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Article Title: How did the bacterial community respond to the urbanization level along the Yangtze River?

Journal Name: Environmental Science: Processes & Impacts

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Table S1. Taxonomic diversity indices of the bacteria communities of the sediment. OTUs were constructed as 97% sequence identity clusters.

	OTU	ace	Chao1	coverage	shannon	simpson
YBsu	1643	2043	2092	0.975	6.36	0.0036
CTsu	1587	2156	2109	0.971	5.49	0.0161
WXsu	960	1616	1317	0.980	3.61	0.1570
XTsu	2284	2847	2849	0.964	6.69	0.0033
HKsu	1507	2129	2157	0.970	5.16	0.0286
HSsu	1943	2416	2443	0.970	6.54	0.0031
MAsu	1596	2016	2203	0.975	6.26	0.0047
NJsu	1303	2501	2086	0.969	4.65	0.0378
ZJsu	2084	2644	2754	0.966	6.53	0.0052
NTsu	1491	2114	2137	0.970	5.31	0.0207
XLsu	1030	1729	1515	0.980	5.2	0.0132
SDsu	901	1597	1344	0.981	4.45	0.0394
YBwi	2002	2606	2576	0.967	6.39	0.0070
CTwi	2046	2590	2584	0.967	6.52	0.0039
WXwi	2250	2780	2769	0.966	6.72	0.0038
XTwi	2235	2826	2830	0.965	6.77	0.0028
HKwi	1571	2189	2201	0.970	5.66	0.0274
HSwi	2336	2909	2945	0.964	6.83	0.0024
MAwi	2360	3001	2965	0.962	6.78	0.0028
NJwi	1283	1833	1884	0.973	4.65	0.0557
ZJwi	2067	2702	2657	0.964	6.31	0.0066
NTwi	1621	2073	2038	0.975	6.27	0.0042
XLwi	461	909	752	0.989	2.69	0.1802
SDwi	711	1039	928	0.989	5.07	0.0165

Table S2. Physiochemical properties of water and sediments of the Yangtze River.

Taxon	T(℃)	pH	Cu (mg/kg)	Pb (mg/kg)	As (mg/kg)	Hg (mg/kg)	Cd (mg/kg)	TP (mg/kg)	TN (mg/kg)	N/P	OM (%)
YB	17.5±5.5	8.2±0.0	60.5±3.5	43.5±1.5	6.3±1.6	0.137±0.049	0.467±0.021	760.5±101.5	8765±3305	11.1±2.9	0.89±0.02
CT	17.0±7.0	8.2±0.0	61.0±9.0	67.0±12.0	9.8±2.6	0.387±0.071	0.763±0.033	1004.5±163.5	9920±3060	9.6±1.5	1.13±0.02
WX	13.0±5.0	8.1±0.0	79.5±36.5	67.0±41.0	6.9±0.2	0.148±0.064	0.619±0.015	850.5±270.5	5780±3400	6.1±2.0	0.96±0.24
XT	15.1±6.2	8.3±0.0	67.0±26.0	39.5±13.5	9.2±1.4	0.198±0.006	0.517±0.010	948.5±274.5	10830±2370	11.7±0.9	0.94±0.09
HK	16.6±9.8	8.0±0.0	9.0±1.0	17.0±1.0	4.6±1.3	0.073±0.026	0.438±0.011	468.0±75.0	10100±4970	20.4±7.3	1.15±0.06
HS	14.3±6.2	8.1±0.1	61.0±27.0	41.0±21.0	11.4±4.5	0.171±0.039	0.682±0.021	732.0±176.0	8450±4250	10.8±3.2	1.02±0.56
MA	16.0±11.6	8.4±0.1	23.7±4.8	18.1±2.1	9.5±1.3	0.077±0.015	0.749±0.032	848.0±107.0	11015±2805	13.6±5.0	1.49±0.06
NJ	17.6±13.4	8.1±0.0	74.0±11.8	42.4±0.1	14.4±4.1	0.150±0.027	0.656±0.008	1781.5±203.5	11500±6470	7.0±4.4	1.06±0.08
ZJ	16.4±11.6	8.5±0.0	12.6±1.9	14.4±0.8	8.0±1.2	0.050±0.001	0.414±0.024	695.5±45.5	8185±3555	11.5±4.4	1.54±0.09
NT	17.2±13.5	8.3±0.1	19.2±0.9	20.9±0.8	11.0±1.2	0.102±0.019	0.572±0.018	676.0±102.3	9470±1850	13.9±0.6	1.53±0.06
XL	17.9±13.8	7.8±0.0	19.5±0.3	19.0±0.3	9.3±0.9	0.067±0.019	0.669±0.037	665.2±131.0	13200±2000	20.0±0.9	0.76±0.12
SD	18.4±14.6	7.7±0.0	18.5±1.5	20.5±3.5	10.4±0.2	0.199±0.067	0.424±0.029	677.0±5.0	7475±4675	11.0±6.8	0.83±0.01

Table S3. Correlation between physicochemical parameters and urbanization level

		T (℃)	pH	Cu (mg/kg)	Pb (mg/kg)	As (mg/kg)	Hg (mg/kg)	Cd (mg/kg)	TP (mg/kg)	TN (mg/kg)	N/P	OM (%)
Overall	Urbanization level (%)	0.124	**-.657****	**-.442***	-0.312	0.139	-0.02	-0.193	-0.044	0.113	0.267	-0.16
First grade	Demographic aspect	0.04	**-.772****	-0.306	-0.226	0.099	-0.046	-0.041	-0.029	0.097	0.263	-0.278
	Spatial aspect	0.055	0.122	0.124	0.186	-0.037	0.26	-0.064	-0.038	-0.052	-0.085	-0.015
	Economic aspect	0.1	**-.610****	**-.510***	**-.415***	0.183	-0.146	-0.145	0.012	0.145	0.276	-0.078
	Social aspect	0.089	**-.764****	**-.505***	**-.427***	0.082	-0.257	-0.249	-0.121	0.119	0.359	-0.21
Basic grade	Percentage of nonagricultural population (%)	0.061	**-.750****	-0.304	-0.271	0.302	-0.103	-0.063	0.067	0.058	0.16	-0.18
	Urban population density(person/km^2)	0.002	**-.544****	-0.209	-0.101	-0.167	0.034	-0.002	-0.13	0.111	0.296	-0.3
	Number of built-up areas(km^2)	0.079	-0.098	0.025	0.22	0.093	**.542****	0.098	0.045	0.001	-0.052	-0.019
	Number of built-up areas per capita(m^2/person)	0.021	0.263	0.168	0.109	-0.129	-0.033	-0.175	-0.092	-0.079	-0.088	-0.009
	Per capita GDP(10^4 yuan /person）	0.089	**-.613****	**-.481***	**-.456***	0.163	-0.323	-0.213	0.007	0.165	0.308	-0.14
	GDP3（10^8 yuan）	0.093	**-.732****	-0.287	-0.143	0.177	0.28	-0.171	-0.007	0.007	0.072	-0.278
	Total fixed asset investment per capita (10^4 yuan /person）	0.055	-0.009	**-.535****	**-.501***	0.09	**-.500***	0.068	0.038	0.234	0.363	0.346
	Number of phones per 10000 people	0.089	**-.764****	**-.505***	**-.427***	0.082	-0.257	-0.249	-0.121	0.119	0.359	-0.21

Two asterisks indicate that the environmental factor is significantly correlated with urbanization level ($P<0.01$) and an asterisk also represents the relevance between the variable and urbanization level ($P<0.05$).

Table S4. Relationships between bacterial community composition based on the genus level and urbanization level. The correlation coefficient was calculated using SPSS 20.0. Two asterisks indicate that the variable is significantly correlated to the alpha diversity index (P<0.01) and an asterisk also represents the relevance between the variable and the diversity index (P<0.05).

Phylum	Class	Genus	Correlation coefficient
Acidobacteria	*Acidobacteria*	*11-24_norank*	0.106
		Acidobacteria_norank	**-0.504***
		Blastocatella	-0.088
		RB41_norank	0.065
		Subgroup_17_norank	**-0.481***
		Subgroup_2_norank	0.319
		Subgroup_6_norank	-0.355
Actinobacteria	*Actinobacteria*	*Acidimicrobiales_uncultured*	0.202
	Actinobacteria	*Arthrobacter*	0.28
	Actinobacteria	*Gaiellales_uncultured*	0.029
	Actinobacteria	*Marmoricola*	0.022
	Actinobacteria	*Micromonospora*	0.264
	Actinobacteria	*Nocardioides*	0.255
Aminicenantes	*norank*	*Aminicenantes_norank*	-0.312
Bacteroidetes	*Cytophagia*	*Pontibacter*	**0.434***
	Flavobacteriia	*Flavobacterium*	0.304
	Flavobacteriia	*Cloacibacterium*	0.371
	Sphingobacteriia	*Chitinophagaceae_uncultured*	0.161
	Sphingobacteriia	*Flavihumibacter*	-0.049
	Sphingobacteriia	*Pedobacter*	0.3
Chloroflexi	*JG37-AG-4*	*JG37-AG-4_norank*	0.379
	S085	*S085_norank*	-0.339
	Anaerolineae	*Anaerolineaceae_uncultured*	-0.375
	Caldilineae	*Caldilineaceae_uncultured*	-0.236
	Chloroflexia	*Roseiflexus*	0.195
	KD4-96	*KD4-96_norank*	**-0.436***
	Ktedonobacteria	*HSB_OF53-F07_norank*	0.125
	unclassified	*Chloroflexi_unclassified*	-0.311
	uncultured	*Chloroflexi_uncultured*	**-0.412***
Firmicutes	*Bacilli*	*Bacillus*	0.28
		Fictibacillus	**0.460***
	Clostridia	*Clostridium_sensu_stricto_1*	0.333
		Fusibacter	0.125
Gemmatimonadetes	*Gemmatimonadetes*	*Gemmatimonadaceae_uncultured*	-0.314
		Gemmatimonas	0.245
Latescibacteria	*norank*	*Latescibacteria_norank*	**-0.434***
Nitrospirae	*Nitrospira*	*Nitrospira*	-0.328

Phylum	Class	Genus	Correlation coefficient
Proteobacteria	*Alphaproteobacteria*	*Xanthobacteraceae_uncultured*	0.354
		Bradyrhizobium	0.397
		Novosphingobium	0.384
		Sphingomonas	0.346
	Betaproteobacteria	*Nitrosomonadaceae_uncultured*	**-0.482***
		TRA3-20_norank	-0.063
		Comamonadaceae_unclassified	-0.313
		SC-I-84_norank	-0.4
		Oxalobacteraceae_unclassified	**0.531****
		Polaromonas	**0.408***
		Massilia	0.344
		Ferribacterium	-0.198
		Methylophilaceae_uncultured	-0.153
		Hydrogenophaga	0.128
		Thiobacillus	-0.368
		Methylophilaceae_unclassified	-0.043
		Pseudorhodoferax	0.267
	Deltaproteobacteria	*M20-Pitesti_norank*	0.341
		GR-WP33-30_norank	-0.193
		Bacteriovorax	0.264
		43F-1404R_norank	**-0.642****
		Sva0485_norank	-0.381
		Anaeromyxobacter	0.056
		Myxococcales_unclassified	0.204
	Gammaproteobacteria	*Pseudomonas*	0.094
		Acinetobacter	0.378
		Xanthomonadales_uncultured	**-0.598****
		Lysobacter	0.015
		Thermomonas	0.134
		Arenimonas	0.085
		Silanimonas	0.266
		Polycyclovorans	-0.023
Thermotogae	*Thermotogae*	*GAL15*	-0.273

Table S5. Correlation between pH and other physicochemical parameters.

	T (℃)	Cu (mg/kg)	Pb (mg/kg)	As (mg/kg)	Hg (mg/kg)	Cd (mg/kg)	TP (mg/kg)	TN (mg/kg)	N/P	OM (%)
Correlation coefficient	-0.328	0.092	0.034	-0.05	-0.107	-0.082	0.114	-0.046	-0.242	0.763**

Double asterisk means the p-value less than 0.01.

Table S6. Index on the urbanization system of sampling sites along the Yangtze River

	FN	YB	CT	WX	XT	HK	HS	MA	NJ	ZJ	NT	XL	SD
Demographic aspect	Percentage of nonagricultural population (%)	0.20	0.41	0.45	0.27	0.68	0.57	0.36	0.78	0.41	0.60	0.74	0.91
	Percentage of secondary and tertiary industry employment (%)	0.54	0.67	0.67	0.84	0.91	0.80	0.69	0.94	0.88	0.79	0.96	0.97
	urban population density(persons/km^2）	1104	12128	13040	13798	18708	6292	10925	9134	7739	3024	17765	15700
Spatial aspect	Number of built-up areas(km^2)	818.60	1248.10	38.13	28.48	336.60	208.52	52.30	410.30	76.90	866.70	256.10	606.77
	Percent of urban area (%)	0.45	0.85	0.61	0.63	0.61	0.88	0.56	0.56	0.57	0.57	0.57	0.40
	Number of built-up areas per capita（m^2/person）	404.25	70.00	46.79	45.87	32.56	139.84	51.31	61.20	74.16	189.15	32.25	25.76
	Urban area per capita（m^2/person）	906.17	82.45	76.69	72.48	53.45	158.94	91.53	109.49	129.22	330.69	56.29	63.70
Economic aspect	Per capita GDP(10^4 yuan /person）	2.75	4.66	4.00	3.56	12.17	4.60	5.98	14.88	12.89	8.02	20.63	17.41
	Proportion of the added value of the second and tertiary industry to GDP（%）	6.05	12.67	12.55	5.58	27.77	10.60	16.17	40.83	25.36	16.32	66.46	226.41
	Percentage of GDP of the added value of secondary industry（10^8 yuan）	889.9	7071.8	361.7	296.0	4785.7	723. 5	818.6	3916.1	1727.0	2977.5	6893.0	7940.7

	FN	YB	CT	WX	XT	HK	HS	MA	NJ	ZJ	NT	XL	SD
Economic aspect	Percentage of GDP of the added value of tertiary industry（10^8 yuan）	419.7	7497.8	288.5	172.3	4933.8	390.1	467.2	5572.3	1642.6	2816.0	6663.9	16914.5
	Gross industrial output value per capita (10^4 yuan /person）	14662	16466	33419	71424	41742	81168	26433	199966	323256	80183	535494	49594
	Local financial revenue per capita (10^4 yuan /person）	2936	13653	4956	2355	23793	5341	9190	27117	26208	8159	23400	38500
	Total fixed asset investment per capita (10^4 yuan /person）	23372	45865	28949	24178	84646	43354	81393	83937	93535	57068	91819	44312
	The total amount of profits（10^8 yuan）	315.40	2439.20	52.94	104.58	406.50	154.49	176.12	1724.90	889.68	1635.50	2086.00	4527.90
Social aspect	Disposable income per capita（yuan）	26207	27239	20110	22503	33270	25208	35262	42813	35752	36291	46677	52962
	Number of phones per 10000 people	7727	9934	9370	5932	22954	10272	9767	19637	14606	14865	28185	28300
	Civilian car ownership per 10000 people	401	687	716	344	1979	573	706	3029	1303	1341	4027	1780
	Number of doctors per 10000 people	41.13	49.33	51.19	28.87	94.88	76.61	49.45	99.63	69.88	53.47	101.95	118.72

Table S7. Factor loading of principal components of different indices of urbanization system

		Axis 1	Axis 2
Demographic aspect	Percentage of nonagricultural population (%)	**0.892**	0.047
	urban population density(person/km^2)	**0.593**	-0.425
Spatial aspect	Number of built-up areas(km^2)	0.008	**0.805**
	Number of built-up areas per capita（m^2/person）	-0.569	**0.619**
Economic aspect	Per capita GDP($10^{\wedge 4}$ yuan /person）	**0.956**	-0.072
	GDP3（$10^{\wedge 8}$ yuan）	**0.821**	0.453
	Total fixed asset investment per capita ($10^{\wedge 4}$ yuan /person）	**0.579**	-0.439
Social aspect	Number of phones per 10000 people	**0.96**	0.066

Table S8. Correlations between metabolic bacteria and urbanization index, as well as physicochemical parameters. All variables in the table are corresponding with the meanings of same variables in figure 3. Two asterisks indicate that the variable is significantly correlated to the alpha diversity index ($P<0.01$) and an asterisk also represents the relevance between the variable and the diversity index ($P<0.05$).

	T(℃)	pH	Cu (mg/kg)	Pb (mg/kg)	As (mg/kg)	Hg (mg/kg)	Cd (mg/kg)	TP (mg/kg)	TN (mg/kg)	N/P	OM (%)	UL
Ammonia oxidizer	-0.007	-0.296	0.129	0.109	0.075	0.332	0.049	0.27	-0.1	-0.314	**-.416***	0.257
Atrazine metabolism	0.105	**-.784****	-0.031	-0.058	0.119	0.125	-0.035	0.116	0.038	-0.013	**-.649****	**.630****
Biomass degrader	-0.15	**.495***	-0.032	0.028	0.007	-0.135	0.149	-0.038	0.141	0.121	**.646****	-0.319
Carbon fixation	-0.315	-0.189	-0.191	-0.15	-0.041	0.282	**-.458***	-0.181	0.142	0.243	-0.126	0.218
Cellobiose degrading	-0.175	**.465***	-0.18	-0.135	0.056	-0.216	0.134	0.07	0.112	0.075	**.614****	-0.171
Cellulose degrader	0.087	-0.006	0.099	0.082	0.167	0.266	-0.174	-0.182	-0.266	-0.287	0.031	0.046
Chitin degradation	-0.052	**-.694****	-0.154	-0.129	0.033	0.201	-0.351	-0.09	-0.057	0.04	**-.477***	**.553****
Chlorophenol degrading	0.006	**-.773****	-0.233	-0.222	0.106	0.091	-0.216	-0.154	0.002	0.133	**-.574****	**.556****
Degrades aromatic hydrocarbons	0.088	**-.545****	0.05	0.101	-0.041	-0.192	0.001	-0.047	-0.179	-0.039	-0.373	0.211
Dehalogenation	0.008	-0.175	0.064	0.128	**-.499***	0.265	-0.085	-0.165	-0.159	-0.058	**-.512***	-0.018
Hydrocarbon degrading	0.015	0.08	0.288	0.393	-0.171	0.027	-0.026	-0.275	-0.305	-0.121	0.024	-0.293
Iron oxidizer	-0.345	0.267	0.016	0.048	-0.056	-0.303	-0.159	-0.013	0.219	0.232	**.439***	-0.254
Iron reducer	-0.137	**-.420***	-0.217	-0.229	0.033	0.047	-0.049	0.069	0.044	-0.034	-0.306	0.335
Lignin degrader	-0.162	-0.213	-0.182	-0.17	-0.017	0.11	**-.479***	-0.121	0.03	0.172	-0.099	0.352
Methane oxidation	0.146	-0.22	0.023	0.032	-0.104	-0.164	0.088	-0.178	-0.148	-0.015	-0.274	0.063
Naphthalene degrading	-0.072	**-.663****	-0.056	-0.049	0.076	0.018	-0.003	0.088	0.211	0.144	**-.474***	**.549****
Nitrite reducer	0.077	-0.084	0.207	0.163	0.366	0.344	0.032	0.393	-0.027	-0.255	-0.174	0.182
Nitrogen fixation	-0.055	**-.672****	-0.096	-0.034	0.019	0.226	-0.21	-0.101	-0.083	-0.07	**-.437***	**.552****
Pollutant degrader	0.155	-0.371	-0.218	-0.252	-0.041	-0.203	0.163	0.023	0.02	0.027	-0.371	0.281
Propionate metabolism	0.128	**-.634****	-0.022	-0.021	-0.099	-0.046	-0.285	-0.157	-0.056	0.054	**-.546****	0.351
Selenate reducer	-0.188	**-.429***	-0.258	-0.174	0.023	0.11	-0.366	-0.21	0.145	0.326	-0.191	**.470***

	T(℃)	pH	Cu (mg/kg)	Pb (mg/kg)	As (mg/kg)	Hg (mg/kg)	Cd (mg/kg)	TP (mg/kg)	TN (mg/kg)	N/P	OM (%)	UL
Stores polyhydroxybutyrate	-0.249	-0.294	0.042	0.093	-0.338	0.04	-0.386	-0.188	0.056	0.21	-0.364	0.151
Streptomycin producer	0.265	**-.498***	0.035	-0.049	0.118	0.123	-0.22	0.065	-0.118	-0.078	**-.498***	0.368
Sugars fermentor	-0.033	**-.455***	0.029	0.04	-0.043	0.017	-0.1	-0.121	0.105	0.231	**-.462***	0.173
Sulfate reducer	0.041	-0.128	-0.07	-0.021	-0.386	0.179	-0.074	-0.183	-0.071	0.042	**-.406***	0.001
Sulfide oxidizer	0.319	**-.476***	-0.157	-0.142	0.081	-0.015	-0.208	-0.074	-0.329	-0.305	-0.185	0.374
Sulfur metabolizing	-0.141	**-.563****	-0.036	-0.024	0.027	0.335	-0.369	-0.006	0.117	0.117	**-.483***	**.477***
Sulfur oxidizer	-0.122	**-.590****	-0.148	-0.094	0.139	-0.076	0.093	-0.092	0.137	0.142	-0.284	0.364
Sulfur reducer	-0.012	0.223	0.044	0.125	-0.151	**-.454***	-0.075	-0.28	-0.036	0.188	0.353	-0.275
Syntrophic	0.201	0.058	-0.037	0.032	0.053	-0.308	-0.073	-0.209	0.041	0.256	0.277	0.031
TCE degrader	0.155	-0.371	-0.218	-0.252	-0.041	-0.203	0.163	0.023	0.02	0.027	-0.371	0.281
Xylan degrader	0.135	0.113	0.072	0.141	-0.39	0.211	0.029	-0.047	-0.333	-0.265	-0.208	-0.176
Unknown	-0.037	0.159	-0.306	-0.329	0.097	-0.39	-0.124	-0.247	0.142	0.355	**.436***	-0.097

	Demographic	Spatial	Economic	Social	PNP	UPD	NBA	NBAPC	PCGDP	GDP3	TFAIPC	NP
Ammonia oxidizer	0.098	0.144	0.192	0.14	0.06	0.11	0.207	0.055	0.175	0.312	-0.101	0.14
Atrazine metabolism	**.587****	-0.017	**.579****	**.634****	**.526****	**.465***	0.172	-0.161	**.588****	**.667****	0.044	**.634****
Biomass degrader	-0.288	-0.109	-0.205	-0.307	-0.335	-0.14	-0.185	-0.02	-0.26	-0.332	0.186	-0.307
Carbon fixation	0.118	0.107	0.151	0.167	0.114	0.084	0.164	0.033	0.085	0.378	-0.225	0.167
Cellobiose degrading	-0.294	0.072	-0.155	-0.23	-0.141	-0.373	0.071	0.053	-0.191	-0.274	0.17	-0.23
Cellulose degrader	-0.085	0.298	-0.121	-0.091	0.004	-0.16	0.326	0.195	-0.201	0.058	-0.223	-0.091
Chitin degradation	**.540****	-0.018	**.502***	**.563****	**.569****	0.33	0.17	-0.162	**.437***	**.756****	-0.152	**.563****
Chlorophenol degrading	**.597****	-0.141	**.563****	**.648****	**.561****	**.444***	0.033	-0.24	**.602****	**.690****	-0.053	**.648****
Degrades aromatic hydrocarbons	0.394	-0.163	0.221	0.351	**.471***	0.177	-0.087	-0.179	0.285	0.315	-0.14	0.351
Dehalogenation	-0.158	0.29	-0.171	-0.144	-0.224	-0.03	0.185	0.294	-0.231	0.071	-0.357	-0.144

	Demographic	Spatial	Economic	Social	PNP	UPD	NBA	NBAPC	PCGDP	GDP3	TFAIPC	NP
Hydrocarbon degrading	-0.204	0.155	**-.416***	-0.276	-0.194	-0.15	-0.015	0.247	-0.399	-0.326	-0.289	-0.276
Iron oxidizer	-0.099	-0.181	-0.156	-0.144	-0.165	0.009	-0.218	-0.104	-0.129	-0.257	0.074	-0.144
Iron reducer	0.345	-0.11	0.368	0.379	0.279	0.307	0.016	-0.178	0.391	0.376	0.081	0.379
Lignin degrader	0.169	0.174	0.242	0.284	0.282	-0.015	0.193	0.113	0.173	**.405***	-0.093	0.284
Methane oxidation	-0.025	0.159	-0.056	0.084	-0.04	-0.001	-0.005	0.246	0.073	-0.161	0.001	0.084
Naphthalene degrading	**.534****	-0.091	**.545****	**.604****	**.429***	**.480***	0.059	-0.185	**.605****	**.490***	0.193	**.604****
Nitrite reducer	0.121	0.065	0.155	0.088	0.13	0.07	0.241	-0.091	0.152	0.266	-0.116	0.088
Nitrogen fixation	**.475***	0.063	**.469***	**.513***	**.462***	0.335	0.267	-0.114	0.402	**.687****	-0.107	**.513***
Pollutant degrader	0.312	-0.156	0.335	0.375	0.189	0.351	-0.084	-0.17	**.452***	0.135	0.284	0.375
Propionate metabolism	0.356	-0.034	0.319	0.403	0.349	0.248	0.009	-0.059	0.33	**.536****	-0.239	0.403
Selenate reducer	0.345	0.072	0.396	**.455***	0.403	0.165	0.18	-0.032	0.355	**.530****	-0.032	**.455***
Stores polyhydroxybutyrate	-0.048	0.335	-0.056	0.07	0.026	-0.118	0.156	0.385	-0.073	0.184	-0.364	0.07
Streptomycin producer	**.424***	-0.024	0.32	0.39	0.393	0.321	0.141	-0.148	0.337	**.459***	-0.126	0.39
Sugars fermentor	0.355	-0.221	0.236	0.31	0.29	0.313	-0.148	-0.218	0.287	0.309	-0.092	0.31
Sulfate reducer	-0.108	0.151	-0.07	-0.063	-0.141	-0.035	0.043	0.195	-0.098	0.084	-0.226	-0.063
Sulfide oxidizer	0.345	-0.038	0.371	0.366	0.382	0.191	0.117	-0.15	0.292	**.582****	-0.115	0.366
Sulfur metabolizing	**.444***	0.058	0.392	**.448***	0.374	0.379	0.253	-0.111	0.348	**.632****	-0.19	**.448***
Sulfur oxidizer	**.476***	-0.273	**.466***	**.504***	0.386	**.424***	-0.138	-0.305	**.536****	**.418***	0.145	**.504***
Sulfur reducer	-0.182	-0.065	-0.25	-0.173	-0.111	-0.204	-0.226	0.08	-0.195	-0.36	0.028	-0.173
Syntrophic	0.093	-0.17	0.107	0.16	0.114	0.039	-0.224	-0.081	0.204	-0.116	0.267	0.16
TCE degrader	0.312	-0.156	0.335	0.375	0.189	0.351	-0.084	-0.17	**.452***	0.135	0.284	0.375
Xylan degrader	-0.283	0.197	-0.248	-0.291	-0.283	-0.19	0.062	0.249	-0.323	-0.107	-0.211	-0.291
Unknown	0.141	-0.308	0.035	0.093	0.127	0.112	-0.269	-0.254	0.07	-0.147	0.25	0.093

Table S9. Indices on the urbanization system of sampling sites along the Yangtze river

FN	YB	CT	WX	XT	HK	HS	MA	NJ	ZJ	NT	XL	SD
Per capita water usage	1	0.7689	0.8438	0.5563	0.9098	0.9665	0	0.8959	0.9697	0.9869	0.9578	0.9099
Waste water discharge per unit area	1	0.3727	0.9263	0.8849	0.7835	0.9261	0	0.7239	0.4707	0.4799	0.2720	0.1559
Fertilizer usage per unit area	0.9779	1	0.9295	0.7947	0.8807	0.9253	0.9350	0.9297	0.5515	0	0.8791	0.4964

Table S10. Comparisons of urbanization level indices based on 12 sampling sites along the Yangtze river

First grade index	Weight (%)	Weight with environmental aspect (%)	Basic grade index	Weight (%)	Weight with environmental aspect (%)
Demographic aspect	12.4	11.8	Percentage of nonagricultural population (%)	6.7	6.4
			Urban population density (persons/km^2)	5.7	5.4
Spatial aspect	35.7	34.1	Number of built-up areas (km^2)	14.6	13.9
			Number of built-up areas per capita (m^2/person)	21.1	20.2
Economic aspect	41.8	33.6	Per capita GDP (10^4 yuan /person)	12.2	11.6
			GDP3 (10^8 yuan）	19.8	12.7
			Total fixed asset investment per capita (10^4 yuan /person）	9.8	9.3
Social aspect	10.1	9.5	Number of phones per 10000 people	10.1	9.5
Environmental aspect	--	11	Per capita water usage	--	2.7
			Waste water discharge per unit area		5.4
			Fertilizer usage per unit area		2.9

Table S11. Urbanization level values with environmental aspect of the selected cities along the Yangtze River

		YB	CT	WX	XT	HK	HS	MA	NJ	ZJ	NT	XL	SD
Overall	Urbanization level values	0.409	0.361	0.211	0.152	0.503	0.299	0.217	0.536	0.394	0.427	0.602	0.567
	Urbanization level values without environmental aspect	0.316	0.377	0.110	0.065	0.426	0.198	0.190	0.438	0.300	0.391	0.532	0.611
First grade	Demographic aspect	0.000	0.053	0.059	0.045	0.097	0.049	0.044	0.077	0.039	0.042	0.100	0.109
	Spatial aspect	0.292	0.163	0.012	0.011	0.039	0.081	0.016	0.063	0.031	0.183	0.029	0.066
	Economic aspect	0.000	0.059	0.026	0.010	0.202	0.047	0.112	0.248	0.219	0.112	0.313	0.250
	Social aspect	0.008	0.017	0.015	0.000	0.073	0.018	0.016	0.058	0.037	0.038	0.095	0.095
	Environmental aspect	0.109	0.070	0.100	0.086	0.093	0.103	0.027	0.090	0.067	0.052	0.066	0.047
Basic grade	Percentage of nonagricultural population (%)	0.000	0.019	0.023	0.006	0.043	0.033	0.014	0.052	0.019	0.036	0.049	0.064
	urban population density (person/km^2)	0.000	0.034	0.036	0.039	0.054	0.016	0.030	0.024	0.020	0.006	0.051	0.044

	Number of built-up areas (km^2)	0.090	0.139	0.001	0.000	0.035	0.021	0.003	0.044	0.006	0.096	0.026	0.066
	Number of built-up areas per capita (m^2/person)	0.202	0.024	0.011	0.011	0.004	0.061	0.014	0.019	0.026	0.087	0.003	0.000
	Per capita GDP (10^4 yuan /person)	0.000	0.012	0.008	0.005	0.061	0.012	0.021	0.079	0.066	0.034	0.116	0.095
	GDP3 (10^8 yuan)	0.000	0.017	0.010	0.004	0.060	0.008	0.015	0.089	0.061	0.034	0.106	0.127
	Total fixed asset investment per capita(10^4 yuan /person)	0.000	0.030	0.007	0.001	0.081	0.026	0.077	0.080	0.093	0.045	0.090	0.028
	Number of phones per 10000 people	0.008	0.017	0.015	0.000	0.073	0.018	0.016	0.058	0.037	0.038	0.095	0.095
	Per capita water usage	0.027	0.021	0.023	0.015	0.025	0.026	0.000	0.024	0.026	0.026	0.026	0.024
	Waste water discharge per unit area	0.054	0.020	0.050	0.048	0.042	0.050	0.000	0.039	0.025	0.026	0.015	0.008
	Fertilizer usage per unit area	0.029	0.029	0.027	0.023	0.026	0.027	0.027	0.027	0.016	0.000	0.026	0.015
Overall	Urbanization rank	Lower middle	Upper middle	Low	Low	Upper middle	Low	Low	Upper middle	Lower middle	Upper middle	High	High

a. YB: Yibin; CT: Cuntan; WX: Wanxian; XT: Xiantao; HK: Hankou; HS: Huangshi; MA: Maanshan; NJ: Nanjing; ZJ: Zhenjiang; NT: Nantong; XL: Xuliujing; SD: Shidongkou.

b. The urbanization rank was distinguished by the overall urbanization level values.

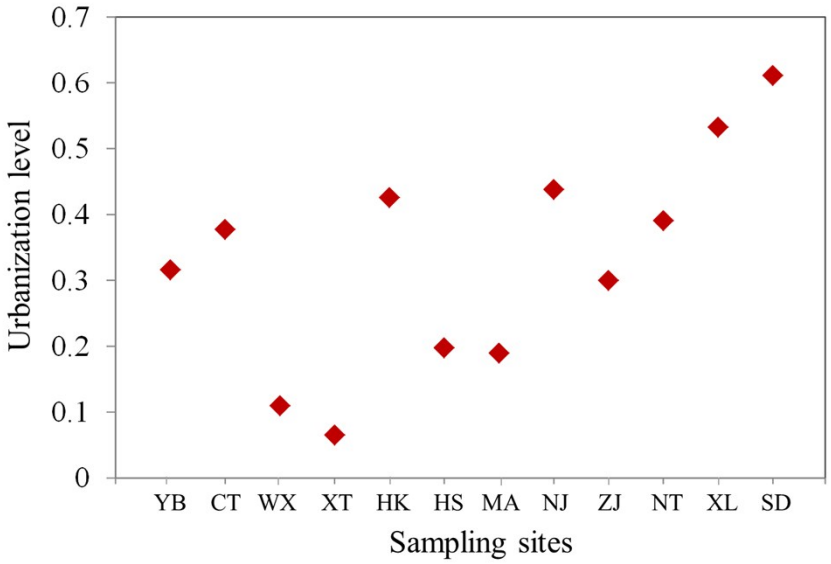


Fig. S1. Changes of urbanization level values of different sampling sites along the Yangtze River

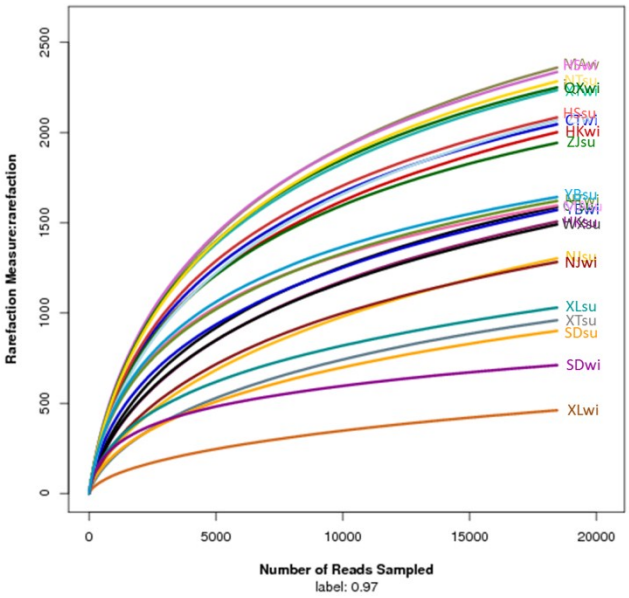


Fig. S2. Rarefaction curves based on bacterial diversity of 12 sampling sites

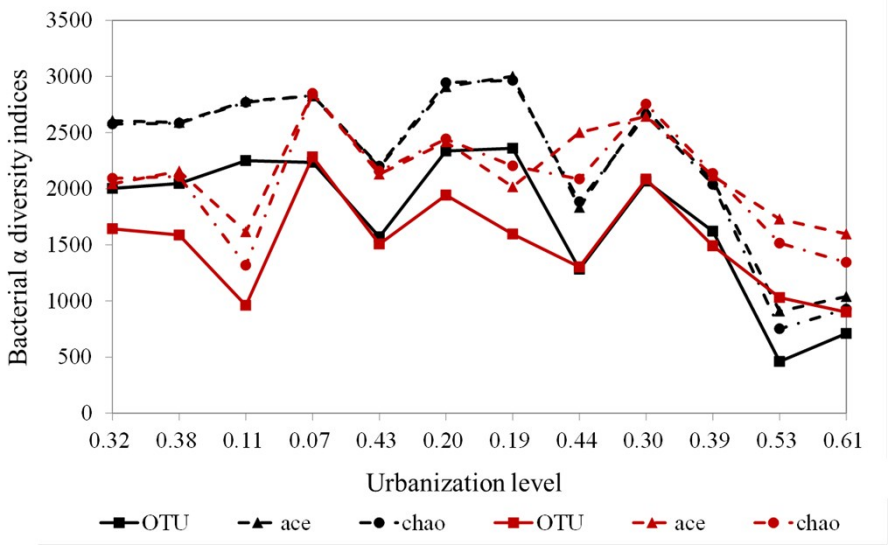
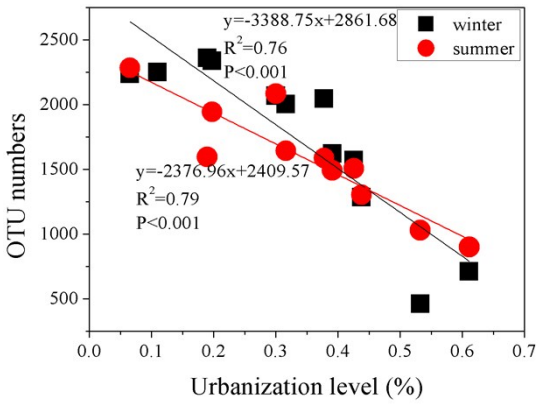
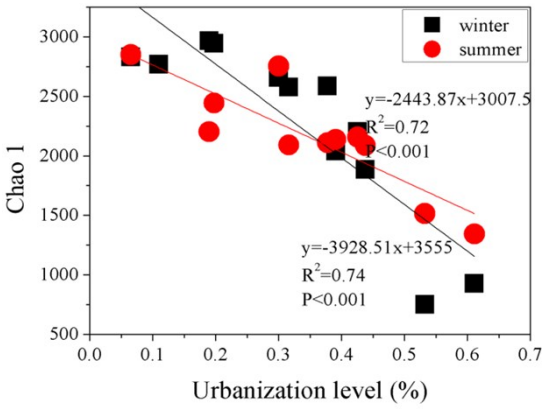


Fig. S3. Variations of the bacterial α-diversity along the changes of urbanization level. Black lines indicated the samples collected in winter, while the red lines indicated these samples collected in summer.

(a)



(b)



(c)

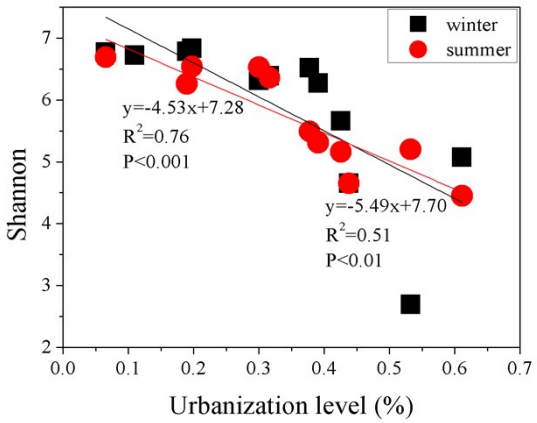


Fig. S4. Indices used to describe α-diversity of bacterial assemblages in the sediment of the Yangtze River along an urbanization level gradient.

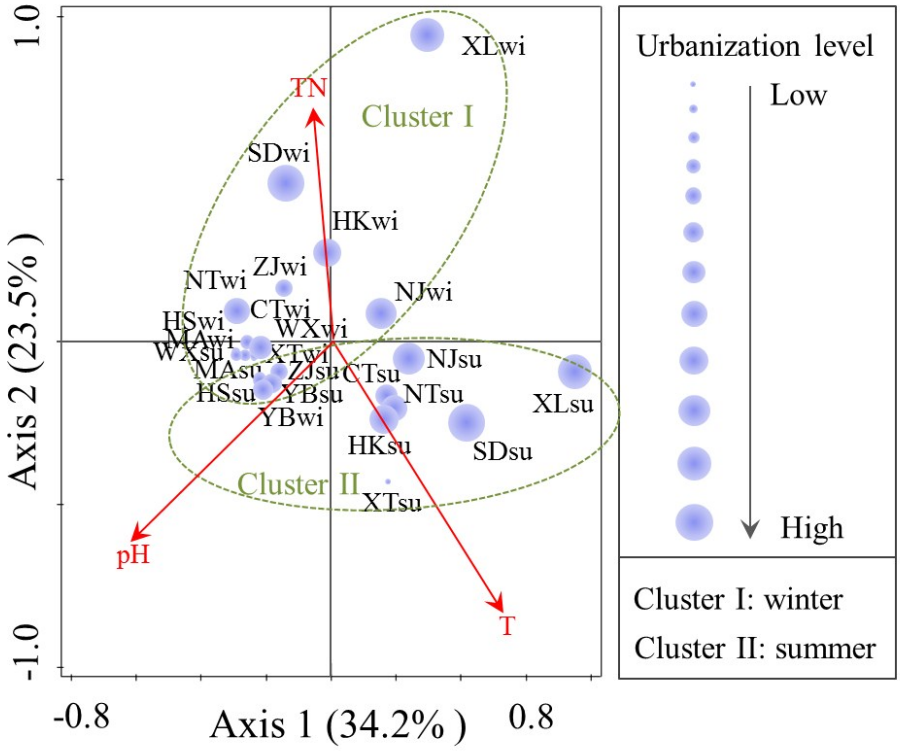


Fig. S5. RDA bioplot of bacterial community composition and physicochemical parameters. Only significant parameters (P<0.05) are showed in the figure. T represents temperature, TN represents total nitrogen. The size of the purple circle indicates the level of the urbanization.

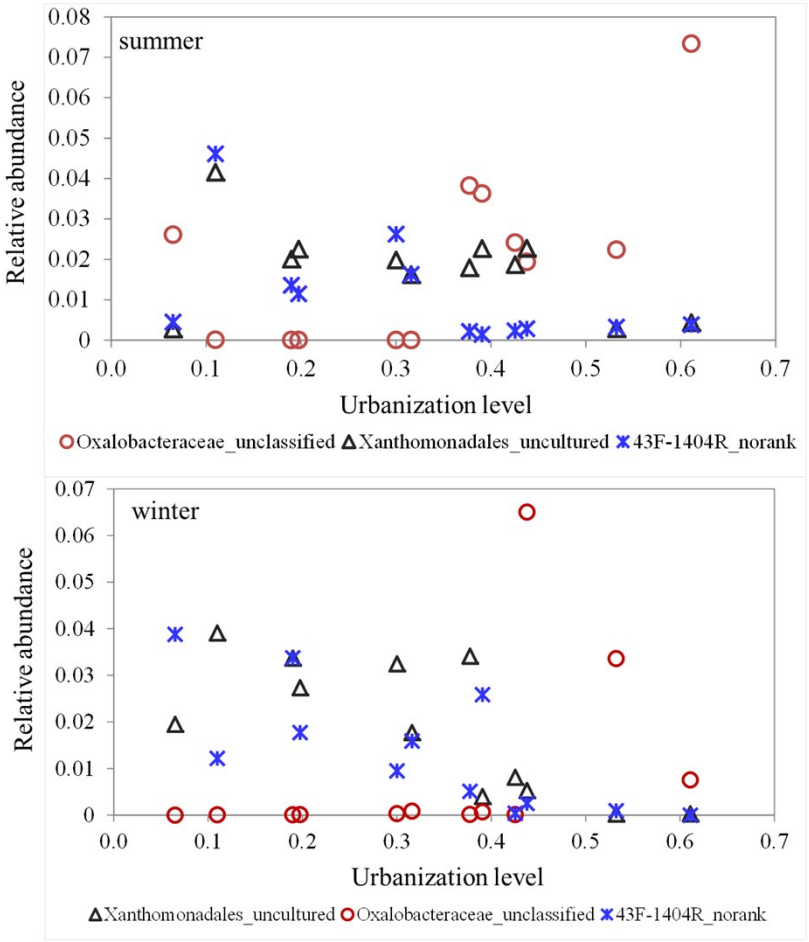


Fig. S6. Variations in the relative abundance of three bacterial genera which were significantly correlated with the urbanization level along the elevated urbanization level gradient.

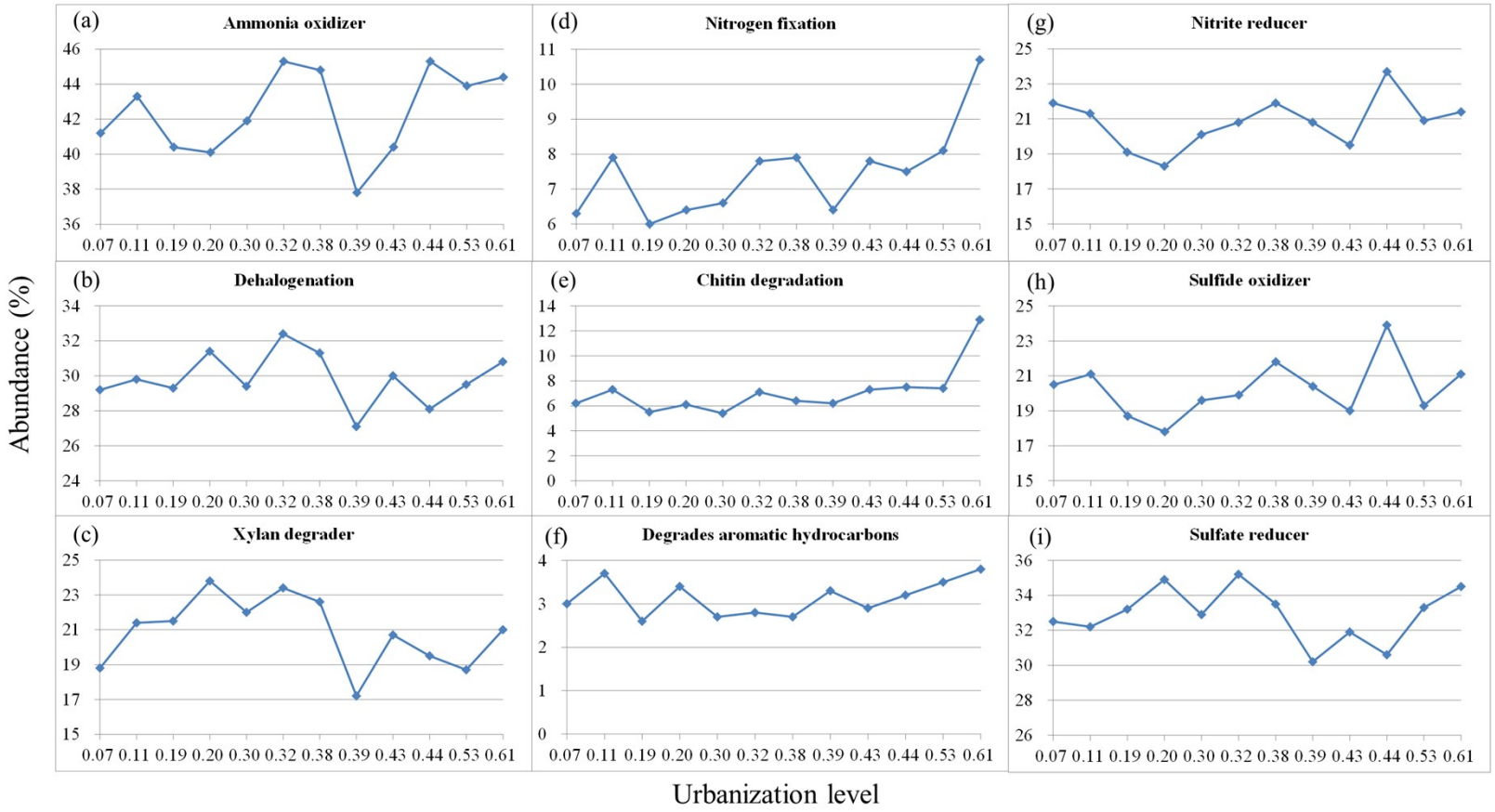


Fig. S7. Variations of the abundance of nine dominant metabolic function (abundance >20%) under the effect of urbanization level.