive (SAR) models with each of the three phylogenetic metrics of freshwater fish assemblages (net relatedness index, NRI; nearest taxon index, NTI; phylogenetic diversity index, PDI) regressed on the environmental variables retained in each of the best ordinary least squares (OLS) models shown in Table 2 for the two biogeographic realms of freshwater fishes in North America.

	Pacific realm			Atlantic realm		
Environmental variable	NRI	NTI	PDI	NRI	NTI	PDI
General environmental condition						
Mean annual temperature		0.60		-3.15	-2.52	2.79
Min. temperature of coldest month	-1.33		0.83			
Max. temperature of warmest month	0.90		-0.93	2.16	1.43	-1.68
Annual precipitation	0.27			-1.55		0.98
Precipitation of driest month				0.82	-0.62	-0.34
Precipitation of wettest month		-0.55		0.68	0.99	-0.83
Actual evapotranspiration		0.55	-0.36	-0.36	-0.62	0.50
Potential evapotranspiration						
Climate seasonality						
Temperature seasonality	-0.96		0.72	-1.20	-0.87	1.02
Precipitation seasonality	-0.27	-0.38	0.32	-0.30	0.52	0.43
Habitat heterogeneity						
Topographic heterogeneity	-0.39					
Temperature heterogeneity	0.44					
Precipitation heterogeneity		0.30		0.09		-0.13
Quaternary climate change						
Temperature anomaly					0.42	-0.35
Precipitation anomaly	-0.36			0.38	-0.56	0.21
R^2adj	0.62	0.70	0.61	0.56	0.22	0.36