Ecography

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Supplementary material

Appendix 1

Environmental predictors

Each grid cell along the HydroSHEDS river network (Lehner et al. 2008) served as an outlet for which the upstream sub-catchment was calculated, aiming to mimic the river continuum and the high spatial autocorrelation of environmental conditions within stream reaches (Vannote et al. 1980). This procedure was carried out in GRASS GIS (GRASS Development Team 2012) and two GRASS GIS add-ons for an automatized computation have been developed (*r.stream.watersheds* & *r.stream.variables*, Domisch et al. (2015b)). We related the upstream topography (Lehner et al. 2008), climate (Hijmans et al. 2005), land use (Tuanmu and Jetz 2014), and surface geology (USGS) to each grid cell, either across each entire sub-catchment (for topography, precipitation, land use, geology) or only along the water courses within each sub-catchment (temperature). For characterizing topography we used the elevation range within each sub-watershed.

Mean monthly climatic predictors were transferred into stream-specific predictors by calculating the average and sum across the sub-catchment for temperature and precipitation, respectively. An inverse distance weighed average and sum was used for land use and surface geology. Thus, upstream land use and surface geology patterns that are far away have a lesser impact on the given outlet cell than near ones. Monthly stream-specific temperature and precipitation predictors were then summarized into 19 “hydro-climatic” predictors (Kuemmerlen et al. 2012). Finally, all predictors were averaged across lake and reservoirs of the Global Lakes and Wetlands Database dataset (Lehner and Döll 2004) to mimic the more static environmental conditions than in streams, and using bilinear interpolation for a range of three cells where a stream is flowing into a lake. The base layer (streams and lakes) was coded as a binary layer that indicates whether a given grid cell is lotic or lentic habitat.

A subset of the variables can be viewed online at www.earthenv.org/streams and we point to Domisch et al. (2015b) for a detailed description of the procedure, and to download the near-global 1 km layers.

Table A1 Absolute and relative contribution of fish presence records derived from the different data sources. Only records dated after 1950 were used, with a total of 1014415 unique records across North America.

Data source	Download link	Number records (proportion within entire data set in %)			
		All species	***Mylopharodon conocephalus***	***Notropis braytoni***	***Etheostoma crossopterum***
fishnet2	http://fishnet2.net/	375370 (37.0)	22 (23.7)	145 (58.0)	77 (52.7)
GBIF	www.gbif.org	374922 (37.0)	22 (23.7)	105 (42)	55 (37.7)
National Fish Habitat	http://fishhabitat.org/	175263 (17.3)	18 (19.4)	0	9 (6.2)
USGS BioData	https://aquatic.biodata.usgs.gov	32948 (3.2)	31 (33.3)	0	5 (3.4)
Fisheries Information Summary System	http://www.env.gov.bc.ca/fish/fiss/	25854 (2.5)	0	0	0
StreamNet	www.streamnet.org/	24848 (2.4)	0	0	0
EPA Mercury	http://water.epa.gov/scitech/swguidance/fishshellfish/techguidance/mercurydata.cfm	5210 (0.5)	0	0	0

Fig. A5 A-G (A) Uniform probability density function with the upper bound of 10 used as a prior for the spatial effect variance ($V\rho$) in the HBMs with the range map (left column, **B**, **D**, **F**) and without the range map (right column, **C**, **E**, **G**). (**B-G**) Posterior probability distributions of the spatial effect variance for (**B-C**) *M. conocephalus*, (**D-E**) *N. braytoni* and (**F-G**) *E. crossopterum*. Insets show the frequency distribution of the predicted spatial random effects ρ across the modeling domain (see Figs. 3 and A3).

References

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