water

MDPI

Supplementary materials

Exploring the Spatial-Seasonal Dynamics of Water Quality, Submerged Aquatic Plants and Their Influencing Factors in Different Areas of a Lake

Kun Li [1], Ling Wang [2], Zhaohua Li [2], Yujing Xie [1,*], Xiangrong Wang [1,*] and Qing Fang [1]

[1] Department of Environmental Science and Engineering, Fudan University, Shanghai 200433, China; 14110740007@fudan.edu.cn (K.L.); xrxrwang@fudan.edu.cn (X.W.)
[2] Faculty of Resources and Environmental Science, Hubei University, Wuhan 430062, China; wlk_211@126.com (L.W.); zhaohli616@163.com (Z.L.)
* Correspondence: xieyj@fudan.edu.cn (Y.X.); xrxrwang@fudan.edu.cn (X.W.); Tel.: +86-21-5566-4052 (Y.X.); Fax: +86-21-6564-3343 (X.W.)

Table S1. The mean values of raw date for water quality parameters at all sampling sites in 14–15 April 2013 (dry season).

Sampling Sites	Locations		pH	Transparency (m)	DO (mg/L)	NH_4^+–N (mg/L)	TN (mg/L)	TP (mg/L)	COD_{Mn} (mg/L)	Biomass (g)
	N	E								
1	29°49′45.79″	113°22′56.67″	7.80	0.5	9.18	0.440	1.140	0.025	5.98	0
2	29°50′23.15″	113°22′33.24″	7.84	1.0	10.32	0.330	0.780	0.026	5.61	10
3	29°51′02.27″	113°21′42.02″	8.13	0.8	13.16	0.300	0.620	0.026	6.19	1715
4	29°49′02.23″	113°21′31.53″	8.04	0.9	12.60	0.320	0.710	0.013	6.35	15
5	29°48′47.90″	113°21′00.71″	8.08	1.1	12.46	0.240	0.630	0.015	5.69	505
6	29°48′52.86″	113°20′26.27″	8.05	1.1	12.16	0.290	0.850	0.013	6.02	1186
7	29°47′26.85″	113°19′58.20″	7.95	1.1	12.85	0.250	0.740	0.015	5.36	176
8	29°46′19.57″	113°19′39.00″	8.25	0.8	10.82	0.430	0.700	0.016	4.87	140
9	29°53′32.98″	113°15′55.78″	8.04	0.4	13.72	0.480	0.890	0.064	5.94	0
10	29°47′25.30″	113°18′24.37″	8.08	0.9	11.94	0.240	0.710	0.015	6.27	315
11	29°49′01.58″	113°17′11.20″	8.16	0.8	11.36	0.450	0.800	0.029	6.19	120
12	29°48′56.71″	113°17′44.90″	8.20	1.2	12.44	0.360	0.750	0.016	6.19	283
13	29°50′15.23″	113°16′34.70″	8.17	0.8	10.01	0.370	0.960	0.028	6.19	80
14	29°50′40.81″	113°15′35.79″	8.28	0.8	13.78	0.460	1.010	0.036	6.85	683
15	29°51′47.41″	113°16′14.10″	7.92	0.4	11.34	0.560	1.580	0.122	7.26	340

16	29°53′23.95″	113°14′24.60″	7.96	0.2	13.80	0.540	1.070	0.082	5.86	0
17	29°54′32.45″	113°15′26.72″	8.09	0.3	14.31	0.700	1.520	0.146	6.85	0
18	29°53′01.02″	113°17′01.18″	8.11	0.5	11.10	0.680	0.910	0.068	6.93	200
19	29°53′31.10″	113°17′09.42″	7.84	0.2	9.74	0.650	0.730	0.165	5.94	0
20	29°51′59.00″	113°17′39.05″	8.32	0.3	9.85	0.410	0.330	0.039	5.44	150
21	29°50′59.80″	113°17′55.81″	7.98	0.6	12.00	0.380	0.420	0.050	5.53	200
22	29°50′45.03″	113°19′53.66″	7.98	0.4	10.30	0.340	0.600	0.157	5.86	0
23	29°49′18.46″	113°19′57.76″	8.25	1.4	13.69	0.310	0.240	0.023	5.36	245
24	29°49′47.92″	113°20′06.79″	8.07	0.9	11.00	0.360	0.290	0.058	5.11	200
25	29°49′48.39″	113°21′12.33″	8.25	1.5	13.42	0.330	0.050	0.020	5.03	256
26	29°51′38.87″	113°22′08.80″	8.05	0.5	9.72	0.330	0.210	0.045	5.20	0
27	29°51′59.53″	113°23′58.49″	7.98	0.6	15.60	0.410	0.310	0.046	4.95	280
28	29°52′20.17″	113°23′03.62″	7.95	1.4	10.40	0.380	0.340	0.018	4.78	280
29	29°53′00.68″	113°22′45.19″	7.89	1.0	11.15	0.290	0.310	0.018	5.77	200
30	29°53′16.44″	113°21′49.02″	7.93	1.7	7.85	0.340	0.370	0.022	5.53	50
31	29°54′09.46″	113°22′35.44″	8.11	1.5	12.95	0.320	0.470	0.030	5.61	350
32	29°54′57.62″	113°21′49.49″	7.99	0.6	9.97	0.550	0.720	0.070	5.90	0
33	29°54′55.07″	113°23′00.38″	8.10	1.2	10.57	0.330	0.600	0.015	5.98	734
34	29°56′19.45″	113°22′55.05″	8.16	1.2	11.45	0.470	0.800	0.027	6.93	300
35	29°56′44.60″	113°22′58.98″	8.05	0.5	13.00	0.440	0.720	0.059	6.35	200
36	29°56′05.62″	113°24′25.55″	7.99	0.5	10.25	0.450	0.720	0.034	6.43	20
37	29°55′40.48″	113°25′26.77″	8.09	0.7	10.50	0.460	0.730	0.049	6.43	0
38	29°55′53.38″	113°26′26.18″	8.08	0.5	10.12	0.370	0.670	0.054	6.19	100
39	29°55′53.26″	113°25′50.69″	8.18	1.3	12.51	0.290	0.530	0.016	5.94	400
40	29°54′03.36″	113°24′33.18″	7.98	1.2	10.89	0.260	0.620	0.018	6.10	600
41	29°53′15.26″	113°24′35.71″	8.05	1.5	11.39	0.290	0.650	0.016	5.77	550
42	29°55'39.23"	113°13'14.75"	8.16	0.8	7.80	0.620	1.230	0.13	6.50	85
43	29°54'41.68"	113°14'22.73"	8.31	0.7	7.90	0.660	2.210	0.18	6.70	90

Table S2. The mean values of raw date for water quality parameters at all sampling sites in 20–21 August 2012 (wet season).

Sampling Sites	Locations		pH	Transparency (m)	DO (mg/L)	NH_4^+–N (mg/L)	TN (mg/L)	TP (mg/L)	COD_{Mn} (mg/L)	Biomass (g)
	N	E								
1	29°49′45.79″	113°22′56.67″	7.85	0.40	5.16	0.598	1.344	0.010	3.32	15
2	29°50′23.15″	113°22′33.24″	7.31	0.43	8.18	0.500	0.571	0.010	3.65	1436
3	29°51′02.27″	113°21′42.02″	7.70	1.10	6.82	0.564	0.711	0.052	3.36	1420
4	29°49′02.23″	113°21′31.53″	8.25	0.30	7.65	0.371	0.806	0.023	3.50	1127
5	29°48′47.90″	113°21′00.71″	7.28	0.40	7.68	0.297	0.446	0.034	4.97	1632
6	29°48′52.86″	113°20′26.27″	7.26	0.40	8.35	0.331	0.503	0.013	4.25	0
7	29°47′26.85″	113°19′58.20″	7.03	1.00	6.92	0.440	0.513	0.010	6.58	2011
8	29°46′19.57″	113°19′39.00″	9.14	1.50	8.43	0.399	0.581	0.012	4.51	2371
9	29°53′32.98″	113°15′55.78″	7.22	0.30	2.42	0.399	2.356	0.086	3.50	0
10	29°47′25.30″	113°18′24.37″	7.32	1.20	7.42	0.580	0.898	0.020	5.62	870
11	29°49′01.58″	113°17′11.20″	7.24	0.70	7.80	0.906	1.196	0.029	4.83	3988
12	29°48′56.71″	113°17′44.90″	7.33	1.20	8.08	0.529	0.680	0.015	4.37	3034
13	29°50′15.23″	113°16′34.70″	7.09	0.40	6.81	0.434	1.346	0.035	4.97	0
14	29°50′40.81″	113°15′35.79″	7.29	0.50	8.68	0.477	1.255	0.010	4.80	34
15	29°51′47.41″	113°16′14.10″	7.11	0.60	8.43	0.394	0.898	0.041	5.91	0
16	29°53′23.95″	113°14′24.60″	7.28	0.30	2.92	0.952	1.553	0.101	4.51	0
17	29°54′32.45″	113°15′26.72″	10.50	0.47	16.71	0.947	2.078	0.103	5.62	0
18	29°53′01.02″	113°17′01.18″	6.55	0.45	11.34	0.340	1.682	0.067	2.68	0
19	29°53′31.10″	113°17′09.42″	7.20	0.40	10.12	0.317	1.741	0.059	2.35	0
20	29°51′59.00″	113°17′39.05″	8.65	0.45	11.28	0.286	1.672	0.067	3.32	0
21	29°50′59.80″	113°17′55.81″	7.23	0.40	7.62	0.363	1.057	0.048	4.44	0
22	29°50′45.03″	113°19′53.66″	7.38	0.60	6.40	0.382	0.891	0.062	6.73	0
23	29°49′18.46″	113°19′57.76″	7.40	0.60	7.78	0.445	0.475	0.040	6.84	1877
24	29°49′47.92″	113°20′06.79″	7.53	0.70	6.57	0.403	0.996	0.032	5.54	1532

25	29°49′48.39″	113°21′12.33″	7.50	0.80	6.67	0.236	0.730	0.024	3.82	1410
26	29°51′38.87″	113°22′08.80″	8.40	0.20	6.82	0.606	1.214	0.052	4.25	112
27	29°51′59.53″	113°23′58.49″	8.75	1.06	6.99	0.363	0.645	0.017	1.53	252
28	29°52′20.17″	113°23′03.62″	8.04	0.60	6.00	0.416	0.873	0.040	3.03	40
29	29°53′00.68″	113°22′45.19″	8.47	0.52	6.16	0.466	2.020	0.062	3.36	0
30	29°53′16.44″	113°21′49.02″	8.26	0.75	5.05	0.395	1.034	0.023	3.36	4046
31	29°54′09.46″	113°22′35.44″	8.68	0.66	6.92	0.458	1.071	0.032	4.83	80
32	29°54′57.62″	113°21′49.49″	8.22	0.33	5.80	0.604	1.128	0.130	4.83	0
33	29°54′55.07″	113°23′00.38″	7.91	0.32	6.20	0.392	1.015	0.061	5.83	507
34	29°56′19.45″	113°22′55.05″	7.82	0.34	2.62	0.839	1.526	0.167	1.85	0
35	29°56′44.60″	113°22′58.98″	7.87	0.42	1.83	1.194	1.678	0.154	2.71	0
36	29°56′05.62″	113°24′25.55″	8.08	0.18	6.40	0.509	1.346	0.084	5.11	0
37	29°55′40.48″	113°25′26.77″	8.24	0.35	6.73	0.546	1.498	0.097	6.98	0
38	29°55′53.38″	113°26′26.18″	8.05	0.45	6.13	0.450	1.820	0.090	6.23	0
39	29°55'53.26"	113°25′50.69″	8.12	0.70	6.26	0.445	1.318	0.084	6.13	993
40	29°54'03.36"	113°24′33.18″	8.03	0.75	6.13	0.437	1.147	0.035	5.54	2921
41	29°53'15.26"	113°24′35.71″	8.99	1.88	7.30	0.382	0.891	0.019	2.71	3245
42	29°55'39.23"	113°13'14.75"	8.32	1.25	7.10	0.575	1.831	0.151	5.12	368
43	29°54'41.68"	113°14'22.73"	8.55	1.35	7.60	0.605	2.692	0.182	5.63	438

Table S3. The mean values of raw date for water quality parameters at all sampling sites in 12–13 December 2012 (normal season).

Sampling Sites	Locations		pH	Transparency (m)	DO (mg/L)	NH_4^+–N (mg/L)	TN (mg/L)	TP (mg/L)	COD_{Mn} (mg/L)	Biomass (g)
	N	E								
1	29°49′45.79″	113°22′56.67″	7.36	0.50	12.27	0.949	1.625	0.023	10.26	650
2	29°50′23.15″	113°22′33.24″	7.42	0.70	14.06	1.076	1.727	0.064	9.20	306
3	29°51′02.27″	113°21′42.02″	7.38	0.60	15.05	0.813	1.508	0.056	10.65	0
4	29°49′02.23″	113°21′31.53″	7.33	0.70	15.03	0.484	1.266	0.050	8.28	0
5	29°48′47.90″	113°21′00.71″	7.35	1.00	14.32	0.478	0.800	0.031	8.69	0
6	29°48′52.86″	113°20′26.27″	7.29	1.10	13.45	0.336	0.683	0.016	9.35	5
7	29°47′26.85″	113°19′58.20″	7.33	1.00	13.80	0.443	0.819	0.007	7.59	15
8	29°46′19.57″	113°19′39.00″	7.65	0.80	13.24	0.542	0.688	0.012	8.98	0
9	29°53′32.98″	113°15′55.78″	7.6	0.25	10.82	1.987	3.056	0.157	8.99	0
10	29°47′25.30″	113°18′24.37″	7.74	0.90	14.66	0.498	0.963	0.013	9.44	15
11	29°49′01.58″	113°17′11.20″	7.48	0.40	11.79	0.342	0.805	0.036	9.76	0
12	29°48′56.71″	113°17′44.90″	7.38	0.40	11.30	0.344	0.810	0.033	9.46	0
13	29°50′15.23″	113°16′34.70″	7.31	0.90	13.66	0.513	0.944	0.028	10.57	0
14	29°50′40.81″	113°15′35.79″	7.4	0.60	15.42	0.391	1.089	0.038	10.45	5
15	29°51′47.41″	113°16′14.10″	7.61	0.90	15.51	0.510	1.709	0.052	8.92	271
16	29°53′23.95″	113°14′24.60″	7.32	0.40	11.40	1.987	3.135	0.169	9.38	0
17	29°54′32.45″	113°15′26.72″	7.48	0.70	9.50	2.036	2.860	0.146	9.18	0
18	29°53′01.02″	113°17′01.18″	7.52	1.00	14.37	0.571	2.110	0.086	8.11	0
19	29°53′31.10″	113°17′09.42″	7.43	1.10	13.82	0.487	1.154	0.030	9.33	0
20	29°51′59.00″	113°17′39.05″	7.5	0.30	9.27	1.111	2.562	0.124	9.69	0
21	29°50′59.80″	113°17′55.81″	7.59	1.10	15.97	0.429	1.960	0.082	8.13	5
22	29°50′45.03″	113°19′53.66″	7.57	0.90	14.92	0.571	2.221	0.098	7.23	0
23	29°49′18.46″	113°19′57.76″	7.58	0.50	17.23	0.741	2.114	0.094	8.01	0
24	29°49′47.92″	113°20′06.79″	7.56	1.00	16.28	0.487	1.807	0.067	8.29	5

25	29°49′48.39″	113°21′12.33″	7.35	0.60	15.10	0.487	1.270	0.050	8.33	0
26	29°51′38.87″	113°22′08.80″	7.12	0.70	15.11	0.824	1.550	0.055	10.54	0
27	29°51′59.53″	113°23′58.49″	9.06	0.40	12.52	0.611	1.424	0.024	8.86	660
28	29°52′20.17″	113°23′03.62″	8.62	0.60	13.13	0.443	1.457	0.022	10.91	275
29	29°53′00.68″	113°22′45.19″	8.61	0.50	15.57	0.657	1.443	0.049	9.87	0
30	29°53′16.44″	113°21′49.02″	8.59	0.50	15.64	0.665	1.435	0.046	9.84	0
31	29°54′09.46″	113°22′35.44″	8.61	0.80	20.64	0.539	1.592	0.080	8.60	160
32	29°54′57.62″	113°21′49.49″	8.62	0.80	12.64	0.810	2.329	0.103	8.85	0
33	29°54′55.07″	113°23′00.38″	8.66	1.50	19.31	0.458	1.420	0.057	9.23	500
34	29°56′19.45″	113°22′55.05″	8.65	0.70	21.70	0.518	1.536	0.070	9.38	305
35	29°56′44.60″	113°22′58.98″	8.67	0.50	10.02	0.819	2.380	0.114	8.76	0
36	29°56′05.62″	113°24′25.55″	8.64	0.70	13.00	0.533	1.383	0.054	8.86	10
37	29°55′40.48″	113°25′26.77″	8.66	0.65	16.70	0.469	1.718	0.078	9.94	0
38	29°55′53.38″	113°26′26.18″	8.97	0.40	16.97	0.602	2.403	0.118	10.42	0
39	29°55′53.26″	113°25′50.69″	8.11	0.50	15.55	0.539	1.951	0.080	9.97	0
40	29°54′03.36″	113°24′33.18″	8.35	0.80	14.05	0.585	1.727	0.051	9.75	0
41	29°53′15.26″	113°24′35.71″	8.31	1.27	15.20	0.420	0.982	0.012	8.76	100
42	29°55'39.23"	113°13'14.75"	7.38	0.65	8.10	0.79	1.79	0.13	10.25	35
43	29°54'41.68"	113°14'22.73"	7.60	0.78	9.60	0.87	2.62	0.17	10.55	41

Table S4. Summary statistics of measured variables for Honghu Lake during dry, wet and normal seasons.

Parameters	Dry Season				Wet Season				Normal Season			
	Min.	Max.	Mean	CV (%)	Min.	Max.	Mean	CV (%)	Min.	Max.	Mean	CV (%)
pH	7.8	8.32	8.06	1.53	6.55	10.5	7.84	9.36	7.5	8.53	7.92	1.65
Transparency (m)	0.2	1.7	0.8	50.15	0.18	1.88	0.61	59.06	0.25	1.5	0.72	38.52
DO (mg/L)	7.85	15.6	11.6	13.97	6.83	16.71	7.06	35.61	9.27	21.7	14.39	18.31
NH_4^+–N (mg/L)	0.24	0.7	0.395	29.14	0.236	1.194	0.497	40.64	0.336	2.036	0.685	60.83
TN (mg/L)	0.05	1.58	0.678	46.53	0.446	2.356	1.151	41.43	0.683	3.135	1.62	39.4
TP (mg/L)	0.013	0.165	0.044	89.25	0.01	0.167	0.052	75.81	0.007	0.169	0.063	64.78
COD_{Mn} (mg/L)	4.78	7.26	5.92	9.91	1.53	6.98	4.46	31.79	7.23	10.91	9.24	9.39
Biomass (g)	0	1715	265	128.51	0	4046	852.5	141.69	0	660	80.2	217.45

Note: CV, coefficient of variation

Table S5. Summary statistics of submerged aquatic plants biomass (g) for Honghu Lake during dry, wet and normal seasons.

Species	Dry Season				Wet Season				Normal Season			
	Min.	Max.	Mean	Proportion (%)	Min.	Max.	Mean	Proportion (%)	Min.	Max.	Mean	Proportion (%)
Myriophyllum verticillatum	0	761	88.3	33	0	1564	105.6	12	0	660	23.4	29
Stuckenia pectinata (L.) Börner sago pondweed	0	973	120	45	0	1385	164.9	19	0	500	12.2	15
Ceratophyllum demersum L.	0	400	48	18	0	3986	542.2	64	0	650	25.9	32
Potamogeton malaianus	0	100	5.1	2	0	32	1.3	1	0	200	7.0	9
Potamogeton maackianus	0	42	1.5	1	0	299	13.3	2	0	300	7.6	9
Vallisneria natans	0	50	2.3	1	0	24	0.6	0	0	-	-	-
Hydrilla verticillata	0	5	0.1	0	0	138	13.9	2	0	100	4.8	6

© 2017 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).