

**Table S1.** Diversity index and amplicon sequence variants (ASVs) of samples in closed and open lakes.

	<b>Samples</b>	<b>ASV</b>	<b>Chao 1</b>	<b>Shannon</b>	<b>Coverage</b>	<b>Reads</b>
Open lake	L1	2314	3687.52	5.27	0.981	69030
	L2	2716	3781.24	5.13	0.977	76147
	L3	2358	3656.05	5.04	0.980	67318
	L4	2282	3243.61	5.03	0.981	57360
	L5	2528	3715.42	5.14	0.978	57892
	R1	2721	3200.26	5.02	0.976	73389
	R2	2688	3680.22	5.15	0.976	77144
	R3	2354	3332.41	5.01	0.981	63133
	R4	2756	3293.66	5.15	0.976	75097
	R5	2866	3872.27	5.10	0.974	75071
Closed lake	L1	533	578.77	1.29	0.997	89270
	L2	570	651.56	1.33	0.996	88689
	L3	424	489.43	1.04	0.997	103069
	L4	1688	1760.54	4.08	0.994	51646
	L5	1680	1721.22	4.00	0.995	45778
	L6	1524	1617.87	4.01	0.994	50102
	L7	954	1078.74	2.01	0.995	67057
	L8	1264	1408.65	2.67	0.993	74782
	L9	742	851.861	1.93	0.995	72741
	L10	1040	1224.50	2.94	0.994	97349
	L11	908	1068.87	2.48	0.994	95276
	L12	1026	1227.81	3.07	0.993	90321
	L13	1276	1493.28	2.90	0.992	89348
	L14	1162	1359.04	2.87	0.993	88082
	L15	1360	1572.29	3.58	0.992	84196

	L16	1332	1518.70	3.37	0.993	72519
	L17	1241	1435.44	3.36	0.993	75569
	L18	1053	1203.01	2.80	0.994	79049

**Table S2.** Correlation analysis between diversity index and significant environmental variables in closed and open lakes.

R	Open lake			Closed lake	
	EC	COD	NH <sub>4</sub> <sup>+</sup>	pH	ORP
Chao 1	-0.46 <sup>*</sup>	0.15 <sup>*</sup>	0.14 <sup>*</sup>	0.26 <sup>*</sup>	0.16 <sup>*</sup>
Shannon	-0.61 <sup>*</sup>	0.83 <sup>**</sup>	0.56 <sup>*</sup>	0.43 <sup>*</sup>	0.35 <sup>*</sup>

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table S3.** Physicochemical parameters of samples in closed and open lakes.

		T	TN	NO <sub>3</sub> <sup>-</sup>	NO <sub>2</sub> <sup>-</sup>	Chla		DO	EC	ORP	COD	BOD	NH <sub>4</sub> <sup>+</sup>	TP
Samples		°C	mg/L	mg/L	mg/L	mg/m <sup>3</sup>	pH	mg/L	us/cm	mv	mg/L	mg/L	mg/L	mg/L
Open lake	L1	20.5	0.54	0.10	0.27	18.7	8.38	10.9	987	120	71.8	9.7	0.36	10.9
	L2	20.5	0.29	0.07	0.03	3.32	7.40	11.5	1231	140	64.2	6.3	0.05	11.5
	L3	23	0.72	0.72	0.03	6.13	7.63	6.50	1252	140	95.4	1.9	0.11	6.5
	L4	21.9	0.63	0.14	0.04	5.98	8.53	9.10	820	138	29.4	3.1	0.09	9.1
	L5	19.3	0.91	0.43	0.03	33.78	8.82	12.20	953	147	59	8.5	0.06	12.2
	R1	19.1	0.32	0.37	0.30	19.48	8.36	10.70	953	145	59	7.1	0.09	10.7
	R2	18.5	0.56	0.30	0.32	11.91	8.75	9.50	1014	120	70.2	5.8	0.3	9.5
	R3	19.2	0.44	0.20	0.04	15.88	8.66	11.30	956	116	68.2	8.2	0.33	11.3
	R4	18.6	0.54	0.18	0.16	16.45	8.33	10.10	919	116	67	6.5	0.33	10.1
	R5	23	0.44	0.17	0.16	25.29	8.70	10.10	831	113	75.8	6.6	0.3	10.1
Closed lake	L1	28.3	0.50	0.39	0.002	4.24	8.62	8.40	550	308	27.64	1.3	0.18	0.14
	L2	27.9	0.58	0.42	0.002	3.26	8.45	7.80	540	272	39.28	1.7	0.44	0.31
	L3	28.9	0.51	0.39	0.007	4.25	8.80	8.20	502	217	44.94	0.8	0.14	0.25

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L4	28.3	0.41	1.12	0.015	3.86	8.69	8.40	556	218	46.68	1.7	0.22	0.20
L5	28.6	0.34	0.25	0.002	3.19	8.99	8.30	554	205	46.3	0.4	0.08	0.24
L6	29.1	0.65	0.04	0.002	3.18	9.08	9.50	562	159	46.74	1.7	0.50	0.28
L7	32.8	0.54	0.11	0.006	12.04	8.81	5.99	535	199	47.24	1.6	0.23	0.31
L8	31.5	0.51	0.35	0.005	9.29	8.64	7.16	597	238	48.4	2.5	0.23	0.32
L9	32.7	0.41	0.04	0.006	7.88	8.93	8.06	586	185	47.16	2.4	0.18	0.21
L10	29.4	0.51	0.39	0.007	10.13	9.14	7.29	497	183	46.2	1.9	0.09	0.15
L11	29.9	0.69	0.63	0.011	12.85	9.18	8.54	509	129	47.42	2.2	0.27	0.15
L12	29.7	0.54	0.35	0.009	12.03	9.08	6.03	514	195	47.94	1.5	0.26	0.22
L13	28.3	0.31	0.04	0.003	5.26	8.95	8.90	506	179	47.74	0.8	0.07	0.17
L14	29.9	0.33	0.08	0.003	6.48	8.91	7.91	524	196	44.66	1.5	0.12	0.22
L15	30.2	0.31	0.01	0.004	4.37	8.84	6.40	531	205	42.44	0.6	0.04	0.25
L16	28.9	0.37	0.14	0.005	3.93	9.03	7.40	445	222	46.5	0.9	0.05	0.35
L17	28.5	0.20	0.04	0.003	7.18	9.05	9.50	536	193	42.78	0.8	0.13	0.21
L18	30.8	0.55	0.08	0.004	2.77	8.76	6.60	529	267	45.2	2.1	0.16	0.24

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**Table S4.** Topological properties of bacterial co-occurrence networks in closed and open lakes.

	Empirical network										Random network		
	N	E		Modularity	avgCC	APL	ND	AD	GD	$\sigma$	Modularity	avgCC	APL
		Positive	Negative										
<b>Closed lake</b>	102	63 (66.3%)	32 (33.7%)	0.85	0.11	5.8	14	1.9	0.018	4.5	0.8	0.001	6.6
<b>Open lake</b>	752	266 (29.6%)	634 (70.4%)	0.83	0.09	7.9	22	2.4	0.003	3.7	0.76	0.001	7.3

N: Nodes; E: Edges; avgCC: Average clustering coefficient; APL: Average path length; ND: network diameter; AD: Average degree; GD:

Graph density;  $\sigma$ : small-world coefficient.

$\sigma = (\text{avgCC}/\text{avgCCr})/(\text{APL}/\text{APLr})$  and  $\sigma > 1$  indicates “small-world” properties.

**Figure S1.** Rarefaction curves of richness of samples in closed and open lakes. **(a)**

Closed lake; **(b)** Open lake.

**Figure S2.** Distribution of bacterial communities at genus levels. **(a)** Closed lake; **(b)**

Open lake.

**Figure S3.** Heatmap representing the abundance of predicted functions based on

FAPROTAX. **(a)** Closed lake; **(b)** Open lake.

**Figure S4.** Mantel test between the Bray–Curtis similarity of bacterial communities

and geographical distance **(a, c)**, physicochemical parameters **(b, d)** in in closed lakes

**(a, b)** and open lakes **(c, d)**.

**Figure S1.**

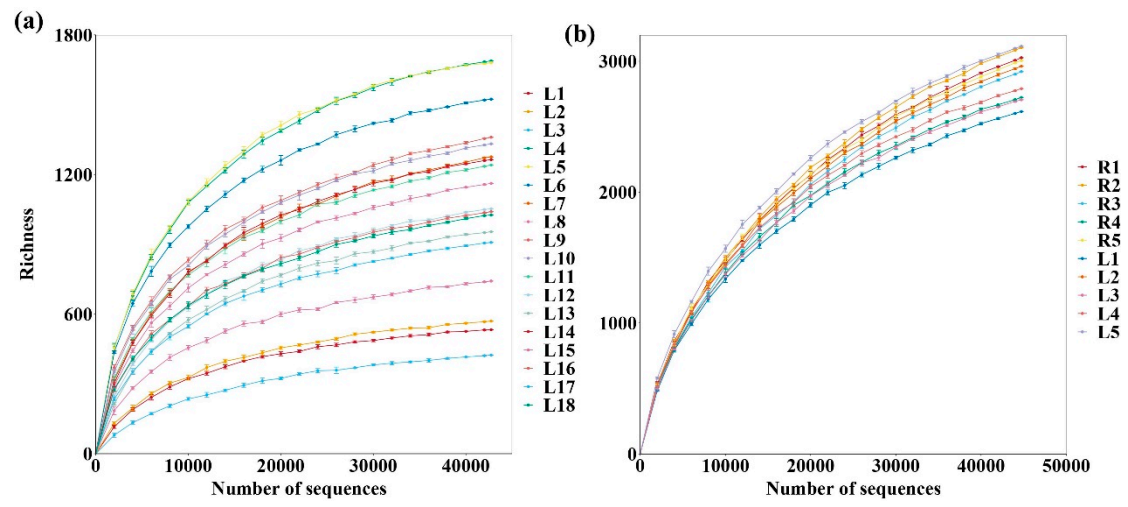
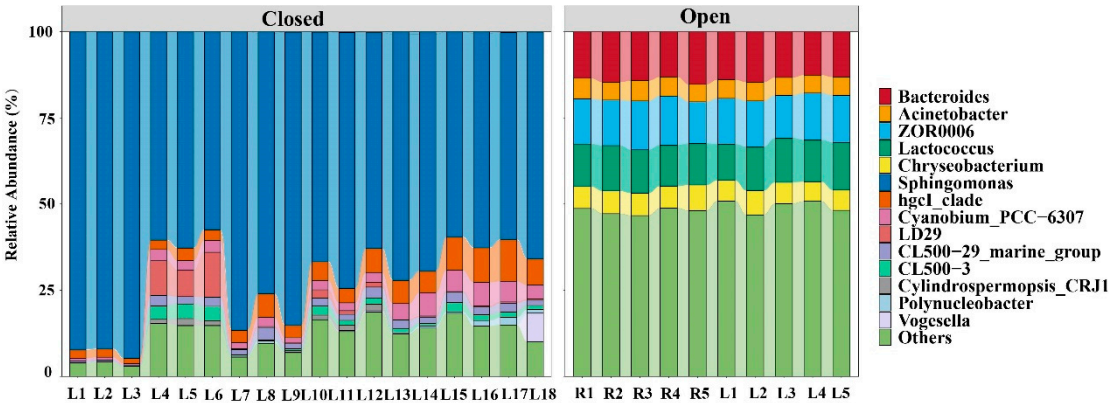
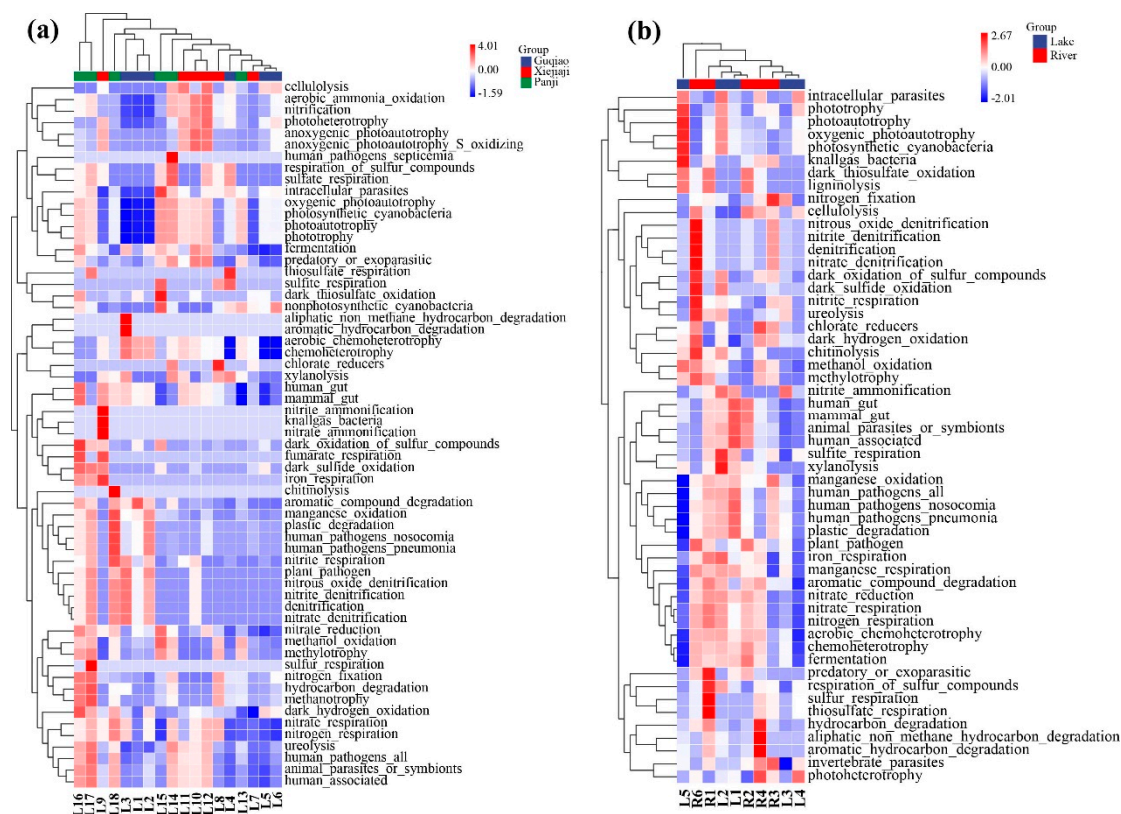




Figure S2.



**Figure S3.**



**Figure S4**

