



Supplementary Material

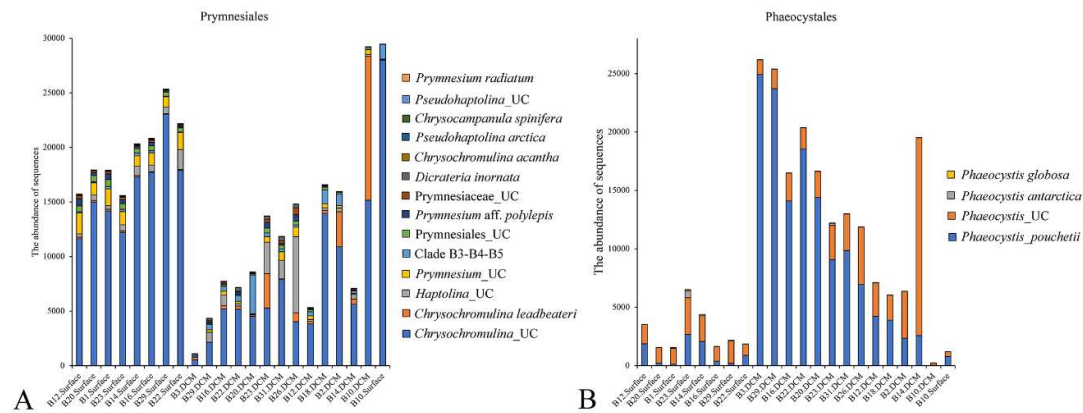


Figure S1. Taxonomic compositions of Prymnesiales (A) and Phaeocystales (B).

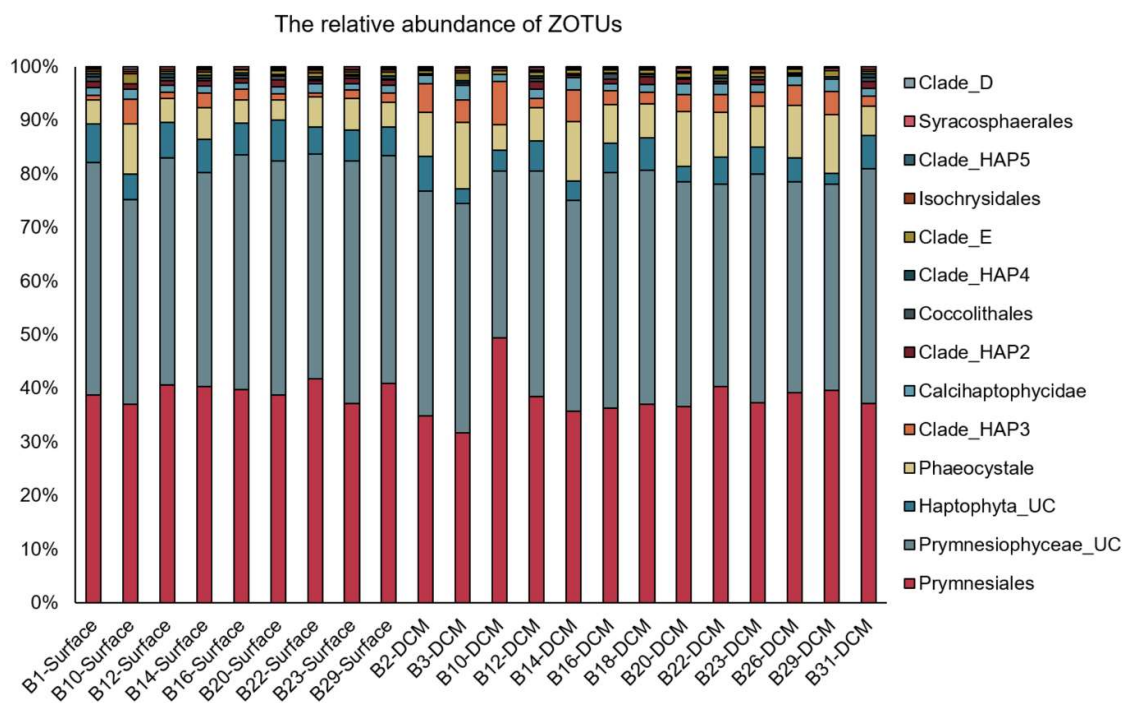
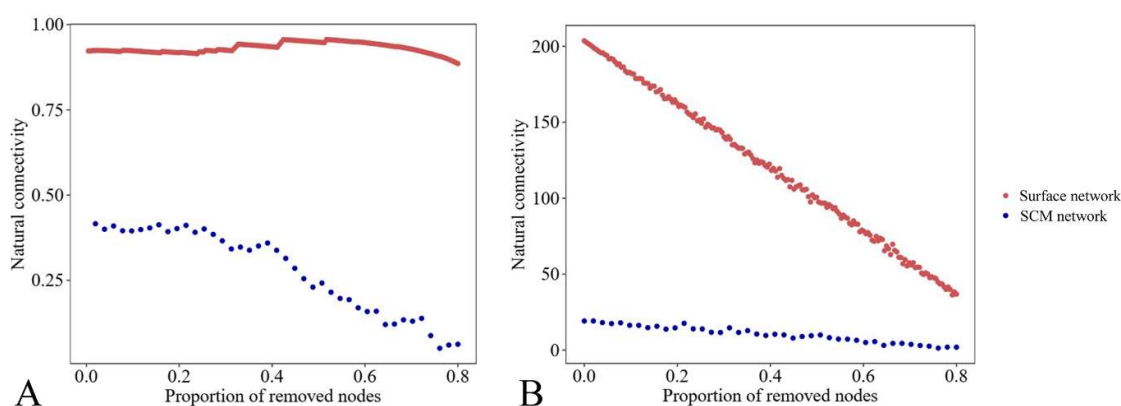


Figure S2. The proportions of ZOTUs.



**Figure S3.** Network stability was measured for surface water and SCM layer pico-haptophyte communities using a network attacking scenario in which nodes were gradually removed in a predetermined order (A) or randomly (B).

**Table S1.** Sample Information: SCM—subsurface chlorophyll maximum layer.

Sample ID	Station	Latitude	Longitude	Depth (m)
B1-Surface	B1	65.1735	-168.6907	0
B2-SCM	B2	66.6299	-168.6875	15
B3-SCM	B3	67.6700	-168.9600	25
B10-Surface	B10	70.5000	-168.6667	0
B10-SCM				25
B12-Surface	B12	72.3600	-168.6667	0
B12-SCM				35
B14-Surface	B14	74.8006	-167.8983	0
B14-SCM				32
B16-Surface	B16	75.1500	-176.0000	0
B16-SCM				50
B18-SCM	B18	75.7669	177.0685	37
B20-Surface	B20	77.0000	176.5700	0
B20-SCM				27
B22-Surface	B22	78.5218	178.8452	0
B22-SCM				35
B23-Surface	B23	77.8664	-175.9087	0
B23-SCM				44
B26-SCM	B26	76.0000	-170.5000	55
B29-Surface	B29	77.4723	-164.1180	0
B29-SCM				62
B31-SCM	B31	75.6912	-166.6382	44

**Table S2.** Environmental parameters at the sampling stations.

Sample ID	T (°C)	S	Nutrients (μM)					Chl <i>a</i> (μg/L)			Bacteria (cells/mL)	PPEs (cells/mL)
			PO <sub>4</sub>	NO <sub>2</sub> +NO <sub>3</sub>	NH <sub>4</sub>	SiO <sub>4</sub>	Total	> 20 μm	2-20 μm	< 2 μm		
B1-Surface	9.40	31.0	0.25	0.00	0.00	3.08	0.50	0.19	0.22	0.09	1.28E+06	1.46E+04
B10-Surface	6.51	31.2	0.24	0.00	0.00	1.00	0.10	0.22	0.15	0.13	1.78E+05	3.39E+03
B12-Surface	-0.74	28.5	0.54	0.00	0.00	9.48	0.28	0.36	0.05	0.09	8.16E+05	3.28E+03

B14-Surface	-1.09	27.5	0.55	0.00	0.00	1.52	0.09	0.10	0.22	0.18	2.47E+05	3.32E+03
B16-Surface	-1.14	28.2	0.63	0.00	0.00	0.49	0.07	0.13	0.21	0.15	2.03E+05	1.79E+03
B20-Surface	-1.51	30.0	0.61	0.00	0.00	0.00	0.40	0.09	0.33	0.07	2.24E+05	4.81E+03
B22-Surface	-1.45	29.2	0.46	0.00	0.00	0.66	0.08	0.14	0.23	0.13	2.20E+05	1.40E+03
B23-Surface	-1.34	28.4	0.61	0.00	0.00	1.38	0.06	0.11	0.22	0.17	2.22E+05	1.10E+03
B29-Surface	-1.25	27.4	0.55	0.03	0.00	2.04	0.05	0.07	0.24	0.19	1.69E+05	1.26E+03
B2-SCM	2.96	31.8	0.87	1.05	1.54	12.38	0.52	0.24	0.15	0.11	8.55E+05	4.07E+03
B3-SCM	2.06	32.2	0.84	1.71	0.21	10.88	6.66	0.45	0.04	0.01	4.62E+05	7.89E+03
B10-SCM	2.41	32.1	0.84	0.70	0.47	9.05	0.68	0.34	0.10	0.05	1.28E+05	2.12E+03
B12-SCM	-1.17	32.4	2.01	8.22	4.03	23.74	2.14	0.42	0.07	0.01	1.01E+06	4.66E+03
B14-SCM	-0.88	30.7	1.00	3.18	0.00	7.65	0.43	0.07	0.18	0.25	3.42E+05	4.92E+03
B16-SCM	-1.45	31.7	1.12	5.75	0.17	11.04	1.89	0.37	0.08	0.05	1.86E+05	5.03E+03
B18-SCM	-1.48	31.7	1.29	3.97	0.00	9.65	1.07	0.40	0.08	0.01	2.17E+05	4.36E+03
B20-SCM	-1.58	31.7	1.08	4.84	0.00	14.72	0.74	0.36	0.08	0.06	1.49E+05	3.56E+03
B22-SCM	-0.80	31.5	0.83	2.96	0.00	8.39	1.24	0.36	0.09	0.06	2.35E+05	5.72E+03
B23-SCM	-0.21	31.1	0.71	1.01	0.00	2.55	1.07	0.29	0.09	0.12	4.03E+05	7.46E+03
B26-SCM	-0.35	31.0	0.74	1.01	0.00	4.00	0.66	0.14	0.12	0.24	3.35E+05	6.90E+03
B29-SCM	0.17	30.9	0.83	1.37	0.00	5.91	0.43	0.05	0.12	0.33	1.89E+05	7.93E+03
B31-SCM	-1.16	30.9	1.06	2.98	0.00	7.31	0.42	0.16	0.17	0.17	2.62E+05	4.12E+03

**Table S3.** Alpha diversity estimates of the samples collected. \*Reads before randomly subsampling of 35,677 sequences without replacement.

Sample	Reads*	ZOTU*	ZOTUs	Coverage	Shannon	PD
B1-Surface	46710	785	750	0.9967	4.82	8.00
B10-Surface	77767	264	198	0.9982	2.67	3.34
B12-Surface	64681	788	741	0.9977	0.88	7.97
B14-Surface	35677	610	610	0.9962	3.46	7.02
B16-Surface	65324	782	719	0.9968	4.81	7.91
B20-Surface	60491	755	703	0.9967	2.52	7.69
B22-Surface	73268	682	590	0.9962	3.99	6.84
B23-Surface	49330	788	742	0.9962	3.16	7.99
B29-Surface	65416	648	579	0.9966	4.45	6.69
B2-SCM	106031	500	363	0.9964	3.91	4.88
B3-SCM	96255	402	275	0.9970	3.62	4.34
B10-SCM	121493	319	213	0.9969	2.64	3.20
B12-SCM	58364	632	544	0.9970	4.6	6.56
B14-SCM	111701	419	296	0.9960	2.35	4.27
B16-SCM	102869	711	596	0.9957	3.78	7.01
B18-SCM	102190	753	616	0.9955	3.58	7.46
B20-SCM	104469	480	335	0.9972	4.78	4.93
B22-SCM	113514	579	415	0.9966	3.17	6.03
B23-SCM	114902	765	613	0.9978	1.53	7.20
B26-SCM	103266	496	360	0.9967	3.45	5.07
B29-SCM	90575	316	223	0.9970	1.27	3.30
B31-SCM	81608	813	720	0.9962	3.91	7.82

**Table S4.** Spearman correlations between environmental factors and alpha diversity estimates of pico-sized haptophytes revealed by the SSU rRNA.

	ZOTU Richness		PD		Shannon	
	r	p	r	p	r	p
Latitude	0.141	0.530	0.148	0.512	-0.013	0.954
Longitude	-0.155	0.490	-0.176	0.432	-0.128	0.570
Depth	-0.403	0.063	<b>-0.433</b>	<b>0.044</b>	<b>-0.505</b>	<b>0.017</b>
Temperature	-0.331	0.132	-0.343	0.118	-0.249	0.264
Salinity	<b>-0.480</b>	<b>0.024</b>	<b>-0.485</b>	<b>0.022</b>	<b>-0.488</b>	<b>0.021</b>
PO <sub>4</sub>	-0.243	0.276	-0.287	0.196	-0.321	0.146
NO <sub>2</sub> +NO <sub>3</sub>	-0.341	0.120	-0.370	0.090	<b>-0.498</b>	<b>0.018</b>
SiO <sub>4</sub>	-0.298	0.179	-0.334	0.129	-0.327	0.138
Chl <i>a</i> , > 20 µm	-0.076	0.737	-0.049	0.830	-0.166	0.461
Chl <i>a</i> , 2-20 µm	0.289	0.192	0.271	0.223	0.390	0.073
Chl <i>a</i> , < 2 µm	-0.005	0.984	-0.022	0.922	0.029	0.899
Heterotrophic bacteria	0.322	0.143	0.292	0.187	0.337	0.125
PPEs	-0.164	0.465	-0.170	0.450	-0.304	0.168

**Table S5.** The topological features of co-occurrence networks for pico-sized haptophytes in surface water and SCM layer.

	Node	Edge	Average degree	Clustering coefficient	Average path length	Diameter	Graph density
Whole	372	28823	154.962	0.807	1.93	6	0.418
Surface	226	22536	199.434	0.964	1.114	3	0.886
DCM	51	439	17.216	0.784	1.991	4	0.344