**SUPPORTING INFORMATION**

Appendix S1 List of the 12 functional traits used to characterize the functional diversity of each species with the loadings for the first three principal coordinate axes (PCs); the axes utilized to calculate the functional diversity of each fish community.

Category	Trait	Description and (or) units	PC1	PC2	PC3
Behavior	Substrate preference	Vegetation, mud-silt-sand, cobble-boulder, or generalist.	-0.187	0.849	0.130
	Fluvial dependence	Slow, moderate, or fast current velocity.	0.411	-0.984	0.030
	Vertical position	Benthic, surface and water column, or generalist.	0.570	1.966	0.055
	Potandromous	Requiring movement through fresh water systems to complete their life cycle (binary).	1.528	-0.018	0.621
Life history	Longevity	Maximum potential life span (years)	1.006	-0.328	-0.092
	Age at maturation	Age at maturation (years)	1.506	-0.415	-0.489
	Fecundity	Total number of eggs or offspring per breeding season	0.536	0.061	-0.420
	Primary spawning season	Fall (Sept-Nov), winter (Dec-Feb), spring (March-May), summer (June-Aug).	1.016	0.324	0.089
	Reproductive guild	Non-guarders (open substratum), non-guarders (brood hiders), guarders (substratum choosers), guarders (nest spawners), substratum indifferent.	-1.260	0.848	0.551
Morphology	Maximum total body length	Maximum total body length (cm)	1.444	0.004	-0.092
Trophic	Trophic breadth	Count of encompassing categories (herbivore, planktavore, invertivore, picivore, and detritivore).	-0.175	0.407	-1.902
	Trophic guild	Herbivore, plankton-invertivore, invertivore, invertivore-piscivore, piscivore, or generalist.	0.205	0.310	-1.915

Appendix S2 Map of North America displaying the location of each lentic (n = 34; ■) and lotic (n = 29; ▲) community included in our analysis. Study references for each community are listed below.
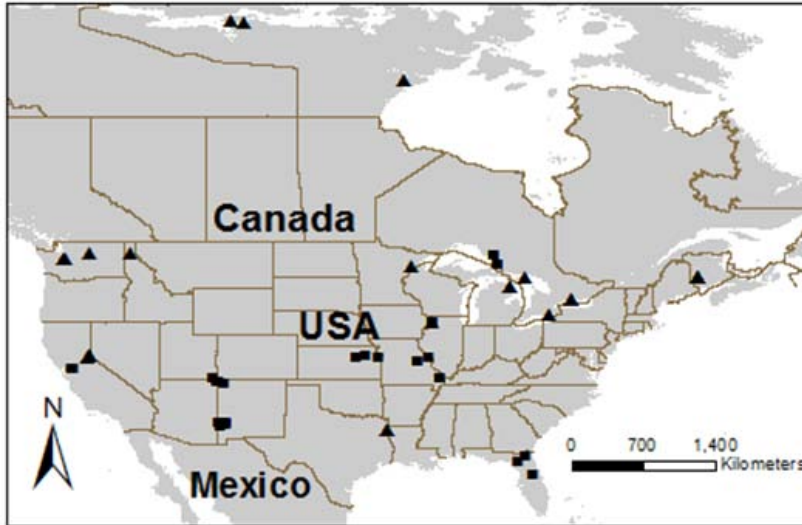
Appendix S3 Conceptual framework displaying a (a) classical Venn diagram illustrating the beta diversity for two communities. Beta diversity identifies, in the case of trophic diversity, the change in 'trophic space' occupied by two communities. In each model, part B and part C identifies unique trophic area occupied by each community and part A identifies shared trophic area occupied by both communities. (b) In the 'centroid' trophic beta diversity approach, the convex hull centroids of the two communities are aligned (Schmidt *et al*. 2011).
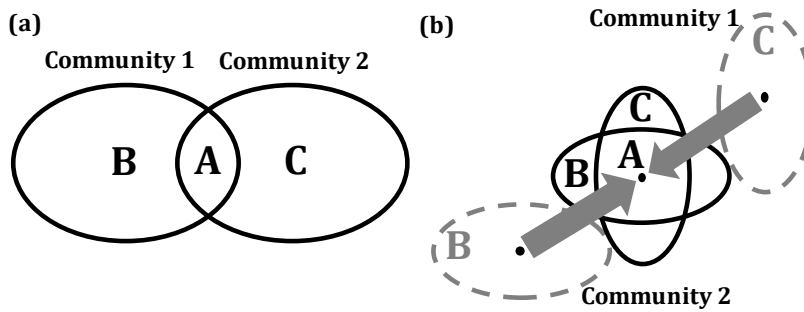
Appendix S4 After reducing the total number of traits in our analyses down to 7 behavior, morphological, and trophic traits (see Appendix S1), lentic communities' functional beta diversity retained a weak correlation with trophic beta diversity using MRM (R^2 = 0.143, p < 0.01) with greater variation exclusively explained by the functional predictor (R^2 = 0.122) than geographic space (R^2 = 0.010). Similarly, lotic communities' functional beta diversity had a weak correlation with trophic beta diversity (R^2 = 0.038, p < 0.02) with low variation explained by both geographic space (R^2 = 0.003) and the functional predictor (R^2 = 0.034).