

Supplementary Materials:

Table S1. List of environmental factors for the ‘Temporal and spatial distribution patterns of microalgae’ survey in study area.

	site	WT (°C)	DO (mg/L)	pH	CON. ($\mu\text{S}/\text{cm}^3$)	TUR.	TOC (mg/L)	TN (mg/L)	TP (mg/L)
1th survey (Apr.)	St.1	12.3	11.00	7.86	164.1	4.1	2.033	1.53	7.33
	St.2	14.1	10.21	7.77	207.3	5.5	3.657	2.29	9.84
	St.3	13.6	10.40	7.87	208.1	4.2	4.766	2.49	20.30
	St.4	14.0	10.16	7.85	197.4	4.5	3.902	2.31	27.10
	St.5	13.0	11.02	7.92	184.1	4.9	3.958	2.09	22.00
	St.6	11.3	12.37	8.10	180.6	12.2	3.724	1.87	20.00
2th survey (Apr.)	St.1	12.7	9.88	7.86	185.4	55.4	4.775	2.08	43.20
	St.2	12.4	9.76	7.94	199.4	29.5	3.203	2.13	34.20
	St.3	12.8	9.76	7.76	181.2	33.5	3.738	2.01	38.00
	St.4	12.5	9.77	7.95	202.8	21.9	4.032	1.93	35.20
	St.5	17.4	11.27	8.89	232.7	2.8	3.274	1.89	29.10
	St.6	16.5	10.71	8.67	224.9	6.2	3.459	2.07	27.60
3th survey (May.)	St.1	14.6	9.91	8.07	223.6	17.7	3.491	2.01	28.70
	St.2	15.5	9.41	7.38	173.1	2.0	2.156	1.98	25.80
	St.3	15.1	9.82	8.03	204.5	8.1	3.119	2.49	31.00
	St.4	15.3	9.43	7.95	208.6	7.4	4.383	2.73	26.70
	St.5	16.9	11.22	8.75	215.4	1.8	5.202	3.62	28.00
	St.6	16.7	10.68	8.26	203.6	16.5	3.559	2.38	30.60
4th survey (May.)	St.1	18.8	9.48	8.21	228.1	10.5	2.503	1.68	19.40
	St.2	19.7	9.57	7.95	212.8	9.2	1.826	2.25	27.20
	St.3	20.3	9.08	8.13	219.4	10.9	2.458	2.34	30.30
	St.4	19.6	9.04	8.13	211.9	4.7	1.945	2.37	22.70
	St.5	22.1	13.56	9.56	215.1	1.3	2.411	2.23	23.40
	St.6	20.7	10.97	8.58	217.0	14.7	2.424	2.22	17.30
5th survey (Jun.)	St.1	22.9	8.90	8.33	228.7	4.4	2.305	1.70	31.80
	St.2	26.9	11.99	7.85	334.8	9.2	1.817	2.00	29.10
	St.3	27.6	11.94	9.29	262.1	2.0	2.287	1.96	39.70
	St.4	27.6	13.51	9.65	239.0	2.4	2.277	1.65	33.60
	St.5	27.2	15.37	9.84	243.7	4.4	2.744	1.59	27.70
	St.6	26.3	11.99	9.05	258.3	17.3	3.082	1.46	29.20
6th survey (Jun.)	St.1	21.6	8.64	8.21	224.6	2.0	2.449	1.63	34.10
	St.2	23.0	9.06	6.98	319.7	2.1	2.299	1.70	32.60
	St.3	22.0	8.76	8.28	227.2	0.1	2.535	1.65	29.50
	St.4	24.8	10.91	8.97	241.5	0.3	2.669	1.62	35.40

	St.5	25.2	10.88	9.34	241.8	0.3	3.023	1.52	32.10
	St.6	22.9	11.34	8.90	255.3	3.2	3.244	1.48	27.70
7th survey (Jul.)	St.1	21.4	3.06	7.02	163.0	1712.1	6.055	1.65	28.90
	St.2	21.8	8.28	7.77	149.6	9.4	1.880	1.56	22.90
	St.3	22.4	7.24	7.57	145.6	49.8	4.659	1.75	60.50
	St.4	22.8	6.99	7.53	154.4	29.3	5.995	1.62	58.50
	St.5	22.0	7.14	7.54	138.0	34.6	5.183	1.47	62.60
	St.6	22.8	8.05	7.65	166.2	50.6	4.084	1.92	53.20
8th survey (Jul.)	St.1	27.6	7.71	8.42	202.9	0.5	3.099	1.25	16.10
	St.2	26.1	6.55	7.17	266.8	1.6	1.885	1.40	7.27
	St.3	29.7	7.75	8.44	239.8	0.4	2.490	1.32	15.20
	St.4	32.1	11.94	9.38	210.3	0.6	3.079	1.44	29.20
	St.5	32.3	13.84	9.74	212.9	0.8	3.140	1.52	11.50
	St.6	28.5	8.45	9.00	216.5	1.0	2.868	1.51	7.09
9th survey (Jul.)	St.1	29.9	10.44	7.84	368.3	0.1	2.788	1.19	35.90
	St.2	33.2	11.53	9.36	218.4	4.2	2.474	0.99	31.20
	St.3	31.5	10.22	8.92	245.3	0.7	2.918	1.08	36.30
	St.4	32.2	12.74	9.51	213.4	1.0	3.574	1.04	41.20
	St.5	32.0	12.06	9.60	215.5	4.7	3.888	1.48	39.60
	St.6	28.1	8.33	8.21	202.6	1.8	3.469	2.01	44.80
10th survey (Aug.)	St.1	25.9	7.88	8.48	214.1	1.3	3.212	1.54	35.30
	St.2	30.3	9.72	8.44	435.3	0.3	3.442	1.72	36.20
	St.3	30.7	12.17	9.27	233.4	0.3	3.736	1.55	38.80
	St.4	29.2	19.81	9.92	218.2	2.2	4.234	1.76	40.50
	St.5	30.0	9.68	9.14	206.5	0.0	4.195	1.82	42.30
	St.6	30.1	10.29	8.81	221.1	4.9	3.987	1.75	39.70
11th survey (Aug.)	St.1	21.5	6.95	8.10	148.3	27.0	3.209	2.14	34.20
	St.2	22.1	7.17	7.53	155.4	34.1	3.801	2.37	36.50
	St.3	22.5	7.26	7.51	164.5	25.8	3.410	2.31	41.20
	St.4	21.7	7.33	7.44	158.5	21.4	4.126	2.29	51.30
	St.5	21.6	7.27	7.70	152.4	18.3	3.904	2.37	43.50
	St.6	24.9	7.88	7.98	174.1	21.3	3.871	2.14	39.80
12th survey (Sep.)	St.1	20.3	8.93	8.12	192.0	3.7	3.145	1.87	31.20
	St.2	22.9	13.40	9.16	202.8	13.0	3.608	2.01	36.10
	St.3	21.6	10.15	8.39	215.7	4.3	3.279	1.68	34.90
	St.4	22.0	10.86	8.75	217.7	1.6	3.881	1.52	40.00
	St.5	22.7	12.52	9.22	206.0	2.5	3.689	1.79	41.20
	St.6	21.7	9.09	7.54	269.2	3.2	3.875	2.10	44.40
13th survey (Sep.)	St.1	18.0	10.21	8.66	211.1	0.7	4.119	1.98	27.70
	St.2	19.9	10.68	7.82	269.4	1.6	3.783	2.19	36.90
	St.3	18.4	9.59	8.14	227.9	0.4	3.624	2.10	35.20
	St.4	20.1	9.76	8.25	225.4	0.3	3.982	1.98	39.00
	St.5	19.9	12.61	9.07	217.9	0.4	3.888	2.05	38.60

14th survey (Oct.)	St.6	19.9	11.94	8.37	226.6	25.4	3.896	2.41	42.30
	St.1	14.9	9.80	8.40	207.3	4.9	3.341	1.72	36.80
	St.2	14.8	10.20	7.92	229.1	0.1	3.212	1.69	33.90
	St.3	15.4	9.98	7.95	212.1	3.2	3.111	2.01	37.50
	St.4	16.1	9.89	8.05	221.1	4.3	3.574	2.04	41.10
	St.5	17.8	9.31	8.07	183.8	8.4	3.721	2.11	39.60
	St.6	17.3	14.10	8.74	170.9	12.8	3.991	1.93	39.10
15th survey (Oct.)	St.1	14.5	11.04	8.30	222.9	0.3	2.843	2.02	28.31
	St.2	15.2	10.82	7.82	297.4	1.0	2.102	2.13	31.63
	St.3	14.6	10.80	8.05	234.5	0.1	2.614	2.01	26.52
	St.4	15.6	10.85	8.21	242.0	0.6	2.575	2.07	26.13
	St.5	15.4	14.59	9.03	231.4	2.1	2.871	2.11	24.48
	St.6	16.7	15.51	9.17	229.7	3.0	2.952	1.89	27.34
16th survey (Nov.)	St.1	10.6	12.22	8.18	217.4	0.8	2.090	2.00	13.70
	St.2	12.0	11.41	7.13	317.2	0.3	1.219	4.72	9.69
	St.3	11.3	11.51	8.07	220.4	0.5	1.821	2.04	14.10
	St.4	13.2	11.55	8.09	240.7	1.5	1.982	2.14	17.03
	St.5	12.3	15.45	9.11	231.5	2.3	2.076	2.05	16.32
	St.6	12.2	13.12	8.24	245.1	5.2	2.078	1.99	14.11
17th survey (Nov.)	St.1	8.3	12.47	8.20	220.4	1.4	2.067	2.03	15.17
	St.2	9.4	12.16	7.73	262.5	0.2	0.867	1.88	4.46
	St.3	9.9	11.77	8.09	229.6	2.4	1.704	2.06	12.60
	St.4	9.2	11.92	8.00	222.7	0.8	1.686	2.09	10.04
	St.5	10.8	12.14	8.34	221.0	1.8	1.754	1.99	11.15
	St.6	12.6	12.88	8.22	224.8	3.2	1.797	1.88	11.47

WT: Water temperature, DO: dissolved oxygen, CON.: conductivity, TUR.: turbidity, TOC: total organic carbon, TP: total phosphorus, TN: total nitrogen.

Table S2. List of environmental factors for the 'Diurnal vertical migration of microalgae' survey in study area.

	time	Water layer	WT (°C)	DO (mg/L)	pH	Cond. ($\mu\text{S}/\text{cm}^3$)	TUR.	TOC	TN	TP
1th survey (Jun.07.- 08.)	13	S	27.20	15.37	9.84	243.70	4.40	2.709	1.66	29.80
	13	M	23.80	8.22	8.46	243.30	2.80	2.420	1.76	31.70
	13	B	20.90	4.97	7.97	244.90	10.20	2.375	1.69	29.70
	16	S	27.30	14.98	9.76	242.40	5.40	2.920	1.60	35.50
	16	M	23.70	8.25	8.52	241.60	2.60	2.702	1.50	25.60
	16	B	21.30	5.71	7.96	242.10	8.10	3.038	1.62	30.70
	19	S	28.00	15.13	9.88	243.30	6.70	2.374	1.56	32.00
	19	M	23.90	8.65	8.63	242.00	3.50	2.581	1.40	30.00
	19	B	20.80	4.65	7.93	245.20	10.00	2.773	1.63	38.60
	22	S	28.40	14.50	9.94	243.40	3.80	2.807	1.63	34.60

	22	M	24.20	9.27	8.78	241.80	3.10	2.765	1.59	36.60
	22	B	21.00	5.08	7.97	244.20	8.20	2.978	1.44	32.20
	1	S	26.70	16.55	9.94	239.50	6.10	3.099	1.25	16.10
	1	M	24.40	10.21	9.01	241.60	3.30	1.885	1.40	7.27
	1	B	20.90	4.73	7.93	245.10	7.90	2.490	1.32	15.20
	4	S	26.80	14.77	9.88	238.50	5.80	3.079	1.44	29.20
	4	M	24.60	9.72	8.85	237.70	3.20	3.140	1.52	11.50
	4	B	21.10	5.22	7.97	243.00	8.00	2.868	1.51	7.09
	7	S	26.60	15.31	9.90	236.80	4.00	2.948	1.02	32.70
	7	M	24.30	9.81	8.94	243.40	4.10	1.887	1.23	39.20
	7	B	20.90	4.59	7.93	244.20	11.40	3.048	1.07	28.50
	10	S	26.40	15.06	9.83	237.10	3.80	3.269	0.99	33.40
	10	M	24.30	8.78	8.54	237.50	2.80	3.166	0.95	41.20
	10	B	20.80	4.19	7.88	244.90	12.50	3.365	0.61	39.90
	13	S	26.60	15.28	9.77	236.50	4.40	3.101	1.73	39.10
	13	M	24.10	8.58	8.52	240.20	2.90	3.313	1.93	62.30
	13	B	21.50	5.17	7.89	240.10	8.90	3.691	1.62	49.50
	13	S	23.00	16.59	10.61	235.50	1.00	3.907	2.01	38.50
	13	M	22.10	13.22	10.71	235.90	1.60	5.189	2.14	39.70
	13	B	20.30	7.74	9.79	225.40	3.80	4.309	1.99	44.20
	16	S	23.20	16.41	10.41	235.40	1.20	4.271	2.34	46.50
	16	M	22.30	15.61	10.43	235.20	1.50	4.108	2.20	48.70
	16	B	20.30	7.79	10.32	225.50	3.80	4.733	2.31	51.10
	19	S	23.70	17.15	10.48	235.00	1.10	3.854	1.52	40.30
	19	M	22.30	14.49	10.09	233.40	1.20	4.142	1.78	45.10
	19	B	20.30	7.32	10.22	225.90	7.80	3.966	1.92	39.20
	22	S	24.40	16.07	10.89	235.60	0.90	3.908	2.12	44.20
	22	M	22.40	14.53	11.05	235.00	1.40	4.113	1.83	43.20
2th	22	B	20.50	8.28	10.59	226.20	2.30	4.405	1.75	45.70
survey	1	S	24.00	16.84	10.63	235.90	0.70	3.301	1.92	31.10
(Sep.18.-	1	M	22.60	15.61	10.87	235.70	1.10	3.213	1.78	34.80
19.)	1	B	20.30	7.16	10.03	226.20	4.70	3.714	2.11	33.60
	4	S	23.60	15.70	10.90	236.00	0.70	3.974	2.22	38.10
	4	M	22.50	13.87	10.75	235.80	1.10	3.995	2.34	37.50
	4	B	20.30	7.26	10.76	224.90	3.30	4.214	2.01	43.20
	7	S	23.30	14.74	10.90	235.90	0.80	2.044	2.01	17.02
	7	M	22.80	14.52	11.22	236.40	0.80	1.415	2.08	12.74
	7	B	20.30	7.03	10.87	225.60	3.80	1.798	2.15	17.20
	10	S	23.40	15.29	11.24	235.50	0.70	2.037	2.17	17.66
	10	M	22.70	13.98	11.45	236.20	0.80	2.141	2.06	17.40
	10	B	20.30	6.76	10.65	225.80	3.80	1.917	1.98	14.83
	13	S	23.40	15.57	11.47	235.40	0.80	2.024	2.07	21.57
	13	M	22.50	13.61	11.41	236.90	0.80	1.117	1.71	7.72

13	B	20.30	6.69	10.80	225.70	3.80	1.493	1.89	20.71
----	---	-------	------	-------	--------	------	-------	------	-------

WT: Water temperature, DO: dissolved oxygen, CON.: conductivity, TUR.: turbidity, TOC: total organic carbon, TP: total phosphorus, TN: total nitrogen, S: surface layer, M: middle layer, B: bottom layer.

Table S3. Summary of CCA analysis based on the species environment factors in study area.

Survey	Variable	Axis			
		1	2	3	4
Temporal and spatial distribution patterns of microalgae	Diatom	-0.043	-0.056	-0.013	0.004
	Green algae	-0.057	-0.033	0.014	0.005
	Unidentified flagellates	-0.031	-0.05	0.001	-0.011
	Dinoflagellates	0.609	-0.03	0.001	0.001
	Cyanobacteria	-0.012	0.373	-0.002	0.001
	Eigen value	0.025	0.017	0.001	0.003
	Cumulative percentage variance of species data	8.441	14.186	14.223	14.236
	Cumulative percentage variance of species environmental relationship	59.294	99.647	99.905	99.924
Diurnal vertical migration of microalgae	Diatom	0.101	0.072	-0.033	-0.003
	Green algae	0.072	0.016	0.012	0.011
	Unidentified flagellates	0.067	-0.009	0.035	-0.009
	Dinoflagellates	-0.441	-1.012	-0.016	0.002
	Cyanobacteria	-1.098	0.485	0.001	0.001
	Eigen value	0.073	0.064	0.001	0.001
	Cumulative percentage variance of species data	21.101	39.755	39.967	39.986
	Cumulative percentage variance of species environmental relationship	52.770	99.423	99.954	99.976