sustainability

Supplementary material for

Mitigation of shallow aquatic eutrophication: The influences of submerged macrophytes on phosphorus load and bacterial community structure in sediments

Juanjuan Wang[1], Siwen Zhang[1], Tianyang Que[1], Anna H. Kaksonen[2,3], Xiaoqing Qian[1], Xuliang Zhuag[4,5], Tsing Bohu[6,7*]

[1] Yangzhou University, Yangzhou, 225127, China; wangjuanjuan@yzu.edu.cn(J.W.); 1924694308@qq.com(S.Z.); 1556124137@qq.com (T.Q.); qianxq@qq.com (X.Q.)
[2] CSIRO Land and Water, Private Bag No.5, Wembley, WA, 6913, Australia; anna.kaksonen@csiro.au (A.H.K.)
[3] School of Biomedical Sciences, University of Western Australia, Crawley, WA, 6009, Australia
[4] Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China; xlzhuang@rcees.ac.cn (X.Z.)
[5] University of Chinese Academy of Sciences, Beijing 100049, China
[6] State Key Laboratory of Lunar and Planetary Sciences, Macau University of Science and Technology, Taipa, Macau; e-mail: qhu@must.edu.mo (T.B.)
[7] CSIRO Mineral Resources, Australian Resources and Research Centre, Kensington, WA 6151, Australia
*Corresponding author: qhu@must.edu.mo

Table S1 The correlation of sediment bacterial community composition and associated environmental factors by canonical correlation analysis (CCA) and envfit analysis.

Sample type	Parameter	CCA1	CCA2	r^2	p
Overlying water	pH	-0.8302	0.5575	0.3018	0.001
	DO	-0.6987	0.7155	0.2279	0.004
Sediment	Fe(III)	-0.0323	-0.9995	0.3291	0.001
	Fe(II)	-0.8312	-0.556	0.4554	0.001
	Fe-P	-0.9487	-0.3162	0.286	0.001
	OM	0.9224	-0.3861	0.2178	0.012
	TP	0.8338	0.5521	0.0249	0.600

CCA1 and CCA2 denote correlations between the environmental factors and the two CCA axes, r^2 denotes the determination coefficients of the environmental factors on the distribution of bacterial communities, and p denotes the statistical significance. DO, dissolved oxygen; Fe(II), ferrous iron; Fe(III), ferric iron; Fe-P, iron-bound phosphorus; OM, organic matter; and TP, total phosphorus.

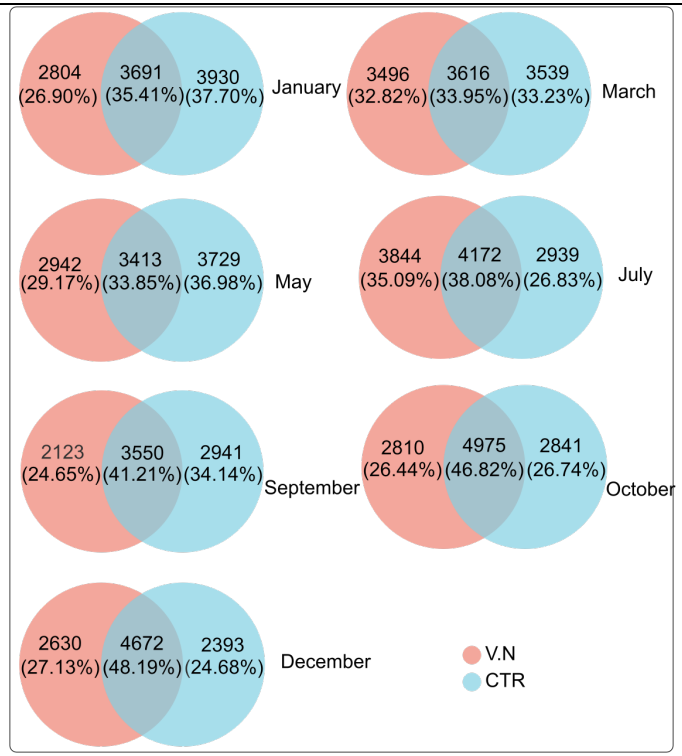
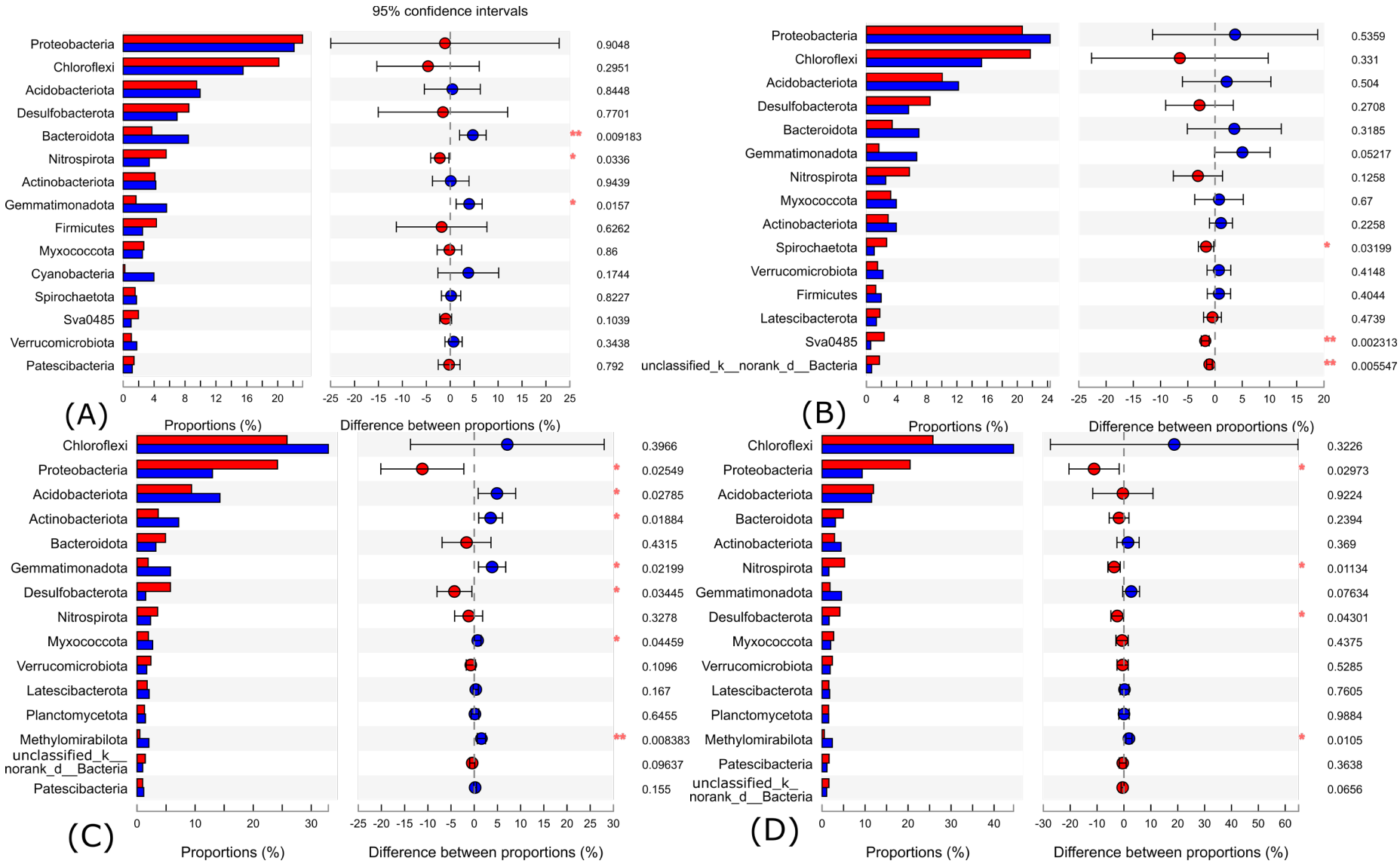


Figure S1 Venn diagram showing the distribution of operational taxonomic units between lake sediment samples in the presence (V.N) and absence (CTR) of *V. natans* over the course of one year.


95% confidence intervals
Proteobacteria
Chloroflexi
Acidobacteriota
Desulfobacterota
Bacteroidota
Nitrospirota
Actinobacteriota
Gemmatimonadota
Firmicutes
Myxococcota
Cyanobacteria
Spirochaetota
Sva0485
Verrucomicrobiota
Patescibacteria
0.9048
0.2951
0.8448
0.7701
0.009183
0.0336
0.9439
0.0157
0.6262
0.86
0.1744
0.8227
0.1039
0.3438
0.792
(A)
Proportions (%)
Difference between proportions (%)
Gemmatimonadota
Nitrospirota
Myxococcota
Actinobacteriota
Spirochaetota
Verrucomicrobiota
Firmicutes
Latescibacterota
Sva0485
unclassified_k__norank_d__Bacteria
0.5359
0.331
0.504
0.2708
0.3185
0.05217
0.1258
0.67
0.2258
0.03199
0.4148
0.4044
0.4739
0.002313
0.005547
(B)
Proportions (%)
Difference between proportions (%)
Chloroflexi
Proteobacteria
Acidobacteriota
Actinobacteriota
Bacteroidota
Gemmatimonadota
Desulfobacterota
Nitrospirota
Myxococcota
Verrucomicrobiota
Latescibacterota
Planctomycetota
Methylomirabilota
unclassified_k__norank_d__Bacteria
Patescibacteria
0.3966
0.02549
0.02785
0.01884
0.4315
0.02199
0.03445
0.3278
0.04459
0.1096
0.167
0.6455
0.008383
0.09637
0.155
(C)
Proportions (%)
Difference between proportions (%)
Chloroflexi
Proteobacteria
Acidobacteriota
Bacteroidota
Actinobacteriota
Nitrospirota
Gemmatimonadota
Desulfobacterota
Myxococcota
Verrucomicrobiota
Latescibacterota
Planctomycetota
Methylomirabilota
Patescibacteria
unclassified_k__norank_d__Bacteria
0.3226
0.02973
0.9224
0.2394
0.369
0.01134
0.07634
0.04301
0.4375
0.5285
0.7605
0.9884
0.0105
0.3638
0.0656
(D)
Proportions (%)
Difference between proportions (%)

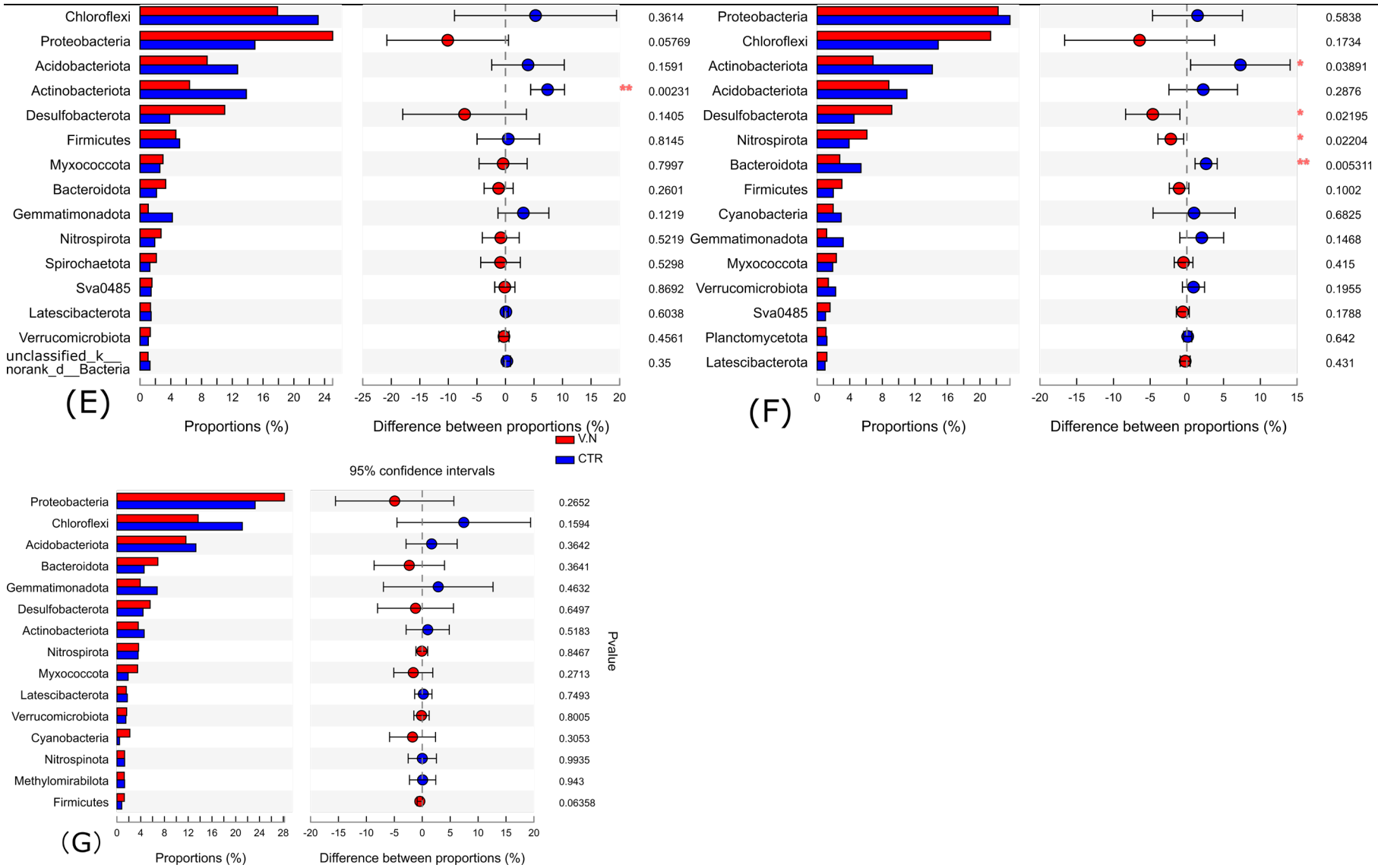


Figure S2 Bacterial phyla with significant difference in relative abundance between lake sediment samples with (V.N) and without (CTR) *V. natans* at different time points. A, January; B,

March; C, May; D, July; E, September; F, October; G, December

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