

**Table S1.** The temperature (T), salinity (S), dissolved oxygen (DO) in the surface and bottom layer, and the dissolved inorganic nutrients (ammonium, nitrate, nitrite, phosphate) for mixed water of the surface and bottom layer at the survey stations.

Date	Station	Sampling depth (m)	T (°C)	S (‰)	DO (mg L <sup>-1</sup> )	NO <sub>2</sub> <sup>-</sup> (mg L <sup>-1</sup> )	NO <sub>3</sub> <sup>-</sup> (mg L <sup>-1</sup> )	NH <sub>4</sub> <sup>+</sup> (mg L <sup>-1</sup> )	PO <sub>4</sub> <sup>3-</sup> (mg L <sup>-1</sup> )
2021-8-16	G1	0.50	25.16	30.28	4.94				
		11.00	24.48	30.19	4.89	0.02	0.08	0.23	0.06
2021-8-16	G2	0.50	25.60	25.71	4.85				
		22.00	23.83	32.63	4.91	0.01	0.07	0.14	0.08
2021-8-16	G5	0.50	25.57	28.69	4.83				
		19.00	24.02	32.01	4.90	0.01	0.07	0.12	0.11
2021-8-17	G3	0.50	26.15	28.31	4.86				
		25.00	24.28	31.32	4.88	0.02	0.05	0.16	0.06
2021-8-17	G4	0.50	26.64	25.47	4.86				
		17.00	24.20	32.20	4.90	0.01	0.05	0.15	0.11
2022-12-7	G1	0.50	12.89	30.42	6.11				
		11.00	13.16	30.9	6.04	0.003	0.04	0.08	0.13
2022-12-7	G2	0.50	12.73	30.49	6.12				
		22.00	13.35	31.14	6.03	0.004	0.04	0.09	0.10
2022-12-7	G5	0.50	12.54	29.97	6.18				
		19.00	13.08	30.83	6.07	0.003	0.04	0.08	0.11
2022-12-8	G3	0.50	12.87	30.69	6.11				
		25.00	13.34	31.11	6.03	0.004	0.05	0.08	0.12
2022-12-8	G4	0.50	13.05	30.69	6.08				
		17.00	13.24	31.02	6.05	0.003	0.03	0.10	0.15

Table S2. Multiple comparison among sites within each site and between seasons within each site at each layer using Least-Squares Means (lsmeans) for phytoplankton sinking rate (a) and concentrations of pico- (b), nano- (c) and micro-sized (d) Chl *a*.

**(a)**

Layer	Site	Season	Contrast	Estimate	SE	df	T ratio	p value
Surface	G1	.	Summer - Winter	-0.04	0.01	20	-3.12	0.134
Surface	G2	.	Summer - Winter	0.00	0.01	20	0.11	1.000
Surface	G3	.	Summer - Winter	0.07	0.01	20	5.34	<b>0.001</b>
Surface	G4	.	Summer - Winter	0.01	0.01	20	0.69	1.000
Surface	G5	.	Summer - Winter	0.03	0.01	20	2.50	0.535
Surface	.	Summer	G1 - G2	-0.01	0.01	20	-0.81	1.000
Surface	.	Summer	G1 - G3	-0.05	0.01	20	-3.77	<b>0.030</b>
Surface	.	Summer	G1 - G4	-0.05	0.01	20	-3.86	<b>0.024</b>
Surface	.	Summer	G1 - G5	-0.01	0.01	20	-1.15	1.000
Surface	.	Summer	G2 - G3	-0.04	0.01	20	-2.96	0.192
Surface	.	Summer	G2 - G4	-0.04	0.01	20	-3.05	0.157
Surface	.	Summer	G2 - G5	0.00	0.01	20	-0.34	1.000
Surface	.	Summer	G3 - G4	0.00	0.01	20	-0.09	1.000
Surface	.	Summer	G3 - G5	0.03	0.01	20	2.62	0.406
Surface	.	Summer	G4 - G5	0.03	0.01	20	2.71	0.335
Surface	.	Winter	G1 - G2	0.03	0.01	20	2.42	0.627
Surface	.	Winter	G1 - G3	0.06	0.01	20	4.69	<b>0.003</b>
Surface	.	Winter	G1 - G4	0.00	0.01	20	-0.05	1.000
Surface	.	Winter	G1 - G5	0.05	0.01	20	4.47	<b>0.006</b>
Surface	.	Winter	G2 - G3	0.03	0.01	20	2.27	0.857
Surface	.	Winter	G2 - G4	-0.03	0.01	20	-2.47	0.568
Surface	.	Winter	G2 - G5	0.02	0.01	20	2.05	1.000
Surface	.	Winter	G3 - G4	-0.06	0.01	20	-4.74	<b>0.003</b>
Surface	.	Winter	G3 - G5	0.00	0.01	20	-0.22	1.000
Surface	.	Winter	G4 - G5	0.06	0.01	20	4.52	<b>0.005</b>
Bottom	G1	.	Summer - Winter	-0.10	0.02	20	-6.77	<b>&lt;0.001</b>
Bottom	G2	.	Summer - Winter	0.06	0.02	20	3.94	<b>0.020</b>
Bottom	G3	.	Summer - Winter	0.06	0.02	20	4.02	<b>0.017</b>
Bottom	G4	.	Summer - Winter	0.01	0.02	20	0.40	1.000

Bottom	G5	.	Summer - Winter	0.00	0.02	20	-0.10	1.000
Bottom	.	Summer	G1 - G2	-0.09	0.02	20	-6.14	<b>&lt;0.001</b>
Bottom	.	Summer	G1 - G3	-0.11	0.02	20	-7.22	<b>&lt;0.001</b>
Bottom	.	Summer	G1 - G4	-0.11	0.02	20	-7.36	<b>&lt;0.001</b>
Bottom	.	Summer	G1 - G5	-0.04	0.02	20	-2.52	0.506
Bottom	.	Summer	G2 - G3	-0.02	0.02	20	-1.08	1.000
Bottom	.	Summer	G2 - G4	-0.02	0.02	20	-1.21	1.000
Bottom	.	Summer	G2 - G5	0.06	0.02	20	3.62	<b>0.043</b>
Bottom	.	Summer	G3 - G4	0.00	0.02	20	-0.13	1.000
Bottom	.	Summer	G3 - G5	0.07	0.02	20	4.70	<b>0.003</b>
Bottom	.	Summer	G4 - G5	0.07	0.02	20	4.83	<b>0.003</b>
Bottom	.	Winter	G1 - G2	0.07	0.02	20	4.57	<b>0.005</b>
Bottom	.	Winter	G1 - G3	0.05	0.02	20	3.56	<b>0.049</b>
Bottom	.	Winter	G1 - G4	0.00	0.02	20	-0.19	1.000
Bottom	.	Winter	G1 - G5	0.06	0.02	20	4.15	<b>0.012</b>
Bottom	.	Winter	G2 - G3	-0.02	0.02	20	-1.01	1.000
Bottom	.	Winter	G2 - G4	-0.07	0.02	20	-4.76	<b>0.003</b>
Bottom	.	Winter	G2 - G5	-0.01	0.02	20	-0.42	1.000
Bottom	.	Winter	G3 - G4	-0.06	0.02	20	-3.75	<b>0.032</b>
Bottom	.	Winter	G3 - G5	0.01	0.02	20	0.59	1.000
Bottom	.	Winter	G4 - G5	0.07	0.02	20	4.34	<b>0.008</b>

**(b)**

Layer	Site	Season	Contrast	Estimate	SE	df	T ratio	p value
Surface	G1	.	Summer - Winter	0.02	0.02	20	0.94	1.000
Surface	G2	.	Summer - Winter	-0.01	0.02	20	-0.69	1.000
Surface	G3	.	Summer - Winter	-0.18	0.02	20	-11.10	<b>&lt;0.001</b>
Surface	G4	.	Summer - Winter	0.01	0.02	20	0.33	1.000
Surface	G5	.	Summer - Winter	-0.05	0.02	20	-2.89	0.225
Surface	.	Summer	G1 - G2	0.05	0.02	20	2.97	0.191
Surface	.	Summer	G1 - G3	0.08	0.02	20	4.65	<b>0.004</b>
Surface	.	Summer	G1 - G4	0.02	0.02	20	1.36	1.000
Surface	.	Summer	G1 - G5	0.05	0.02	20	2.78	0.292
Surface	.	Summer	G2 - G3	0.03	0.02	20	1.68	1.000
Surface	.	Summer	G2 - G4	-0.03	0.02	20	-1.61	1.000
Surface	.	Summer	G2 - G5	0.00	0.02	20	-0.19	1.000
Surface	.	Summer	G3 - G4	-0.05	0.02	20	-3.29	0.092
Surface	.	Summer	G3 - G5	-0.03	0.02	20	-1.87	1.000

Surface	.	Summer	G4 - G5	0.02	0.02	20	1.42	1.000
Surface	.	Winter	G1 - G2	0.02	0.02	20	1.33	1.000
Surface	.	Winter	G1 - G3	-0.12	0.02	20	-7.40	<b>&lt;0.001</b>
Surface	.	Winter	G1 - G4	0.01	0.02	20	0.75	1.000
Surface	.	Winter	G1 - G5	-0.02	0.02	20	-1.05	1.000
Surface	.	Winter	G2 - G3	-0.14	0.02	20	-8.73	<b>&lt;0.001</b>
Surface	.	Winter	G2 - G4	-0.01	0.02	20	-0.59	1.000
Surface	.	Winter	G2 - G5	-0.04	0.02	20	-2.39	0.674
Surface	.	Winter	G3 - G4	0.13	0.02	20	8.14	<b>&lt;0.001</b>
Surface	.	Winter	G3 - G5	0.10	0.02	20	6.34	<b>&lt;0.001</b>
Surface	.	Winter	G4 - G5	-0.03	0.02	20	-1.80	1.000
Bottom	G1	.	Summer - Winter	0.01	0.02	20	0.69	1.000
Bottom	G2	.	Summer - Winter	-0.10	0.02	20	-5.84	<b>&lt;0.001</b>
Bottom	G3	.	Summer - Winter	-0.05	0.02	20	-3.10	0.143
Bottom	G4	.	Summer - Winter	-0.08	0.02	20	-4.82	<b>0.003</b>
Bottom	G5	.	Summer - Winter	-0.03	0.02	20	-1.88	1.000
Bottom	.	Summer	G1 - G2	0.06	0.02	20	3.35	0.080
Bottom	.	Summer	G1 - G3	0.05	0.02	20	2.87	0.237
Bottom	.	Summer	G1 - G4	0.07	0.02	20	3.85	<b>0.025</b>
Bottom	.	Summer	G1 - G5	0.02	0.02	20	1.16	1.000
Bottom	.	Summer	G2 - G3	-0.01	0.02	20	-0.48	1.000
Bottom	.	Summer	G2 - G4	0.01	0.02	20	0.50	1.000
Bottom	.	Summer	G2 - G5	-0.04	0.02	20	-2.18	1.000
Bottom	.	Summer	G3 - G4	0.02	0.02	20	0.98	1.000
Bottom	.	Summer	G3 - G5	-0.03	0.02	20	-1.71	1.000
Bottom	.	Summer	G4 - G5	-0.05	0.02	20	-2.69	0.355
Bottom	.	Winter	G1 - G2	-0.05	0.02	20	-3.18	0.117
Bottom	.	Winter	G1 - G3	-0.02	0.02	20	-0.92	1.000
Bottom	.	Winter	G1 - G4	-0.03	0.02	20	-1.66	1.000
Bottom	.	Winter	G1 - G5	-0.02	0.02	20	-1.41	1.000
Bottom	.	Winter	G2 - G3	0.04	0.02	20	2.26	0.871
Bottom	.	Winter	G2 - G4	0.03	0.02	20	1.52	1.000
Bottom	.	Winter	G2 - G5	0.03	0.02	20	1.78	1.000
Bottom	.	Winter	G3 - G4	-0.01	0.02	20	-0.74	1.000
Bottom	.	Winter	G3 - G5	-0.01	0.02	20	-0.49	1.000
Bottom	.	Winter	G4 - G5	0.00	0.02	20	0.25	1.000

(c)

Layer	Site	Season	Contrast	Estimate	SE	df	T ratio	p value
Surface	G1	.	Summer - Winter	0.02	0.03	20	0.64	1.000
Surface	G2	.	Summer - Winter	0.12	0.03	20	3.84	<b>0.026</b>
Surface	G3	.	Summer - Winter	0.12	0.03	20	3.93	<b>0.020</b>
Surface	G4	.	Summer - Winter	0.04	0.03	20	1.25	1.000
Surface	G5	.	Summer - Winter	0.09	0.03	20	2.85	0.246
Surface	.	Summer	G1 - G2	-0.10	0.03	20	-3.25	0.100
Surface	.	Summer	G1 - G3	-0.15	0.03	20	-4.90	<b>0.002</b>
Surface	.	Summer	G1 - G4	-0.05	0.03	20	-1.69	1.000
Surface	.	Summer	G1 - G5	-0.13	0.03	20	-4.14	<b>0.013</b>
Surface	.	Summer	G2 - G3	-0.05	0.03	20	-1.65	1.000
Surface	.	Summer	G2 - G4	0.05	0.03	20	1.56	1.000
Surface	.	Summer	G2 - G5	-0.03	0.03	20	-0.89	1.000
Surface	.	Summer	G3 - G4	0.10	0.03	20	3.21	0.109
Surface	.	Summer	G3 - G5	0.02	0.03	20	0.77	1.000
Surface	.	Summer	G4 - G5	-0.07	0.03	20	-2.45	0.595
Surface	.	Winter	G1 - G2	0.00	0.03	20	-0.06	1.000
Surface	.	Winter	G1 - G3	-0.05	0.03	20	-1.61	1.000
Surface	.	Winter	G1 - G4	-0.03	0.03	20	-1.09	1.000
Surface	.	Winter	G1 - G5	-0.06	0.03	20	-1.93	1.000
Surface	.	Winter	G2 - G3	-0.05	0.03	20	-1.55	1.000
Surface	.	Winter	G2 - G4	-0.03	0.03	20	-1.03	1.000
Surface	.	Winter	G2 - G5	-0.06	0.03	20	-1.87	1.000
Surface	.	Winter	G3 - G4	0.02	0.03	20	0.53	1.000
Surface	.	Winter	G3 - G5	-0.01	0.03	20	-0.31	1.000
Surface	.	Winter	G4 - G5	-0.03	0.03	20	-0.84	1.000
Bottom	G1	.	Summer - Winter	-0.02	0.03	20	-0.65	1.000
Bottom	G2	.	Summer - Winter	0.09	0.03	20	3.19	0.116
Bottom	G3	.	Summer - Winter	0.13	0.03	20	4.47	<b>0.006</b>
Bottom	G4	.	Summer - Winter	-0.04	0.03	20	-1.48	1.000
Bottom	G5	.	Summer - Winter	0.05	0.03	20	1.75	1.000
Bottom	.	Summer	G1 - G2	-0.13	0.03	20	-4.49	<b>0.006</b>
Bottom	.	Summer	G1 - G3	-0.15	0.03	20	-5.08	<b>0.001</b>

Bottom	.	Summer	G1 - G4	0.00	0.03	20	0.04	1.000
Bottom	.	Summer	G1 - G5	-0.08	0.03	20	-2.84	0.255
Bottom	.	Summer	G2 - G3	-0.02	0.03	20	-0.59	1.000
Bottom	.	Summer	G2 - G4	0.13	0.03	20	4.53	<b>0.005</b>
Bottom	.	Summer	G2 - G5	0.05	0.03	20	1.65	1.000
Bottom	.	Summer	G3 - G4	0.15	0.03	20	5.12	<b>0.001</b>
Bottom	.	Summer	G3 - G5	0.07	0.03	20	2.24	0.906
Bottom	.	Summer	G4 - G5	-0.09	0.03	20	-2.88	0.234
Bottom	.	Winter	G1 - G2	-0.02	0.03	20	-0.66	1.000
Bottom	.	Winter	G1 - G3	0.00	0.03	20	0.04	1.000
Bottom	.	Winter	G1 - G4	-0.02	0.03	20	-0.79	1.000
Bottom	.	Winter	G1 - G5	-0.01	0.03	20	-0.44	1.000
Bottom	.	Winter	G2 - G3	0.02	0.03	20	0.70	1.000
Bottom	.	Winter	G2 - G4	0.00	0.03	20	-0.13	1.000
Bottom	.	Winter	G2 - G5	0.01	0.03	20	0.22	1.000
Bottom	.	Winter	G3 - G4	-0.02	0.03	20	-0.83	1.000
Bottom	.	Winter	G3 - G5	-0.01	0.03	20	-0.48	1.000
Bottom	.	Winter	G4 - G5	0.01	0.03	20	0.35	1.000

**(d)**

Layer	Site	Season	Contrast	Estimate	SE	df	T ratio	p value
Surface	G1	.	Summer - Winter	0.06	0.04	20	1.32	1.000
Surface	G2	.	Summer - Winter	0.38	0.04	20	9.09	<b>&lt;0.001</b>
Surface	G3	.	Summer - Winter	0.42	0.04	20	10.00	<b>&lt;0.001</b>
Surface	G4	.	Summer - Winter	0.53	0.04	20	12.62	<b>&lt;0.001</b>
Surface	G5	.	Summer - Winter	0.37	0.04	20	8.79	<b>&lt;0.001</b>
Surface	.	Summer	G1 - G2	-0.33	0.04	20	-7.75	<b>&lt;0.001</b>
Surface	.	Summer	G1 - G3	-0.38	0.04	20	-8.91	<b>&lt;0.001</b>
Surface	.	Summer	G1 - G4	-0.45	0.04	20	-10.62	<b>&lt;0.001</b>
Surface	.	Summer	G1 - G5	-0.30	0.04	20	-7.13	<b>&lt;0.001</b>
Surface	.	Summer	G2 - G3	-0.05	0.04	20	-1.16	1.000
Surface	.	Summer	G2 - G4	-0.12	0.04	20	-2.87	0.236
Surface	.	Summer	G2 - G5	0.03	0.04	20	0.63	1.000
Surface	.	Summer	G3 - G4	-0.07	0.04	20	-1.71	1.000
Surface	.	Summer	G3 - G5	0.08	0.04	20	1.79	1.000
Surface	.	Summer	G4 - G5	0.15	0.04	20	3.50	0.057
Surface	.	Winter	G1 - G2	0.00	0.04	20	0.02	1.000
Surface	.	Winter	G1 - G3	-0.01	0.04	20	-0.23	1.000

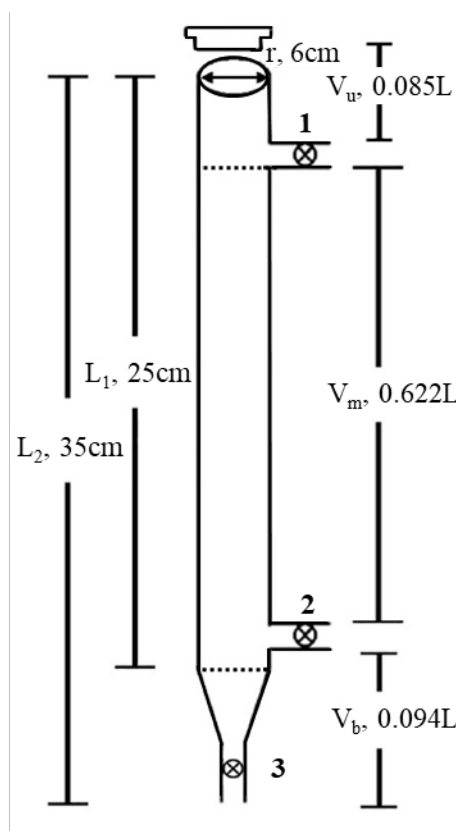
Surface	.	Winter	G1 - G4	0.03	0.04	20	0.68	1.000
Surface	.	Winter	G1 - G5	0.01	0.04	20	0.35	1.000
Surface	.	Winter	G2 - G3	-0.01	0.04	20	-0.25	1.000
Surface	.	Winter	G2 - G4	0.03	0.04	20	0.66	1.000
Surface	.	Winter	G2 - G5	0.01	0.04	20	0.32	1.000
Surface	.	Winter	G3 - G4	0.04	0.04	20	0.91	1.000
Surface	.	Winter	G3 - G5	0.02	0.04	20	0.57	1.000
Surface	.	Winter	G4 - G5	-0.01	0.04	20	-0.34	1.000
Bottom	G1	.	Summer - Winter	0.25	0.03	20	7.11	<b>&lt;0.001</b>
Bottom	G2	.	Summer - Winter	0.49	0.03	20	14.11	<b>&lt;0.001</b>
Bottom	G3	.	Summer - Winter	0.53	0.03	20	15.27	<b>&lt;0.001</b>
Bottom	G4	.	Summer - Winter	0.38	0.03	20	10.77	<b>&lt;0.001</b>
Bottom	G5	.	Summer - Winter	0.19	0.03	20	5.43	<b>0.001</b>
Bottom	.	Summer	G1 - G2	-0.25	0.03	20	-7.29	<b>&lt;0.001</b>
Bottom	.	Summer	G1 - G3	-0.34	0.03	20	-9.72	<b>&lt;0.001</b>
Bottom	.	Summer	G1 - G4	-0.16	0.03	20	-4.67	<b>0.004</b>
Bottom	.	Summer	G1 - G5	0.02	0.03	20	0.53	1.000
Bottom	.	Summer	G2 - G3	-0.09	0.03	20	-2.44	0.607
Bottom	.	Summer	G2 - G4	0.09	0.03	20	2.61	0.415
Bottom	.	Summer	G2 - G5	0.27	0.03	20	7.81	<b>&lt;0.001</b>
Bottom	.	Summer	G3 - G4	0.18	0.03	20	5.05	<b>0.002</b>
Bottom	.	Summer	G3 - G5	0.36	0.03	20	10.25	<b>&lt;0.001</b>
Bottom	.	Summer	G4 - G5	0.18	0.03	20	5.20	<b>0.001</b>
Bottom	.	Winter	G1 - G2	-0.01	0.03	20	-0.29	1.000
Bottom	.	Winter	G1 - G3	-0.05	0.03	20	-1.57	1.000
Bottom	.	Winter	G1 - G4	-0.04	0.03	20	-1.01	1.000
Bottom	.	Winter	G1 - G5	-0.04	0.03	20	-1.16	1.000
Bottom	.	Winter	G2 - G3	-0.04	0.03	20	-1.28	1.000
Bottom	.	Winter	G2 - G4	-0.03	0.03	20	-0.73	1.000
Bottom	.	Winter	G2 - G5	-0.03	0.03	20	-0.87	1.000
Bottom	.	Winter	G3 - G4	0.02	0.03	20	0.56	1.000
Bottom	.	Winter	G3 - G5	0.01	0.03	20	0.41	1.000
Bottom	.	Winter	G4 - G5	-0.01	0.03	20	-0.15	1.000

Significant level was shown in bold.

**Table S3.** Significant environmental factors with RDA results.

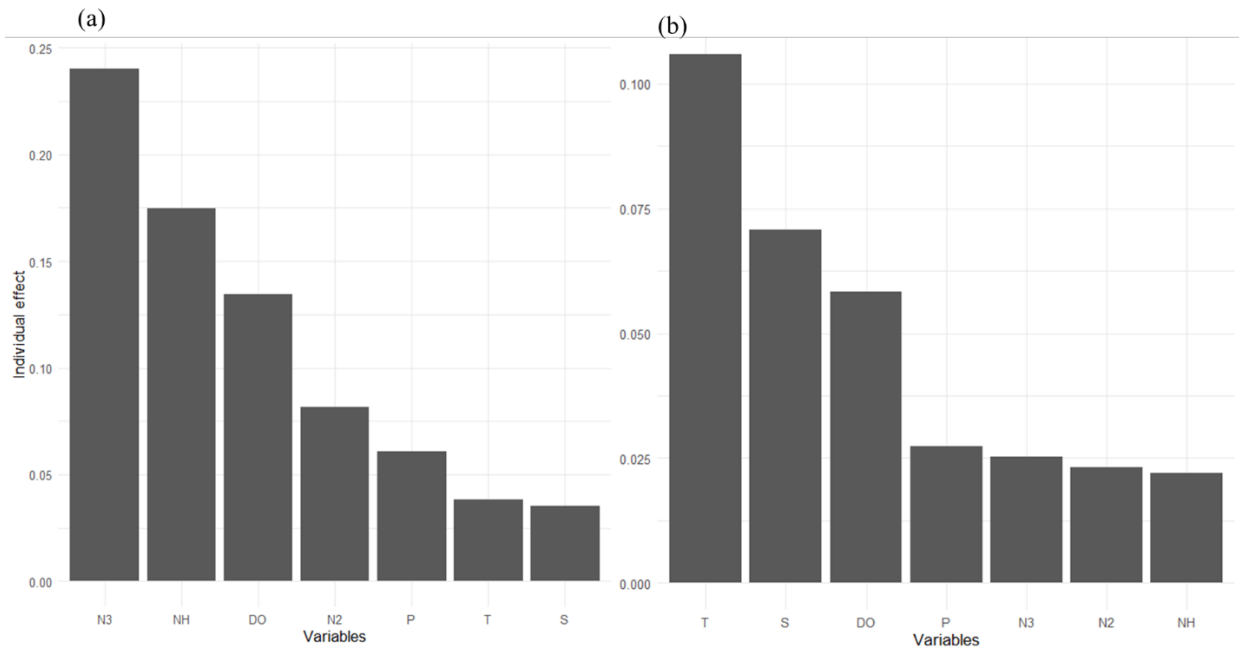
Season	Indicators	Shared contributions (%)	Individual contributions (%)	<i>p</i>
Summer	NO <sub>3</sub> <sup>-</sup>	35.57	24.58	<b>0.001</b>
	NH <sub>4</sub> <sup>+</sup>	24.79	17.13	<b>0.003</b>
	DO	18.13	12.53	<b>0.01</b>
Winter	T	69.92	8.39	<b>0.037</b>
	S	34.92	4.19	0.126
	DO	23.08	2.77	0.171

Significant level was shown in bold.



**Fig. S1.** Modified sedimentation column in SETCOL method





**Fig. S2.** The relative importance of individual environmental variables in predicting phytoplankton size structures in summer (a) and winter (b) by *rdacca.cp*. T: Temperature; S: Salinity; DO: Dissolved oxygen; N2:  $\text{NO}_2^-$ ; N3:  $\text{NO}_3^-$ ; NH:  $\text{NH}_4^+$ ; P:  $\text{PO}_4^{3-}$