

Bacterial community dynamics along a river-wetland-lake system

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Abstract: Balaton is the largest shallow lake in Central Europe. It is one of the few lakes where eutrophication processes have been successfully reversed. The creation of a wetland area on the lower part of main inflow river played a major role in the re-oligotrophication processes. After several decades of operation and multiple transformations, an attempt was made to explore the microbial community of the water reservoir and its relationship with algal groups and environmental parameters. In the main inflow river, floods had the greatest effect on the microbial community composition. While in the open water areas of the wetland system, the algae production that develops due to external nutrient load was the main driver of the bacterial community. In the high macrophyte covered areas, the decomposition processes of the dying algae biomass were the most decisive. Finally, in the large open water areas of Lake Balaton, the external and internal nutrient loads together determined the algal production and thus the bacterial community composition.

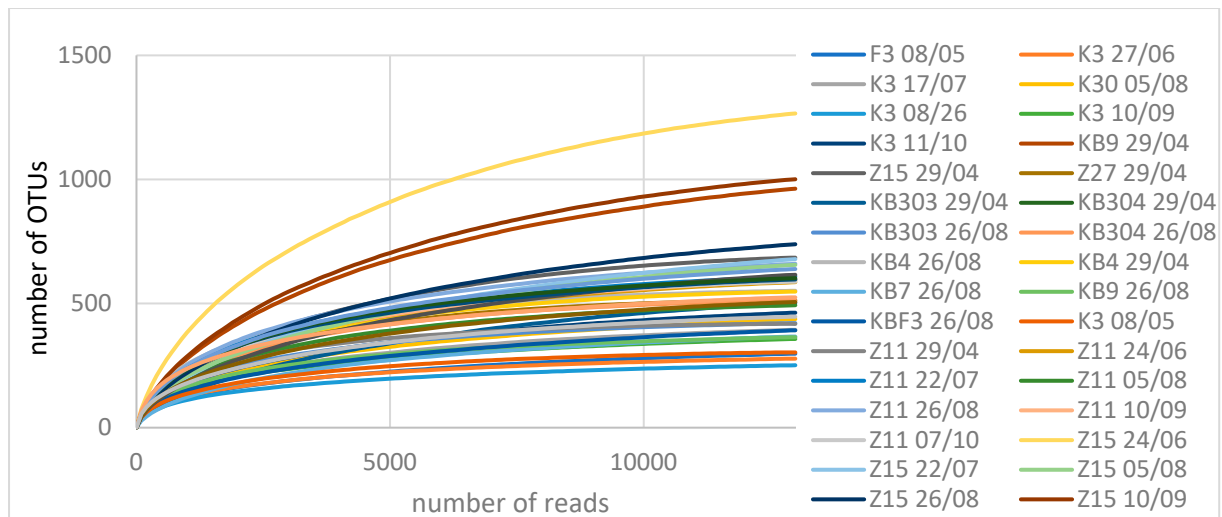


Figure S1: Rarefaction curve of Illumina MiSeq 16S amplicon sequencing dataset

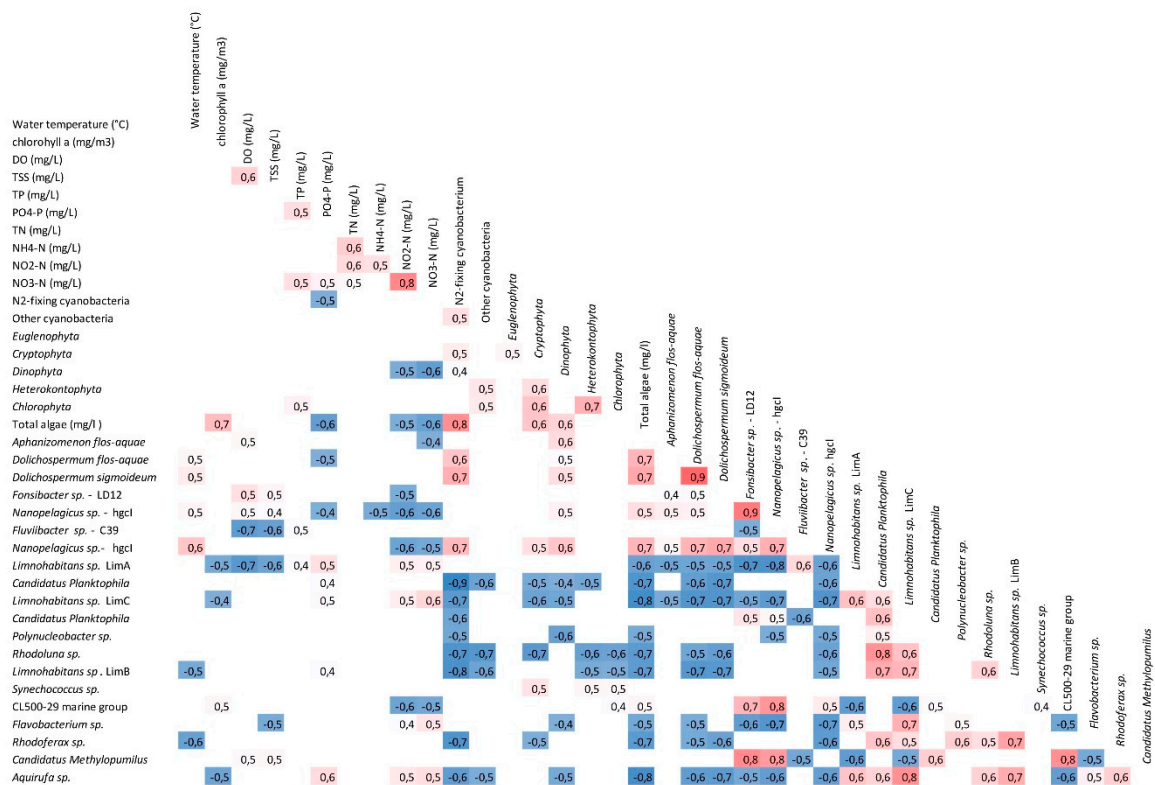


Figure S2: Spearman's rank correlation between the top 20 bacterial OTUs, main algal phyla and environmental parameters. The red and blue dots represent the negative and positive Spearman's rank correlation coefficient (r), considering p value < 0.01, respectively.

Physical and chemical parameters of water samples from Zala River (Z15) in 2019														
Sampling date	Water temp. (°C)	Chl-a (mg/m³)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	TDOM (mg/L)	TP (mg/L)	TDP (mg/L)	PO ₄ -P (mg/L)	TOC (mg/L)	TN (mg/L)	NH ₄ -N (mg/L)	NO ₂ -N (mg/L)	NO ₃ -N (mg/L)
29/04	13.6	8.9	9.7	6.7	26	512	0.11	0.09	0.08	8.99	2.55	0.08	0.046	1.67
24/06	21.2	10.4	7	4.1	252	602	0.18	0.1	0.09	17.60	3.80	0.05	0.03	1.78
22/07	20.2	0	7.5	6.3	49	536	0.12	0.12	0.11	6.10	3.00	0.001	0.03	2.5
05/08	18.9	0	7.7	3.1	165	460	0.22	0.12	0.10	16.00	3.50	0.16	0.03	1.43
26/08	20.2	3.0	7.0	1.1	31	546	0.16	0.16	0.11	5.80	3.00	0.10	0.03	2.00
10/09	16.7	7.4	8.0	3.5	124	438	0.19	0.14	0.11	10.80	3.90	0.26	0.10	2.20
07/10	11.6	4.4	8.7	1.8	12	402	0.15	0.10	0.09	7.30	3.40	0.07	0.01	1.93

Physical and chemical parameters of water samples from KBWPS interface (Z11) in 2019														
Sampling date	Water temp. (°C)	Chl-a (mg/m³)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	TDOM (mg/L)	TP (mg/L)	TDP (mg/L)	PO ₄ -P (mg/L)	TOC (mg/L)	TN (mg/L)	NH ₄ -N (mg/L)	NO ₂ -N (mg/L)	NO ₃ -N (mg/L)
29/04	16.1	67	10.4	8.8	32	474	0.10	0.03	0.005	14.22	1.52	0.03	0.007	0.09
24/06	28.6	52	6.6	6.8	26	410	0.19	0.14	0.11	14.4	1.57	0.01	0.005	0.11
22/07	27.3	15	6.0	8.3	32	426	0.13	0.07	0.05	14.2	1.66	0.003	0.003	0.06
05/08	25.0	28	12.4	10.4	36	348	0.14	0.07	0.03	23	3.40	0.07	0.003	0.06
26/08	24.3	24	6.6	8.0	42	416	0.13	0.07	0.03	22	2.80	0.18	0.01	0.25
10/09	20.1	268	8.3	8.0	43	374	0.15	0.07	0.02	25	3.80	0.29	0.02	0.09
07/10	13.8	172	8.8	9.9	62	332	0.14	0.04	0.02	24	3.50	0.03	0.004	0.11

Physical and chemical parameters of water samples from from KBWPS outflow (Z27) in 2019														
Sampling date	Water temp. (°C)	Chl-a (mg/m³)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	TDOM (mg/L)	TP (mg/L)	TDP (mg/L)	PO ₄ -P (mg/L)	TOC (mg/L)	TN (mg/L)	NH ₄ -N (mg/L)	NO ₂ -N (mg/L)	NO ₃ -N (mg/L)
29/04	15.9	31	6.5	3.6	17	510	0.14	0.11	0.09	16.31	1.62	0.03	0.004	0.10
24/06	24.7	42	0.9	4.4	8	442	0.26	0.22	0.21	20.00	2.30	0.02	0.005	0.18
22/07	24.2	6	1.1	5.4	10	438	0.15	0.07	0.05	17.50	1.66	0.006	0.009	0.08
05/08	21.8	10	1.6	3.5	9	364	0.21	0.11	0.06	21.00	2.50	0.20	0.005	0.11
26/08	24.1	19	0.8	9.1	20	418	0.19	0.10	0.008	25.00	3.50	0.48	0.01	0.16
10/09	19.4	160	5.0	8.6	15	438	0.17	0.13	0.06	21.00	2.30	0.26	0.02	0.14
07/10	13.3	24	3.1	4.8	4	418	0.12	0.09	0.04	20.00	2.50	0.29	0.01	0.13

Physical and chemical parameters of water samples from Lake Balaton, Keszthely basin (K3) in 2019

Sampling date	Water temp. (°C)	Chl-a (mg/m ³)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	TDOM (mg/L)	TP (mg/L)	TDP (mg/L)	PO4-P (mg/L)	TOC (mg/L)	TN (mg/L)	NH ₄ -N (mg/L)	NO ₂ -N (mg/L)	NO ₃ -N (mg/L)
08/05	10.4	11	ND	ND	40	ND	0.04	ND	0.01	ND	0.70	ND	ND	ND
27/06	26.7	30	11.1	ND	13	ND	0.04	ND	0.02	ND	1.46	0.02	0.001	0.07
17/07	22.4	31	8.3	ND	25	ND	0.06	ND	0.03	ND	1.42	0.00	0.001	0.04
01/08	25.3	43	11.5	ND	52	ND	0.09	ND	0.04	ND	1.37	0.01	0.001	0.05
26/08	24.2	106	10.5	ND	32	ND	0.04	ND	0.03	ND	3.05	0.01	0.001	0.02
10/09	19.9	39	7.5	ND	33	ND	0.08	ND	0.02	ND	1.46	0.11	0.003	0.08
11/10	16	11	9.6	ND	36	ND	0.07	ND	0.04	ND	0.79	0.01	0.002	0.07