

Table S1. Statistical values of water quality of 9 urban ponds at Lishui, Nanjing.

Code	parameter	Unit	Mean	SD	Medium	Max	Min
wd	Water depth	cm	138.861	106.078	115.000	280.000	65.000
temp	Temperature	°C	18.014	9.632	17.350	33.400	3.800
o2	Dissolved oxygen	mg/L	7.889	3.416	7.100	17.300	2.600
ph	pH	-	7.913	0.560	7.954	8.927	6.810
cond	Conductivity	uS/cm	478.315	107.447	457.667	699.667	277.667
tn	Total nitrogen	mg/L	1.610	0.937	1.524	4.017	0.233
no3	Nitrate nitrogen	mg/L	0.575	0.581	0.368	2.417	0.097
tp	Total phosphorus	mg/L	0.073	0.083	0.040	0.380	0.013
toc	Total organic carbon	mg/L	11.723	3.528	11.645	22.680	6.907
doc	Dissolved organic carbon	mg/L	5.882	1.153	5.610	9.843	3.373
bod	Biochemical oxygen demand	mg/L	12.124	3.403	12.327	18.613	3.763
cod	Chemical oxygen demand	mg/L	32.299	7.431	30.737	57.090	24.133
cha	Chlorophyll A	µg/L	24.010	8.150	23.132	43.597	10.547
ss	Suspended particulate matter	mg/L	12.546	11.580	9.334	45.500	0.833
vss	Volatile particulate matter	mg/L	7.119	5.274	7.209	20.000	0.333
turb	turbidity	-	26.905	14.271	22.315	70.700	9.397
col	chroma	-	29.461	3.376	29.700	40.493	16.047

SD, standard deviation.

Table S2. List of fish species at the sites investigated in this study.

Order	Family	Species	Alien or not
Cypriniformes	Cobitidae	<i>Misgurnus anguillicaudatus</i>	
		<i>Abbottina rivularis</i>	
		<i>Acheilognathus gracilis</i>	
		<i>Acheilognathus macropterus</i>	
		<i>Hypophthalmichthys nobilis</i>	
		<i>Carassius auratus</i>	
		<i>Ctenopharyngodon idellus</i>	
		<i>Cyprinus carpio</i>	
		<i>Culter mongolicus</i>	
		<i>Culter oxycephalus</i>	
		<i>Hemiculter leucisculus</i>	
		<i>Hypophthalmichthys molitrix</i>	
		<i>Megalobrama amblycephala</i>	
		<i>Pseudobrama simoni</i>	
		<i>Mylopharyngodon piceus</i>	
		<i>Plagiognathops microlepis</i>	
		<i>Pseudolaubuca sinensis</i>	
		<i>Pseudorasbora parva</i>	
		<i>Rhodeus ocellatus</i>	
		<i>Sarcocheilichthys nigripinnis</i>	
Cyprinodontiformes	Adrianichthyidae	<i>Toxabramis swinhonis</i>	
		<i>Oryzias latipes</i>	
	Poeciliidae	<i>Gambusia affinis</i>	A
Osmeriformes	Salangidae	<i>Hemisalanx brachyrostralis</i>	
		<i>Neosalanx tangkahkeii</i>	
Perciformes	Channidae	<i>Channa argus</i>	
		<i>Channa maculata</i>	
	Cichlidae	<i>Oreochromis niloticus</i>	
		<i>Rhinogobius giurinus</i>	
	Odontobutidae	<i>Micropercops swinhonis</i>	
		<i>Odontobutis potamophila</i>	
	Osphronemidae	<i>Macropodus chinensis</i>	
		<i>Lateolabrax japonicus</i>	
Siluriformes	Bagridae	<i>Lateolabrax japonicus</i>	
		<i>Tachysurus fulvidraco</i>	
	Loricariida	<i>Tachysurus vachellii</i>	
		<i>Hypostomus plecostomus</i>	
		<i>Silurus asotus</i>	
Synbranchiformes	Synbranchidae	<i>Silurus meridionalis</i>	
		<i>Monopterus albus</i>	

Table S3. List of wetland plant species in this study.

	Family	Species	Alien or not
Pteridophyta	Salviniaceae	<i>Azolla mexicana</i> <i>Salvinia natans</i>	A
Ceratophyllales	Ceratophyllaceae	<i>Ceratophyllum demersum</i> <i>Ceratophyllum</i> <i>platyacanthum</i>	
Dicotyledons	Acanthaceae	<i>Hygrophila polysperma</i>	
	Amaranthaceae	<i>Alternanthera philoxeroides</i> <i>Alternanthera sessilis</i>	A
	Asteraceae	<i>Artemisia carvifolia</i> <i>Artemisia princeps</i> <i>Conyza bonariensis</i> <i>Conyza canadensis</i> <i>Eclipta prostrata</i> <i>Erigeron annuus</i> <i>Erigeron elongatus</i> <i>Erigeron lonchophyllus</i> <i>Sonchus oleraceus</i> <i>Sphagneticola trilobata</i>	A A
	Convolvulaceae	<i>Ipomoea aquatica</i>	A
	Cucurbitaceae	<i>Actinostemma tenerum</i>	
	Droseraceae	<i>Drosera</i> sp.	
	Fabaceae	<i>Aeschynomene indica</i> <i>Glycine soja</i> <i>Sesbania cannabina</i>	 A
	Haloragaceae	<i>Myriophyllum spicatum</i>	
	Lentibulariaceae	<i>Utricularia macrorhiza</i>	
	Lythraceae	<i>Trapa maximowiczii</i> <i>Trapa natans</i>	
	Nelumbonaceae	<i>Nelumbo nucifera</i>	
	Nymphaeaceae	<i>Euryale ferox</i> <i>Nuphar lutea</i> <i>Nymphaea alba</i>	
	Onagraceae	<i>Ludwigia octovalvis</i>	
	Plantaginaceae	<i>Limnophila sessiliflora</i>	
	Ranunculaceae	<i>Ranunculus sceleratus</i>	
	Umbelliferae	<i>Hydrocotyle verticillata</i>	A
Monocotyledons	Alismataceae	<i>Hydrocleys nymphoides</i>	A
	Araceae	<i>Wolffia globosa</i> <i>Lemna minor</i> <i>Spirodela polyrhiza</i> <i>Pinellia ternata</i> <i>Pistia stratiotes</i>	 A
	Butomaceae	<i>Butomus umbellatus</i>	
	Cabombaceae	<i>Cabomba caroliniana</i>	A
	Cannaceae	<i>Canna indica</i>	A
	Cyperaceae	<i>Cyperus cyperoides</i> <i>Rhynchospora chinensis</i>	
	Hydrocharitaceae	<i>Hydrilla verticillata</i> <i>Hydrocharis dubia</i>	

	<i>Vallisneria natans</i>	
	<i>Vallisneria rubra</i>	A
	<i>Vallisneria spinulosa</i>	
	<i>Vallisneria spiralis</i>	
Marantaceae	<i>Thalia dealbata</i>	A
Poaceae	<i>Alopecurus aequalis</i>	A
	<i>Arthraxon hispidus</i>	
	<i>Brachiaria mutica</i>	A
	<i>Miscanthus sinensis</i>	
	<i>Oryza glaberrima</i>	A
	<i>Oryza rufipogon</i>	
	<i>Oryza sativa</i>	
	<i>Paspalum distichum</i>	
	<i>Phragmites australis</i>	
	<i>Phragmites japonicus</i>	
	<i>Zizania latifolia</i>	
Pontederiaceae	<i>Eichhornia crassipes</i>	A
Potamogetonaceae	<i>Potamogeton crispus</i>	
	<i>Potamogeton malaianus</i>	
	<i>Potamogeton nodosus</i>	
	<i>Stuckenia pectinata</i>	
Typhaceae	<i>Typha latifolia</i>	

Table S4. Important values of dominant wetland plants in each urban ponds at Lishui, Nanjing.

Species	Alien or not	DP	ZT1	ZT2	BM	YY1	YY2	SQ1	SQ2	JQ
<i>Actinostemma tenerum</i>		6.1	11.8	34.6	12.1	13.1	17.1	0	6.2	0
<i>Alopecurus aequalis</i>	A	0	35.7	12.4	0	0	35.2	0	0	0
<i>Alternanthera philoxeroides</i>	A	3.1	3.1	0	37	42.9	0	3.1	0	0
<i>Artemisia carvifolia</i>		0	0	12.4	24.6	0	0	15.3	0	0
<i>Cabomba caroliniana</i>	A	7	0	6.2	0	0	0	6.1	0	33.4
<i>Canna indica</i>	A	14	28.7	0	0	0	0	0	0	0
<i>Ceratophyllum demersum</i>		61.7	9.2	0	0	0	19.1	0	4.1	9.6
<i>Conyza bonariensis</i>		0	13.1	16.9	13.1	0	0	25.4	0	0
<i>Cyperus cyperoides</i>		0	0	44.4	0	0	0	11	0	0
<i>Eclipta prostrata</i>		0	0	53.6	0	0	0	21.4	17	0
<i>Eichhornia crassipes</i>	A	0	0	6.2	92.8	0	3.1	45.3	46.7	0
<i>Euryale ferox</i>		0	0	0	13.9	0	0	46.8	0	0
<i>Glycine soja</i>		0	0	40.7	39.5	4.8	6.2	9.2	0	0
<i>Hydrocharis dubia</i>		0	0	10.9	0	0	23.4	9.3	0	0
<i>Hydrocotyle verticillata</i>	A	24.5	79.4	0	0	2	7.9	0	0	0
<i>Ipomoea aquatica</i>		0	0	17.1	47.7	0	0	0	0	0
<i>Myriophyllum spicatum</i>		0	27.9	62.7	0	0	0	0	9.6	0
<i>Nelumbo nucifera</i>		73.8	0	32.7	0	4.8	0	0	0	26.9
<i>Oryza sativa</i>		0	0	0	16.9	11	8.5	44.5	0	0
<i>Paspalum distichum</i>		0	0	44.2	0	0	0	6.2	0	0
<i>Phragmites australis</i>		0	11.5	0	21.7	0	21.5	0	0	41.9
<i>Thalia dealbata</i>	A	21.9	20.1	0	0	0	0	0	53.1	0
<i>Trapa maximowiczii</i>		0	0	64.7	58.1	0	0	11	0	14.1
<i>Trapa natans</i>		0	11	58.8	14.6	0	0	0	0	0
<i>Typha latifolia</i>		14	0	0	4.8	0	0	0	44.4	21.8
<i>Vallisneria natans</i>		0	0	52.8	0	0	0	0	0	0
<i>Wolffia globosa</i>		9.6	6.1	14.8	0	0	0	0	0	21

Table S5. Statistics of metagenomic splicing results and alpha diversity of each sample.

sample	Total len.(bp)	Total num.	Average len.(bp)	Max len.(bp)	N50 len.(bp)	Shannon	Simpson	Pielou	Chao1	ACE	goods_coverage
Spring											
DP	348,048,491	103,136	3,375	150,708	3,649	2.130	0.562	0.465	24.200	24.987	0.998
ZT1	269,353,646	83,160	3,239	132,578	3,380	2.567	0.735	0.546	54.000	35.537	0.992
ZT2	320,315,632	101,992	3,141	164,294	3,241	2.414	0.722	0.526	38.000	33.107	0.992
BM	352,519,961	124,065	2,841	132,183	2,825	2.383	0.741	0.513	29.200	31.567	0.993
YY1	153,105,226	82,069	2,940	168,272	2,971	2.774	0.798	0.583	28.667	30.417	0.995
YY2	325,865,666	88,659	3,675	314,779	4,315	2.752	0.774	0.600	29.000	29.264	0.994
SQ1	200,057,947	90,864	2,823	121,384	2,815	2.835	0.783	0.596	27.750	28.623	0.997
SQ2	445,100,059	138,899	3,204	247,965	3,378	2.546	0.664	0.548	27.500	31.032	0.995
JQ	481,061,828	130,230	3,694	287,832	4,193	2.316	0.680	0.512	26.750	30.816	0.994
Summer											
DP	563,270,575	161,080	3,497	309,982	3,860	2.372	0.608	0.517	24.000	24.376	0.999
ZT1	475,850,781	142,561	3,338	206,135	3,573	3.204	0.850	0.708	26.000	26.407	0.996
ZT2	522,420,060	146,577	3,564	223,281	3,995	3.018	0.814	0.650	32.500	30.185	0.994
BM	537,751,244	168,584	3,190	201,130	3,337	2.972	0.800	0.632	36.500	33.209	0.993
YY1	569,865,478	158,986	3,584	463,809	3,976	2.241	0.686	0.495	24.667	26.719	0.995
YY2	699,334,704	188,578	3,708	371,790	4,237	2.099	0.598	0.471	25.000	24.211	0.996
SQ1	473,867,591	142,370	3,328	258,226	3,571	3.229	0.846	0.704	24.000	24.343	0.999
SQ2	456,682,667	121,280	3,766	203,508	4,294	2.792	0.771	0.626	22.750	23.847	0.997
JQ	436,258,583	102,963	4,237	286,122	5,475	2.053	0.657	0.513	19.000	17.779	0.997
Autumn											
DP	245,867,118	94,061	3,838	264,660	4,597	1.265	0.341	0.293	22.000	21.971	0.996
ZT1	333,805,608	111,287	3,000	155,185	3,029	3.042	0.785	0.655	25.000	25.497	0.999
ZT2	295,910,993	92,940	3,184	203,695	3,301	1.911	0.593	0.411	27.000	27.734	0.995
BM	83,708,660	92,082	2,609	149,850	2,538	3.789	0.963	0.796	63.500	40.000	0.996
YY1	353,283,818	111,981	3,155	190,077	3,289	2.140	0.627	0.467	25.667	28.414	0.995
YY2	322,988,006	95,333	3,388	216,329	3,651	2.197	0.645	0.479	26.000	27.953	0.995
SQ1	216,434,386	107,046	2,809	105,267	2,805	2.837	0.761	0.604	26.750	28.209	0.997

sample	Total len.(bp)	Total num.	Average len.(bp)	Max len.(bp)	N50 len.(bp)	Shannon	Simpson	Pielou	Chao1	ACE	goods_coverage
SQ2	227,444,425	106,660	2,967	164,189	2,987	2.731	0.744	0.581	31.000	29.430	0.995
JQ	375,549,723	105,470	3,561	229,418	4,017	1.930	0.529	0.427	24.500	25.361	0.996
Winter											
DP	362,890,824	85,275	4,256	306,474	5,597	1.958	0.639	0.470	21.333	22.349	0.995
ZT1	167,261,626	83,219	3,143	266,448	3,305	2.411	0.746	0.533	30.000	33.525	0.993
ZT2	389,410,429	115,550	3,370	630,333	3,612	2.094	0.703	0.493	29.500	28.537	0.993
BM	284,862,093	196,600	2,949	192,387	3,046	2.576	0.715	0.555	25.200	25.880	0.998
YY1	388,737,617	108,892	3,570	365,979	3,975	2.046	0.677	0.466	28.000	31.220	0.992
YY2	305,707,408	93,883	3,256	167,966	3,521	1.814	0.539	0.396	26.500	28.914	0.994
SQ1	315,696,779	90,193	3,500	248,716	3,879	2.378	0.729	0.512	27.000	27.940	0.995
SQ2	385,894,363	127,461	3,028	132,145	3,053	2.453	0.632	0.522	31.000	31.777	0.994
JQ	498,690,490	131,739	3,785	382,946	4,374	2.123	0.629	0.491	23.000	23.163	0.996

Total number, number of Scaffolds; Total len. Total length of Scaffolds; Average len., average length of Scaffolds; ; Max len., maximum length of Scaffolds; N50 the length of the largest sequence contig whose Scaffolds length covers 50% of all nucleotides.

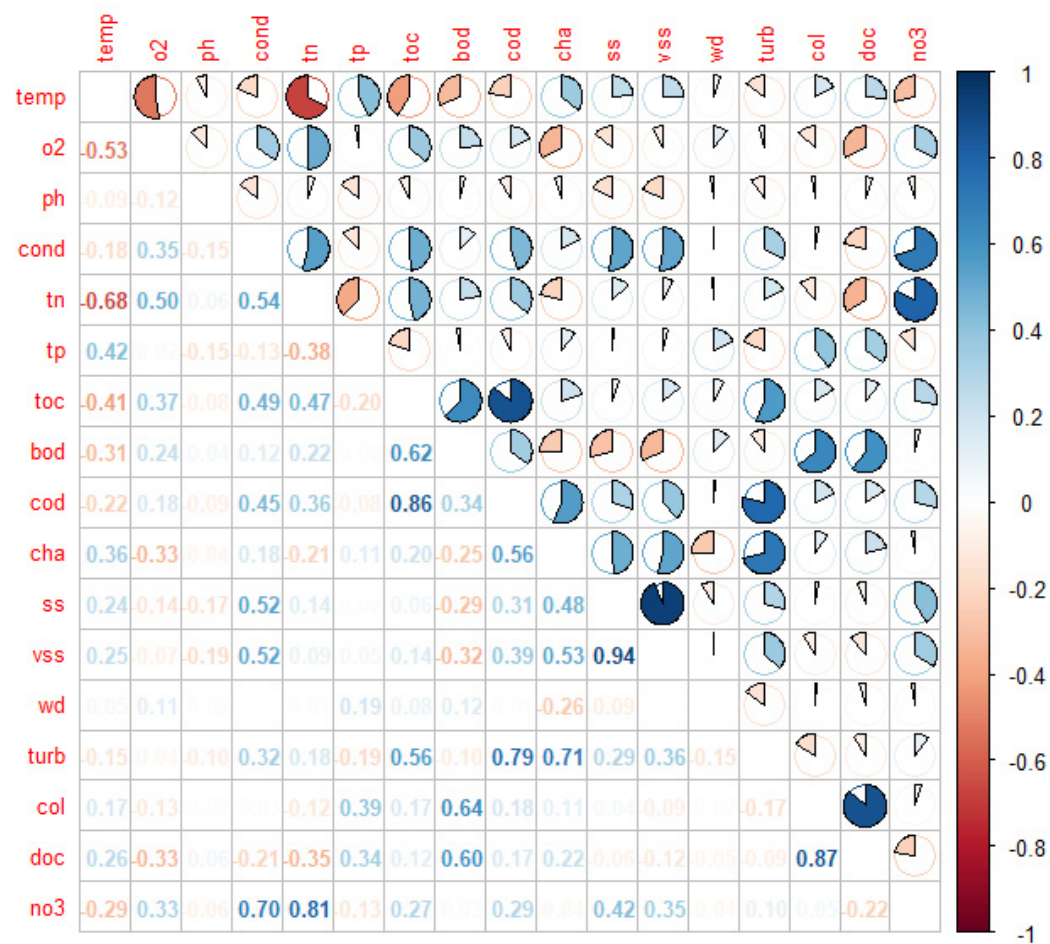


Figure S1. Correlation between water quality parameters.

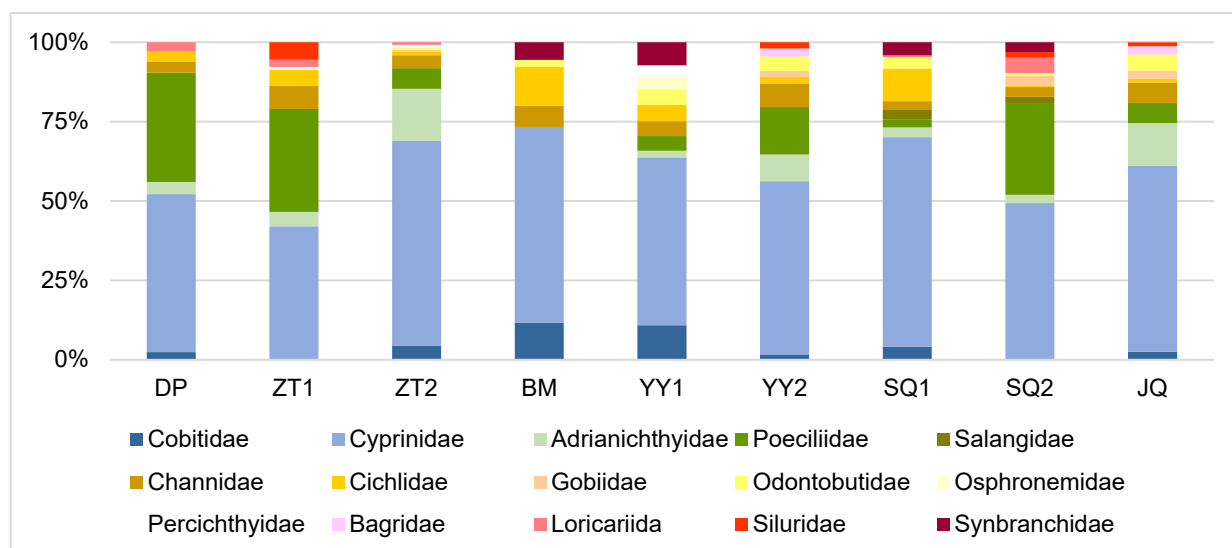


Figure S2. Composition of fish community at each study site.

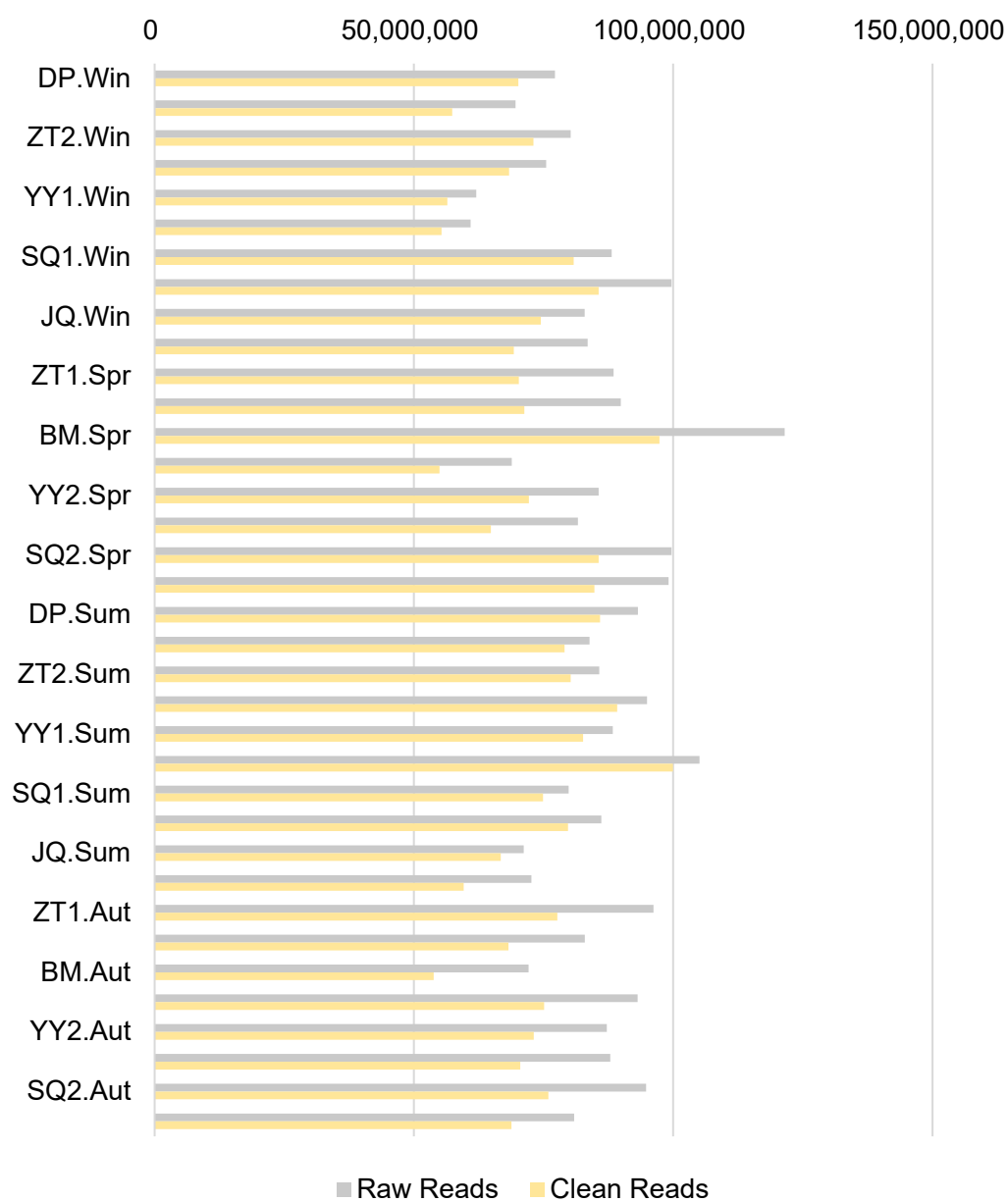


Figure S3. Sequencing data of microbial metagenomes.

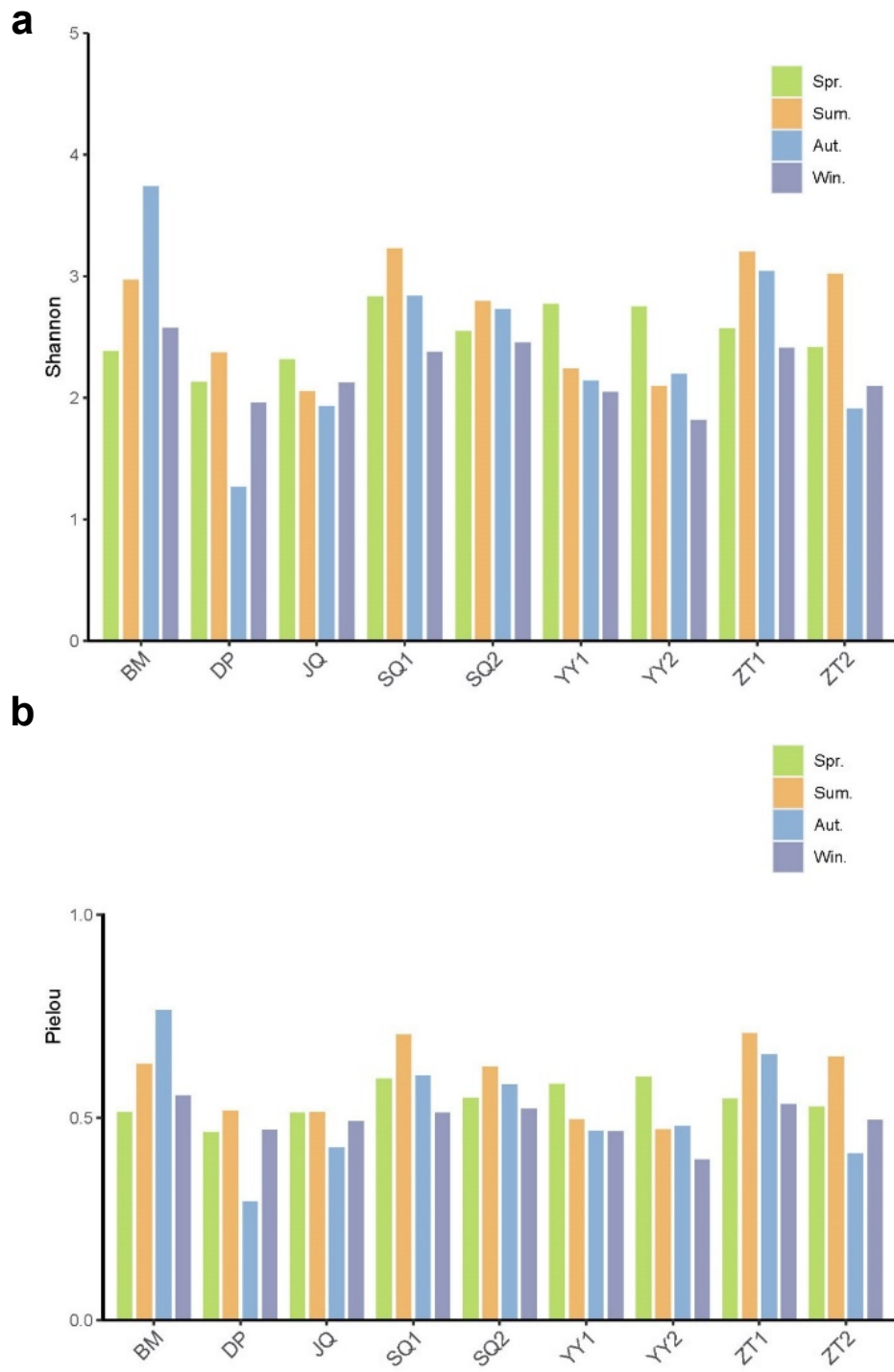


Figure S4. Microbial alpha diversity in each sample.

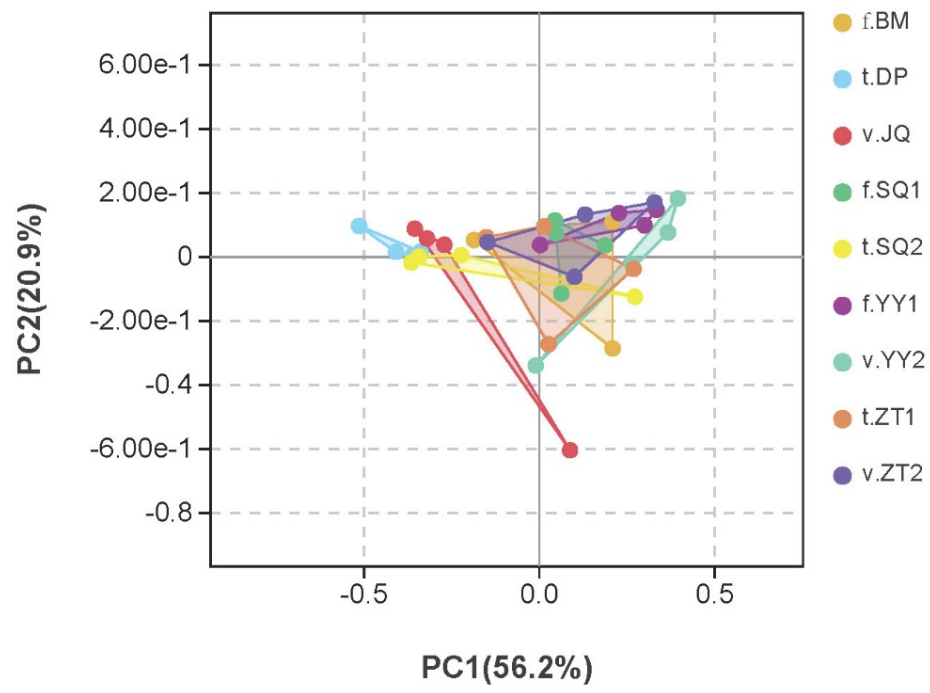


Figure S5. PCA of microbial community.

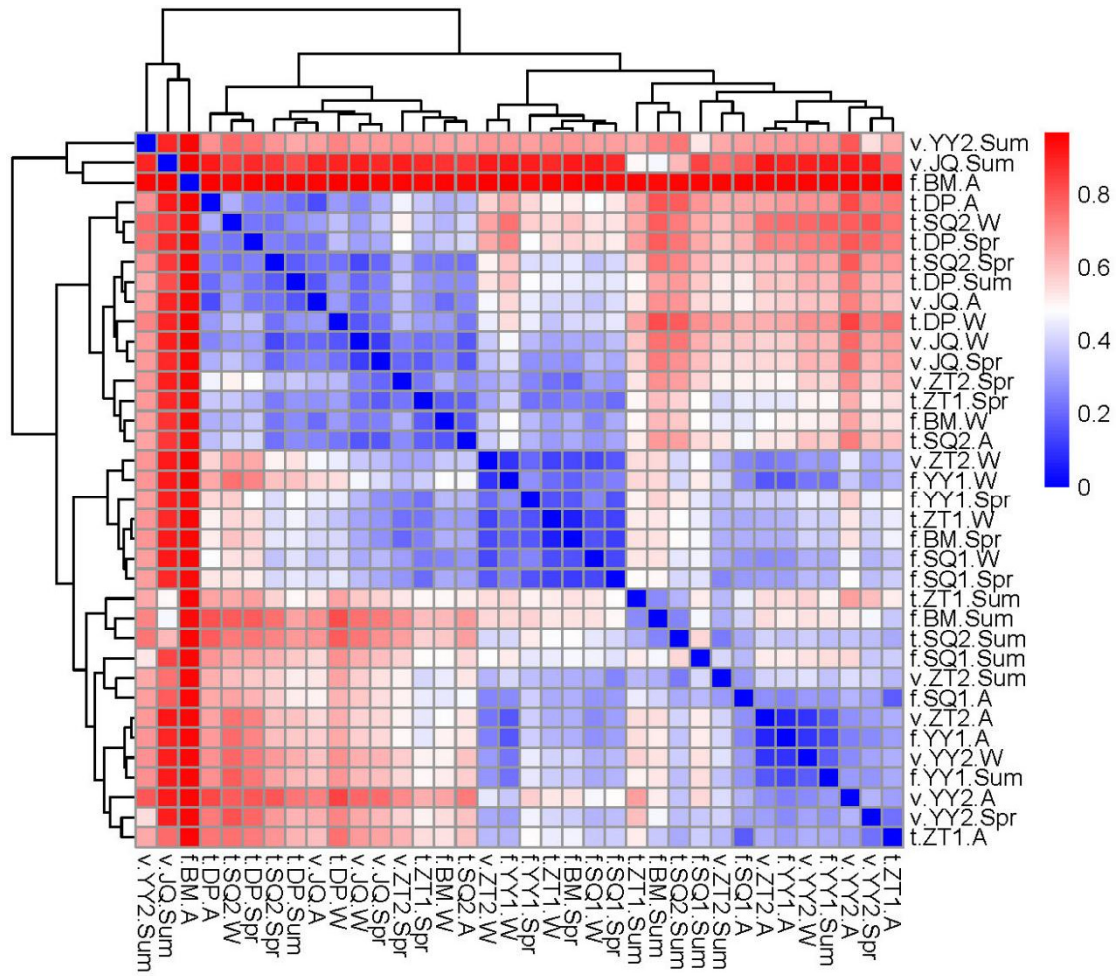


Figure S6. Heatmap of microbial community similarity.

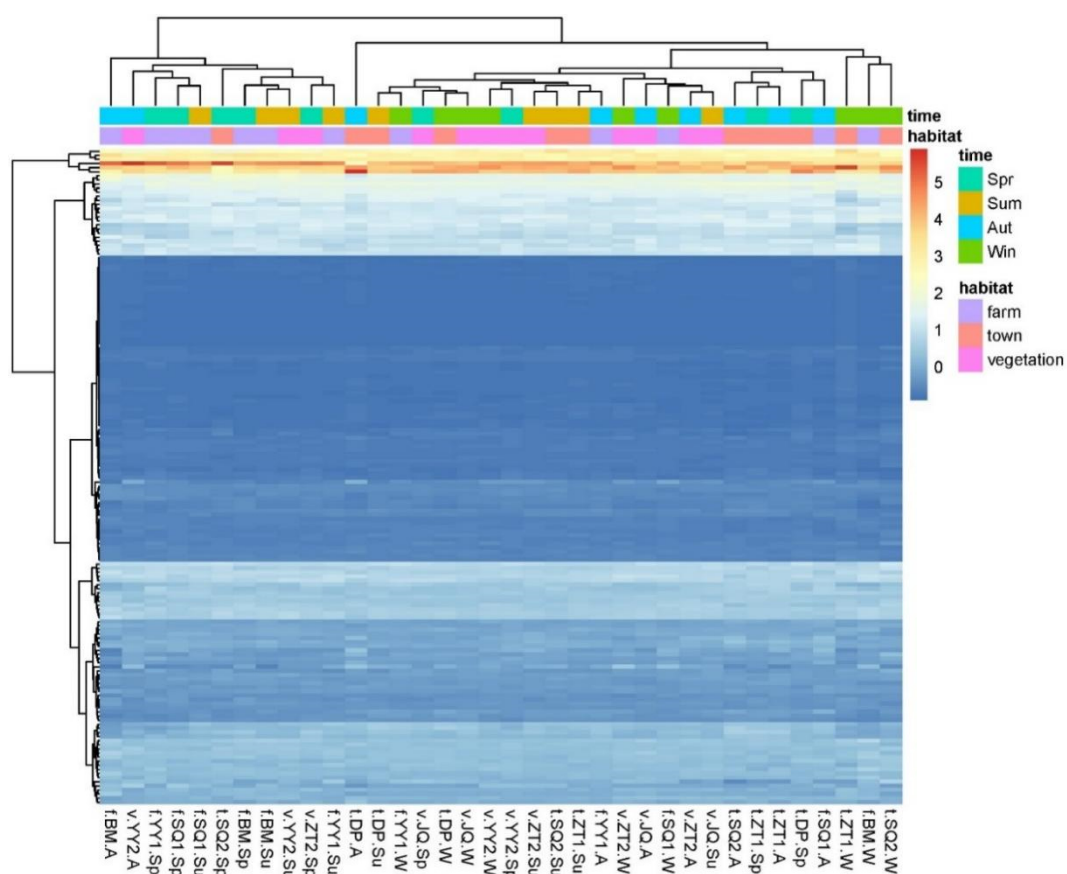


Figure S7. Heat map of gene abundance similarity of KEGG metabolic pathway in different samples.

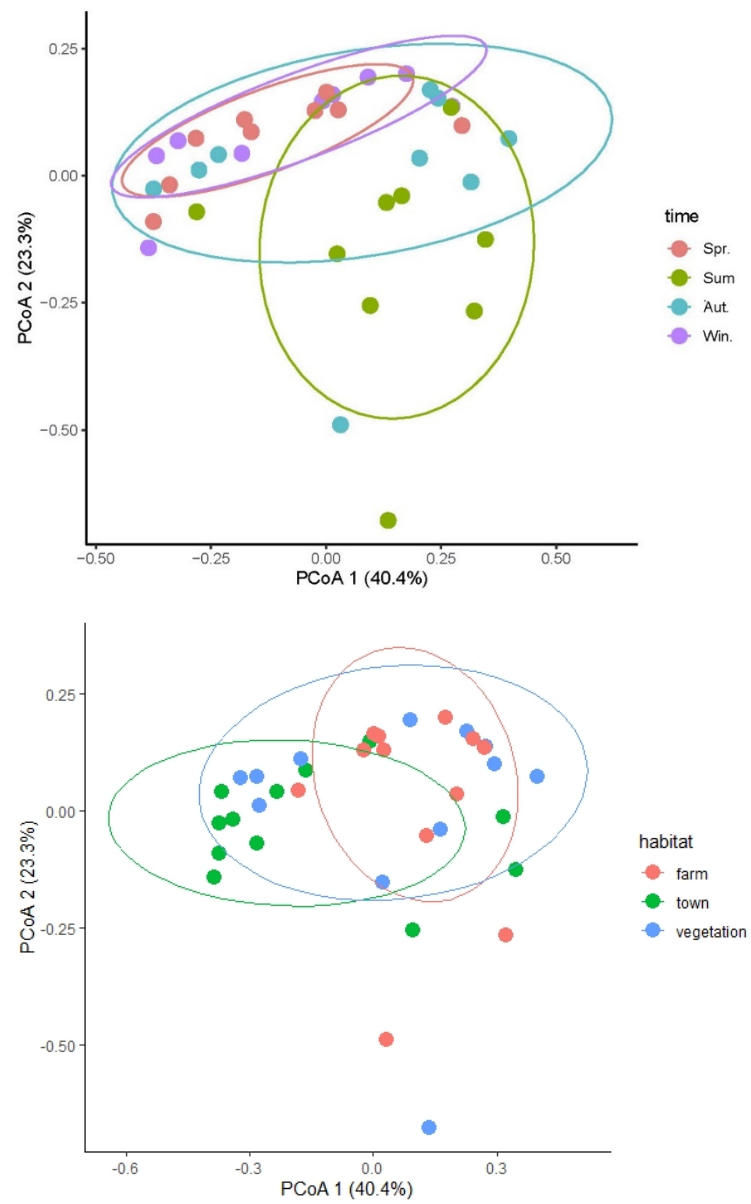


Figure S8. PCoA of microbial community based on bray distance.

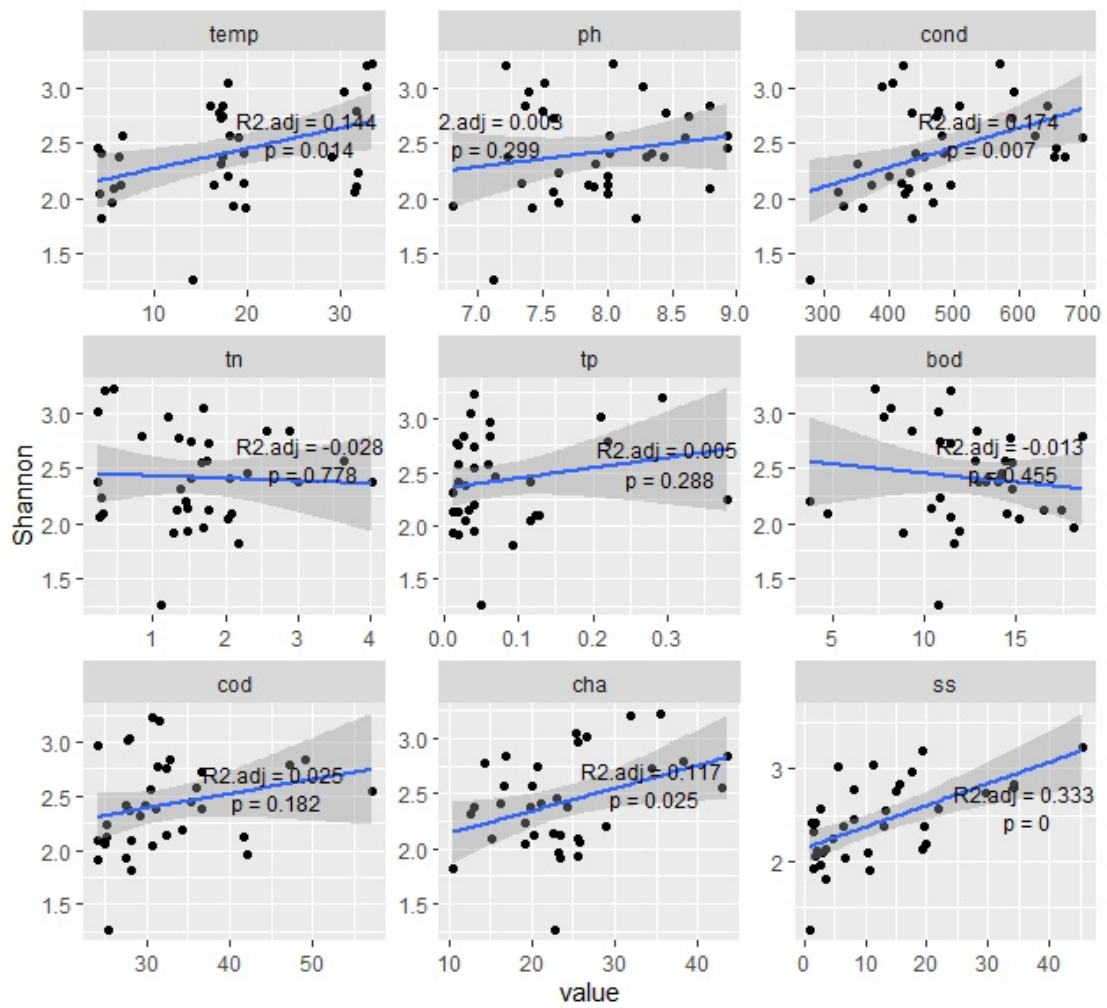


Figure S9. Linear relationship between water quality and microbial Shannon diversity.

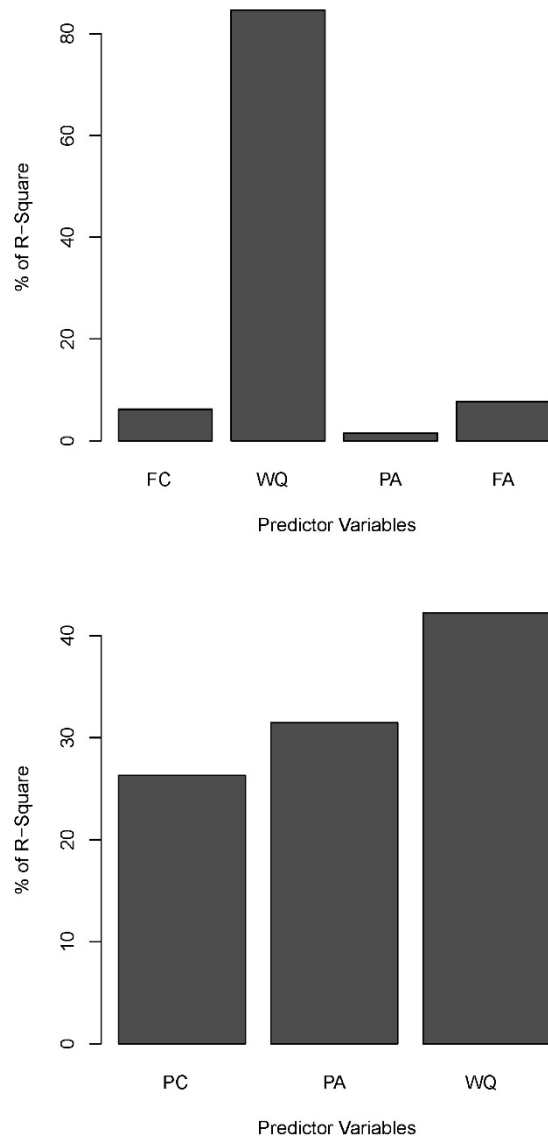


Figure S10. Contribution of biotic and abiotic factors to the linear model of microbial diversity (WQ: Water Quality, FC: Fish Community, PC: wetland Plant Community, PA: Alien wetland Plant abundance).

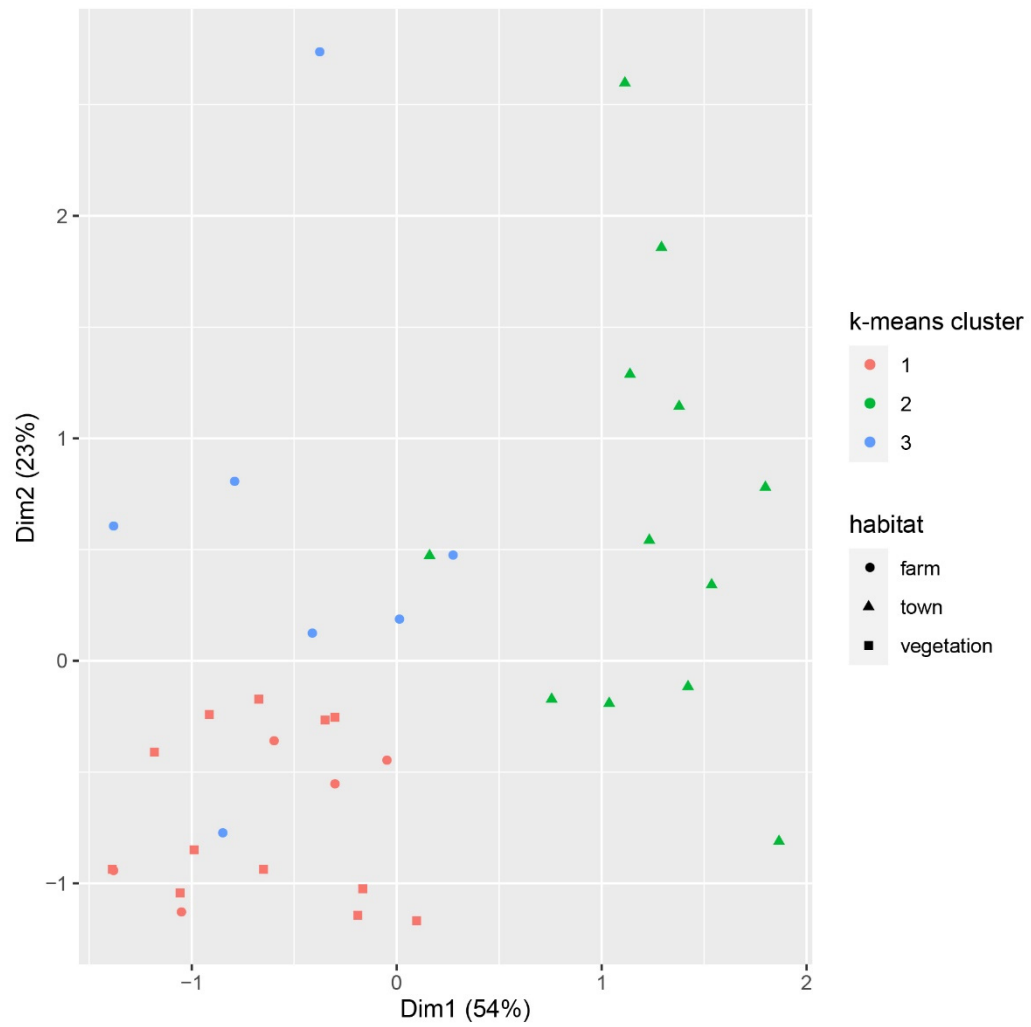


Figure S11. The cluster plot based on k-means analysis on organism and microbial community, the habitat type of each sample is labelled.