

Supplementary Information

Upstream



Midstream



Downstream



Fig. S1 Photos of sampling sites along Xiyuan River

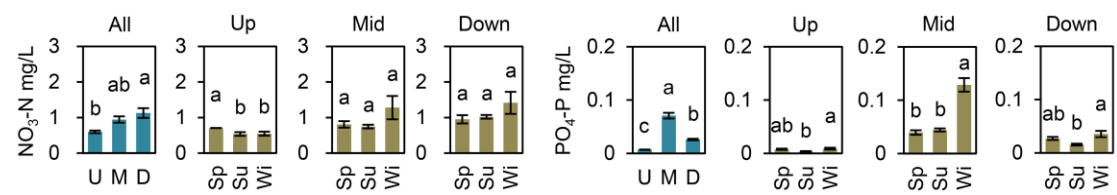


Fig. S2 Spatiotemporal variation of NO₃-N and PO₄-P in Xiyuan River (U or Up – upstream, M or Mid – midstream, D or Down – downstream; Sp – spring, Su – summer, Wi – winter; mean $\pm$ s.e., different letters indicate significant differences testing by one-way ANOVA).

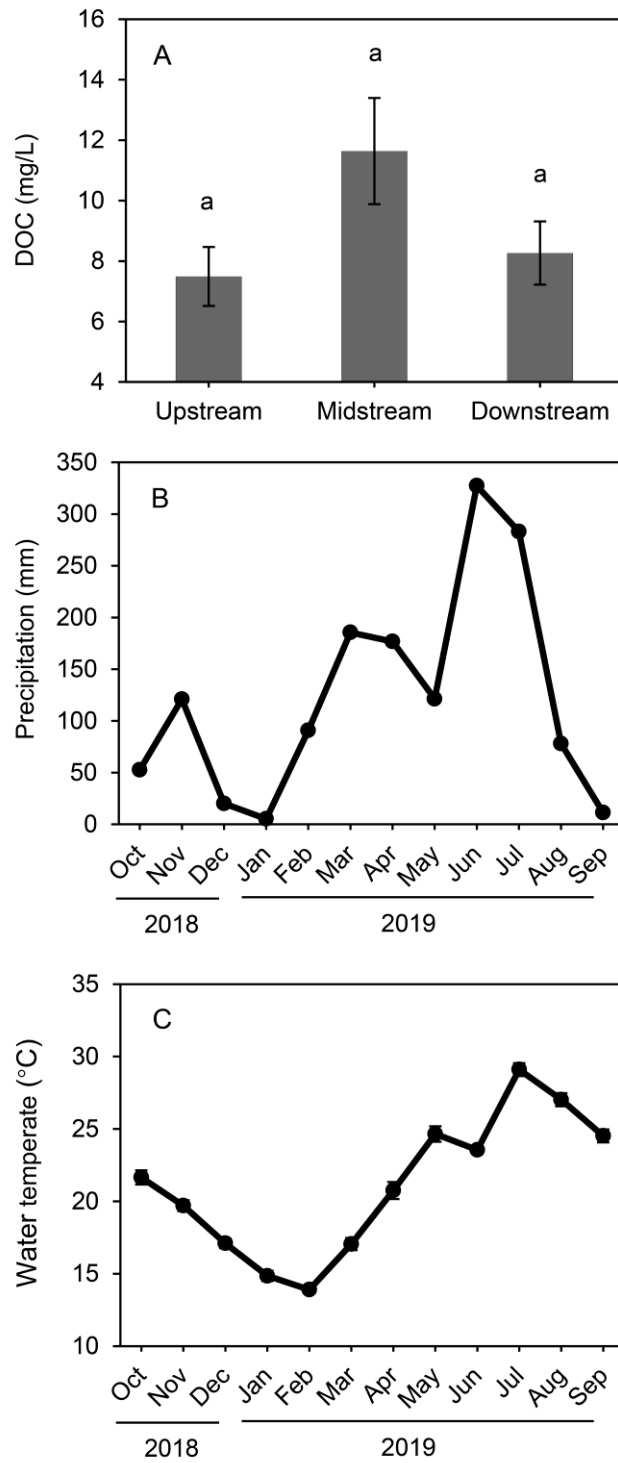


Fig. S3 Spatiotemporal variation of DOC (dissolved organic carbon) (A), precipitation (B) and water temperature (C) in Xiyuan River. Mean $\pm$ s.e., different letters indicate significant differences testing by one-way ANOVA.

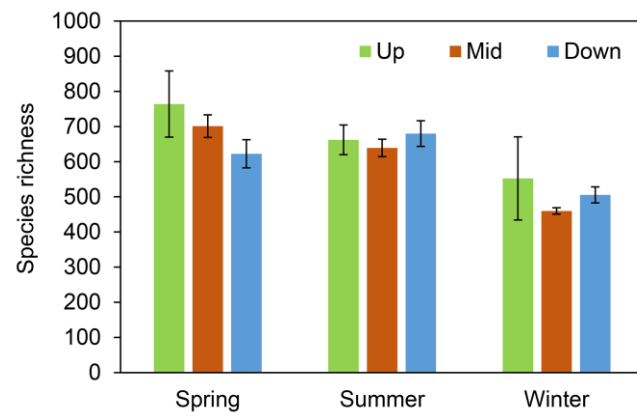


Fig. S4 Spatiotemporal variation of bacterial species richness in Xiyuan River (mean $\pm$ s.e.).

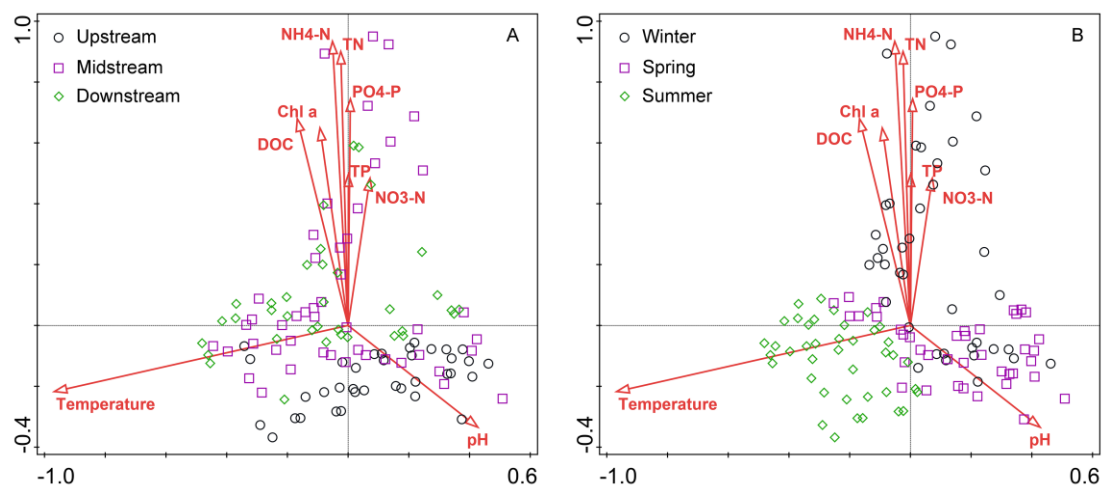


Fig. S5 CCA ordination showing bacterial community composition in relation to environmental factors for spatial scale (A) and temporal scale (B).

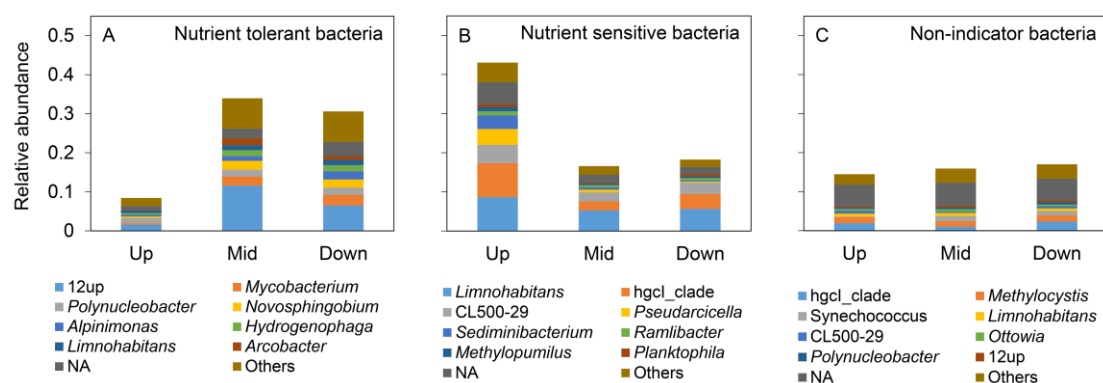


Fig. S6 Anthropogenic activity tolerant (A, 85 bacterial ASVs), anthropogenic activity sensitive (B, 95 bacterial ASVs) and non-indicator (C, 69 bacterial ASVs) bacterial ASVs in the positive networks, and their relative abundance (read number) in upstream, midstream and downstream areas (bacterial ASVs were classified into genes level, NA – unidentified genera, Others – other genera).

Table S1 Latitude and longitude of sampling sites along Xiyuan River

	Sampling site	Latitude °N	Longitude °E
Upstream	Site 1	26.059	119.127
	Site 2	26.063	119.142
	Site 3	26.071	119.149
Midstream	Site 4	26.078	119.161
	Site 5	26.061	119.181
	Site 6	26.042	119.185
	Site 7	26.031	119.200
Downstream	Site 8	26.016	119.209
	Site 9	26.009	119.221
	Site 10	26.008	119.238

Table S2 Spearman's rank correlations showing precipitation in relation to nutrient concentration and chl a

	TN	NH ₄ -N	NO ₃ -N	TP	PO ₄ -P	Chl a
Upstream	0.212	-0.021	0.062	0.300	-0.075	0.201
Midstream	-0.650**	-0.651**	-0.062	-0.355*	-0.439**	-0.602**
Downstream	-0.496**	-0.447**	-0.332*	0.259	0.005	-0.349*

Table S3 Properties of the ten networks from the ten sampling sites (networks contained only the significant correlations)

Network ID	Nodes	Links	Positive links (%)	Diameter	Density	Average clustering coefficient	Average path length	Average betweenness
S1	119	350	65.43	12	0.05	0.451	4.055	171
S2	107	415	63.13	8	0.073	0.416	3.287	121
S3	95	442	65.84	7	0.099	0.513	2.92	86
S4	118	575	73.57	7	0.083	0.545	3.039	115
S5	122	521	83.49	10	0.071	0.463	3.365	143
S6	122	773	76.20	6	0.105	0.524	2.765	103
S7	121	623	78.01	7	0.086	0.514	2.958	112
S8	114	561	69.88	7	0.087	0.499	3.105	115
S9	123	502	69.72	8	0.067	0.466	3.43	148
S10	140	831	69.31	8	0.085	0.488	2.948	135