Supplementary Materials

Supplementary Table 1. Barcode sequences.

Supplementary Table 2. Sequencing information for the samples.

Supplementary Table 3. Spearman's correlation between microbial α-diversity indices and environmental factors.

Supplementary Table 4. Significance test of the similarity between the phycosphere microbial communities and null model simulations at different stages, and βNTI and RCBray values based on Weighted Bray−Curtis distances.

Supplementary Figure 1. Samples collected according to the HAB phases, including pre-, during- and post-bloom stages (the red cycle).

Supplementary Figure 2. Morphology of *S. trochoidea* under a light microscope. Scale bar is 20 μm.

Supplementary Figure 3. Venn diagram showing the overlap of OTUs between sample types.

Supplementary Figure 4. LEfSe diagram showing the difference of OTUs among the different bloom stages.

Supplementary Figure 5. Relative abundance of bacteria at phylum level.

Supplementary Figure 6. Heat-map of microbial communities at family (A) and genus (B) levels. AT, attached bacteria; FL, free-living bacteria.

Supplementary Figure 7. (A) Bray-Curtis similarity-based dendrogram at the OTU level illustrating groups in samples. (B) Correspondence canonical analysis (CCA) based on microbial communities (OTUs) and environmental parameters sampled during the bloom.

Supplementary Figure 8. Correlation analysis between relative abundances of the 100 most abundant bacterial OTUs and environmental variables based on Pearson correlations. Correlation values depict r-values of Pearson correlations. Statistical significance: $^{+}$, $P<0.05$; *, $P<0.01$.

Supplemental Table 1: Barcode sequences.

Sample names	Barcode sequences
Pre-A-1	CACGCTGT
Pre-A-2	CGCATGAA
Pre-A-3	TATCGCAA
Pre-A-4	AGTGCTTA
Pre-A-5	AGTGTGAA
Pre-A-6	CAGTATTA
Pre-A-7	TGCACATT
Pre-A-8	AGGCCAGT
Pre-A-9	TTCGACTA
Pre-A-10	AGTGACGA
Pre-A-11	TGCATACA
Pre-A-12	AGTCGAAC
Pre-FL-1	ACCAGTGA
Pre-FL-2	GAATACCA
Pre-FL-3	GTAGATCG
Pre-FL-4	TAACGTGT
Pre-FL-5	CATTATGG
Pre-FL-6	CCAATACG
Pre-FL-7	GATCTGCG
Pre-FL-8	GCAACACC
Pre-FL-9	GCGATATA
Pre-FL-10	CGAGCAAT
Pre-FL-11	CGAGGGAA
Pre-FL-12	CAAATTCG
During-A-1	TCGACATC
During-A-2	TTGGCTCT
During-A-3	GATCCCAC
During-A-4	TACCGCTT
During-A-5	TGTGCGAT
During-A-6	GATTATCG
During-A-7	GCCTAGCC
During-A-8	ACTCCTTG
During-A-9	GTCACGGA
During-A-10	GCGAGCGA
During-A-11	TCTTGGAG
During-A-12	TCACCTCC
During-FL-1	GCACACCT
During-FL-2	GCGACAAT
During-FL-3	TCATGCTC
During-FL-4	AGCTGTCA
During-FL-5	GAGAGCAA
During-FL-6	TACTCGGG
During-FL-7	CGTGCTTA
During-FL-8	GTATTTCG
During-FL-9	TATCTATC
During-FL-10	TTGCCAAG
During-FL-11	AGTAGCGG
During-FL-12	GCAATTAG
After-A-1	CATACCGT
After-A-2	CCTGCGAA
After-A-3	TTCTCTCG
After-A-4	GCTCTCCG
After-A-5	TGCATACA
After-A-6	AGTCGAAC
After-A-7	ACCAGTGA
After-A-8	GAATACCA
After-A-9	GTAGATCG
After-A-10	TAACGTGT
After-A-11	CATTATGG
After-A-12	CCAATACG
After-FL-1	GATCTGCG
After-FL-2	GCAACACC
After-FL-3	GCGATATA
After-FL-4	CGAGCAAT
After-FL-5	CGAGGGAA
After-FL-6	CAAATTCG
After-FL-7	AGTTGAGG
After-FL-8	ACAATAGA
After-FL-9	AGTTACGA
After-FL-10	GCATATGC
After-FL-11	AGTCGTGC
After-FL-12	GTATCTGC

Table 2. Sequencing information for the samples.

Sample ID	Raw Reads (PE)	Clean Reads (PE)	Raw Tags	Clean Tags	MaxLen (nt)	MinLen (nt)	AvgLen (nt)	GC (%)	No. of seqs	No. of OTUs	Effective/ Coverage (%)
Pre.A.1	152066	144928	143909	97157	398	366	372.07	51.96	66801	1143	82.68 (95.32)
Pre.A.2	170871	163210	161740	151635	389	362	372.28	51.28	101078	1765	82.04 (97.13)
Pre.A.3	145990	139070	137949	118365	391	368	372.3	50.38	74461	1382	80.86 (97.66)
Pre.A.4	152282	145813	144535	101977	401	364	372.4	50.8	62864	1381	86.09 (95.43)
Pre.A.5	151895	144696	143381	99502	391	361	372.39	50.63	62101	1348	86.28 (96.89)
Pre.A.6	138048	132162	131156	113066	396	363	372.36	50.03	67335	1247	80.82 (96.93)
Pre.A.7	192582	184280	182739	174199	391	364	372.14	51.29	124666	1583	87.05 (97.04)
Pre.A.8	187035	178323	176626	163391	385	366	372.39	51.25	107997	2108	82.43 (96.12)
Pre.A.9	140224	134044	133132	85809	386	364	372.06	51.94	59237	1068	83.06 (96.22)
Pre.A.10	131911	125398	123879	113403	395	364	372.37	50.62	71485	1687	81.34 (96.99)
Pre.A.11	140913	134460	133440	126664	399	363	371.94	51.7	91990	1338	87.50 (97.11)
Pre.A.12	144024	137809	136716	117166	386	368	372.3	50.05	75518	1332	83.99 (96.88)
Pre.FL.1	194629	184610	182811	143433	397	361	372.05	52.36	84065	1563	93.33 (98.34)
Pre.FL.2	143542	136586	135270	120701	389	361	372.12	52.71	77310	1261	92.31 (98.21)
Pre.FL.3	152514	146049	144532	103571	397	363	372.38	51.2	67107	2522	86.95 (97.75)
Pre.FL.4	161819	154679	153212	117515	397	362	372.48	51.28	72759	2911	88.12 (97.78)
Pre.FL.5	150890	144395	142826	101771	402	363	372.53	50.87	63039	2709	89.40 (97.86)
Pre.FL.6	186933	177370	174290	126203	413	363	372.64	50.28	65688	2440	84.94 (98.02)
Pre.FL.7	157382	148915	147585	113735	395	361	372	52.48	65491	1309	89.66 (98.01)
Pre.FL.8	180833	172818	170872	115077	406	364	372.48	50.66	67014	2786	84.01 (96.47)
Pre.FL.9	148122	140331	138923	113474	398	365	372.09	52.42	65186	1369	94.85 (96.52)
Pre.FL.10	163449	155874	154120	119329	408	363	372.6	50.83	67290	2942	85.07 (97.77)
Pre.FL.11	176245	167402	164520	127302	393	361	372.74	50.22	59407	2539	79.85 (98.18)
Pre.FL.12	167155	159692	157036	123864	401	361	372.65	50.83	66715	3253	82.49 (97.99)

During.A.1	177538	169853	168016	138870	395	363	372.59	50.45	78099	1628	85.15 (96.77)
During.A.2	158268	151254	149650	119621	401	365	372.29	50.5	77802	1371	85.94 (96.45)
During.A.3	122271	116659	115188	94631	390	366	372.42	50.4	57399	1253	98.21 (96.65)
During.A.4	112874	107554	106361	83356	407	364	372.32	50.78	52907	1219	84.49 (97.31)
During.A.5	158313	150955	149268	120125	400	364	372.36	50.71	74574	1526	84.08 (96.32)
During.A.6	144230	138234	137313	91833	393	359	372.11	52.15	61000	1138	80.72 (96.32)
During.A.7	140347	133610	132630	84129	382	362	372.07	52.03	58202	1039	83.24 (97.59)
During.A.8	137902	130941	129108	105337	401	366	372.41	50.45	63160	1403	81.94 (96.92)
During.A.9	149205	142580	141124	109001	405	364	372.66	50.48	60969	1422	88.78 (96.75)
During.A.10	153063	145265	143685	115261	407	361	372.52	50.34	64251	1406	85.27 (96.66)
During.A.11	206123	196752	194569	152827	403	362	372.56	50.59	90003	1764	87.02 (96.94)
During.A.12	169853	162627	161253	128968	397	367	372.33	51.19	85695	1657	85.68 (96.87)
During.FL.1	154053	147251	146282	132205	382	366	371.92	53.27	112851	764	96.25 (97.03)
During.FL.2	142735	135230	132840	117182	397	361	372.67	51.75	60353	2518	95.47 (97.55)
During.FL.3	138501	130801	128129	109921	401	359	372.66	51.93	67917	2456	84.26 (97.82)
During.FL.4	161740	154550	153456	118784	385	367	372.12	52.12	71552	1414	86.53 (96.86)
During.FL.5	149047	140964	137749	117919	406	361	372.58	51.97	66946	2074	84.22 (97.37)
During.FL.6	170248	161819	159427	138826	409	361	372.27	51.52	88400	2521	83.65 (97.85)
During.FL.7	150389	143170	142075	105216	390	359	371.99	52.18	60753	1388	89.65 (97.32)
During.FL.8	160623	151460	149125	126418	403	361	372.39	51.25	72349	2384	80.74 (97.46)
During.FL.9	162647	153516	151892	129338	390	361	372.07	53.04	72802	1469	98.66 (96.87)
During.FL.10	159745	151727	149697	119807	397	361	372.24	50.88	74261	2236	83.89 (97.03)
During.FL.11	176216	167329	164013	141484	405	361	372.61	51.04	77746	2730	81.82 (97.58)
During.FL.12	167900	159791	157696	132179	408	361	372.22	50.97	80700	2451	83.16 (95.58)
After.A.1	145865	139175	138195	122417	397	359	372.35	50.64	78240	2082	84.13 (95.89)
After.A.2	168939	161308	160142	146536	386	363	372.42	50.28	93123	2173	84.76 (95.66)
After.A.3	161907	155191	153930	140398	404	363	372.53	49.81	81202	1952	83.11 (95.74)
After.A.4	168182	160254	159073	145209	406	362	372.39	50.72	97865	2182	86.48 (95.99)
After.A.5	171636	164491	162954	152202	387	363	371.96	50.55	105378	1711	85.18 (95.71)

After.A.6	161036	153378	152209	137996	388	362	372.45	50.38	85020	2137	82.21 (96.02)
After.A.7	162239	154601	153425	138280	389	362	372.36	50.72	88910	2158	82.20 (96.84)
After.A.8	173429	165128	163238	151189	412	364	372.49	51.06	90880	1807	86.36 (96.09)
After.A.9	174458	166915	165702	148662	394	362	372.45	50.49	90220	2357	81.18 (98.64)
After.A.10	155924	148457	147194	136837	398	365	372.63	49.66	71413	1685	89.62 (98.39)
After.A.11	129938	122786	121612	112868	399	361	372.06	52.42	72146	1732	83.66 (97.76)
After.A.12	142437	135143	133546	123969	392	366	372.58	50.23	69403	1774	95.25 (98.72)
After.FL.1	176898	167462	164168	147686	402	359	372.58	52.66	89465	3395	93.21 (98.64)
After.FL.2	168993	160074	155446	144775	406	359	372.55	53.37	90401	2831	94.24 (98.09)
After.FL.3	169272	159606	156295	143730	397	360	372.77	53.2	97703	3851	82.97 (97.94)
After.FL.4	152181	143442	138540	131325	401	360	373.07	52.68	87756	2764	84.22 (98.03)
After.FL.5	130411	123195	120994	116116	404	359	372.97	52.91	92716	2331	97.86 (97.72)
After.FL.6	171451	162775	161080	143790	411	361	372.4	51.81	93500	3760	80.18 (96.69)
After.FL.7	155677	146794	141573	134805	401	359	373.35	52.13	94912	2461	88.43 (95.77)
After.FL.8	171355	162472	157779	145962	391	358	373.8	51.82	95237	2495	83.57 (98.38)
After.FL.9	161943	152883	150095	137961	406	358	372.8	52.61	89517	3903	82.40 (97.55)
After.FL.10	144380	136829	133315	127031	393	359	373.08	53.07	95507	2258	92.16 (98.53)
After.FL.11	150813	142649	140486	120098	407	359	372.55	51.13	63630	2763	87.59 (97.92)
After.FL.12	143375	136026	133813	121824	393	361	372.62	52.9	108863	1354	98.42 (97.08)

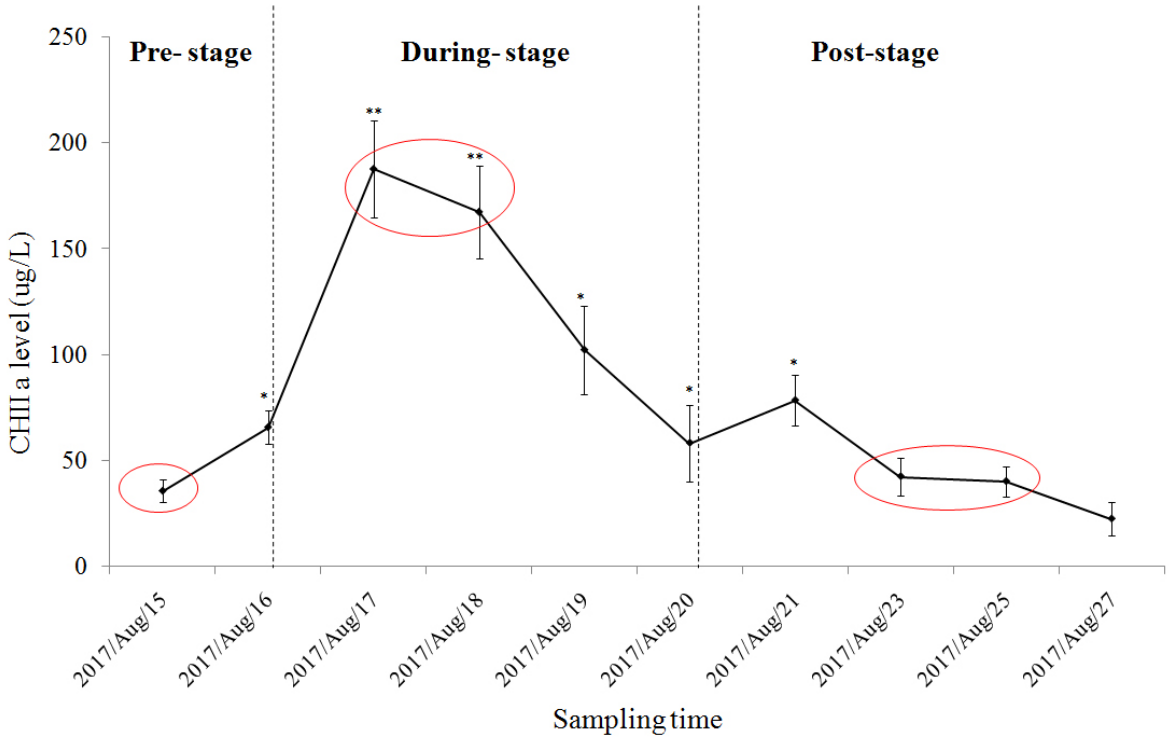
Table 3. Spearman's correlation between microbial alpha-diversity indices and environmental factors.

	Richness	Chao 1	Shannon	Simpson	Dominance
ChI *a*	r=-0.517, p=0.047*	r=-0.764, p=0.027*	r=0.712, p=0.054	r=0.707, p=0.059	r=0.529, p=0.066
Temperature	r=0.711, p=0.028*	r=0.273, p=0.048*	r=0.665, p=0.061	r=0.628, p=0.069	r=0.417, p=0.058
Salinity	r=-0.763, p=0.048*	R=-0.498, p=0.041*	r=0.803, p=0.069	r=0.295, p=0.054	r=0.516, p=0.052
pH value	r=0.432, p=0.057	r=0.347, p=0.067	r=0.412, p=0.056	r=0.447, p=0.067	r=0.365, p=0.051
NO_3^-	r=-0.238, p=0.068	r=0.567, p=0.078	r=0.198, p=0.064	r=0.453, p=0.067	r=0.657, p=0.071
NO_2^-	r=0.451, p=0.076	r=0.199, p=0.087	r=0.659, p=0.057	r=0.452, p=0.051	r=0.366, p=0.069
NH_4^+	r=0.117, p=0.082	r=0.332, p=0.052	r=0.557, p=0.079	r=0.409, p=0.062	r=0.523, p=0.072
PO_4^{3-}	r=0.166, p=0.013*	r=0.441, p=0.037*	r=0.663, p=0.061	r=0.472, p=0.077	r=0.631, p=0.063
IN/IP value	r=0.402, p=0.025*	r=0.339, p=0.046*	r=0.507 p=0.091	r=0.481, p=0.083	r=0.664, p=0.075

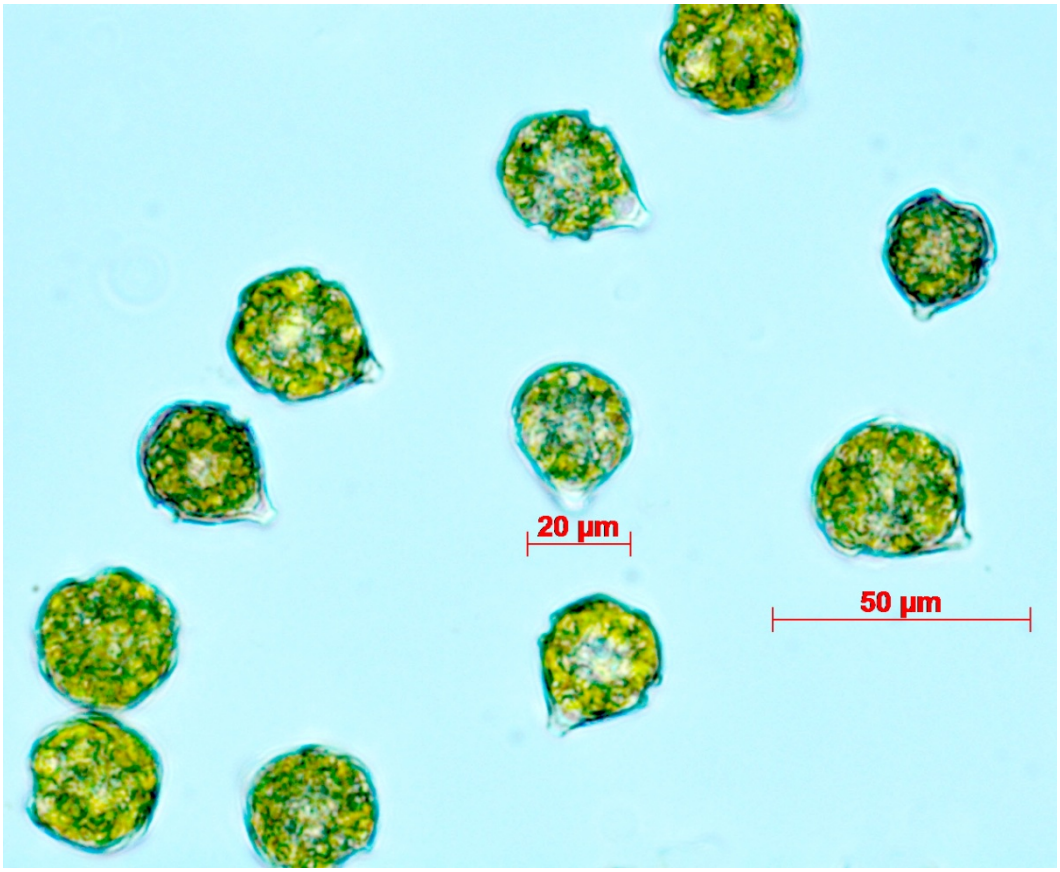
Table 4. Significance test of the similarity between the phycosphere microbial communities and null model simulations at different stages, and βNTI and RC_{Bray} values based on Weighted Bray−Curtis distances.

Bray-Curtis	Mean of observed similarity	Mean of null expected similarity	F	P value	βNTI value	RC_{bary} value
Pre-AT	0.681	0.624	10.56	0.025	-2.52	-0.885
During-AT	0.524	0.236	9.67	0.012	+3.22	-0.263
Post-AT	0.329	0.151	12.85	0.019	+0.57	-0.969
Pre-FL	0.442	0.209	13.67	0.008	+0.86	-0.997
During-FL	0.546	0.138	29.33	0.027	-4.25	-0.558
Post-FL	0.621	0.448	27.11	0.036	-3.11	-0.281

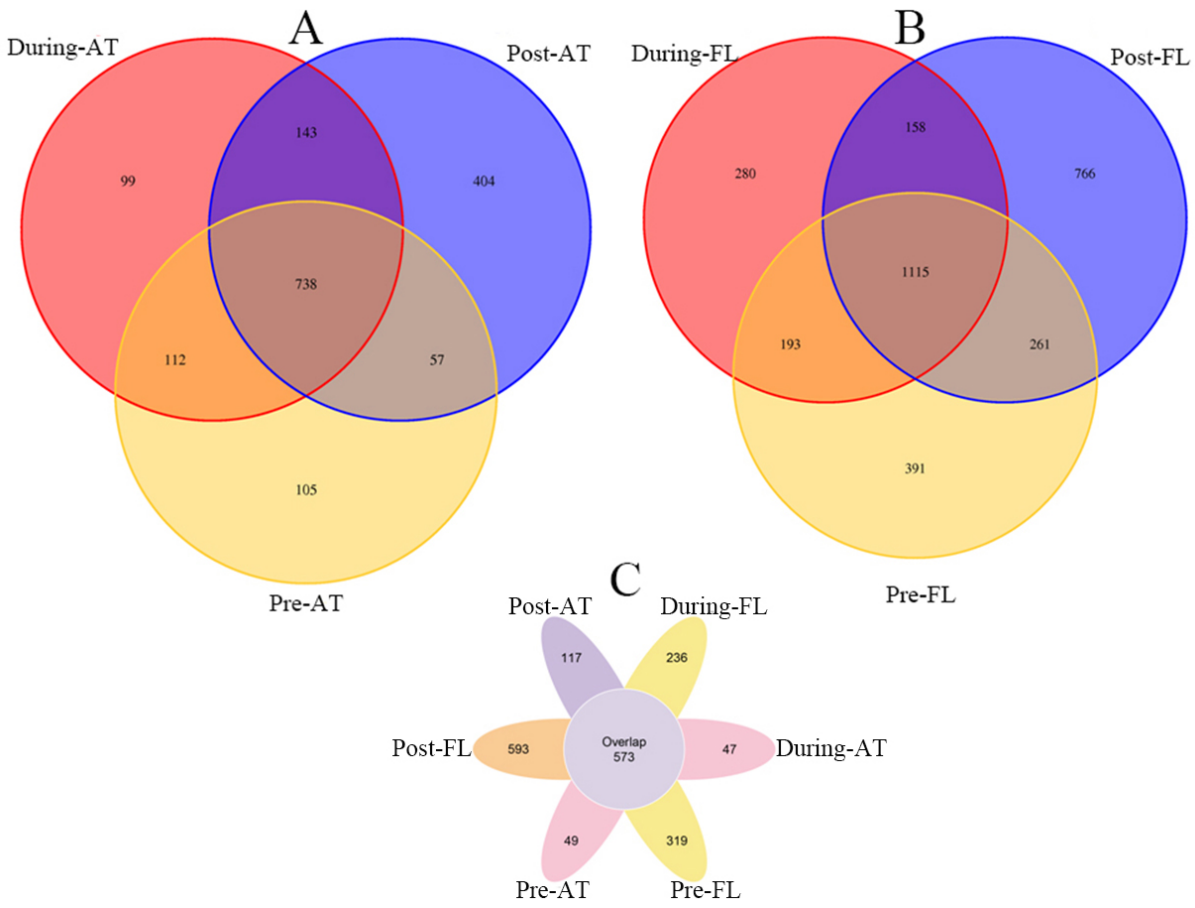
Supplementary Figure 1. Samples collected according to the HAB phases, including pre-, during- and post-bloom stages (the red cycle).



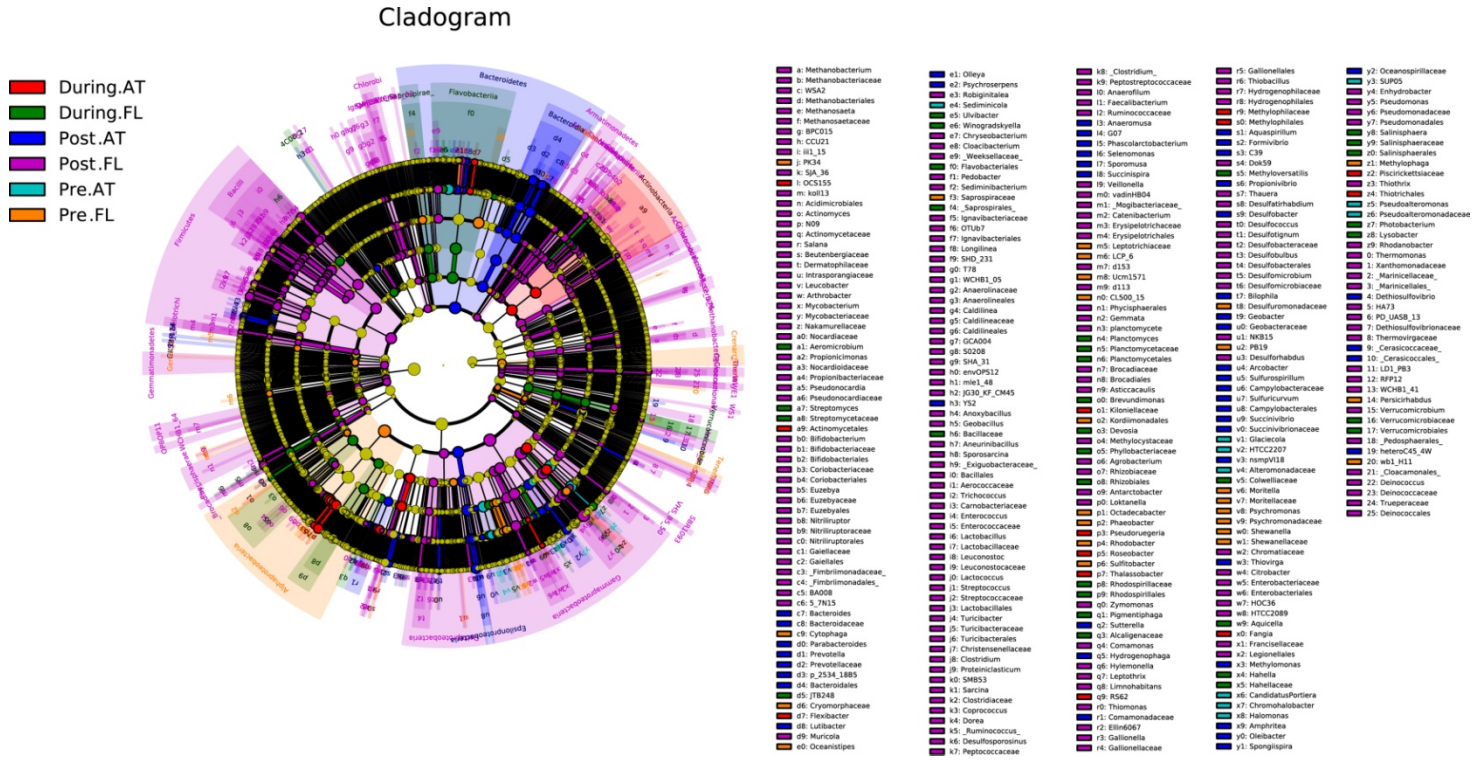
Supplementary Figure 2. Morphology of *S. trochoidea* under a light microscope. Scale bar is 20 µm.



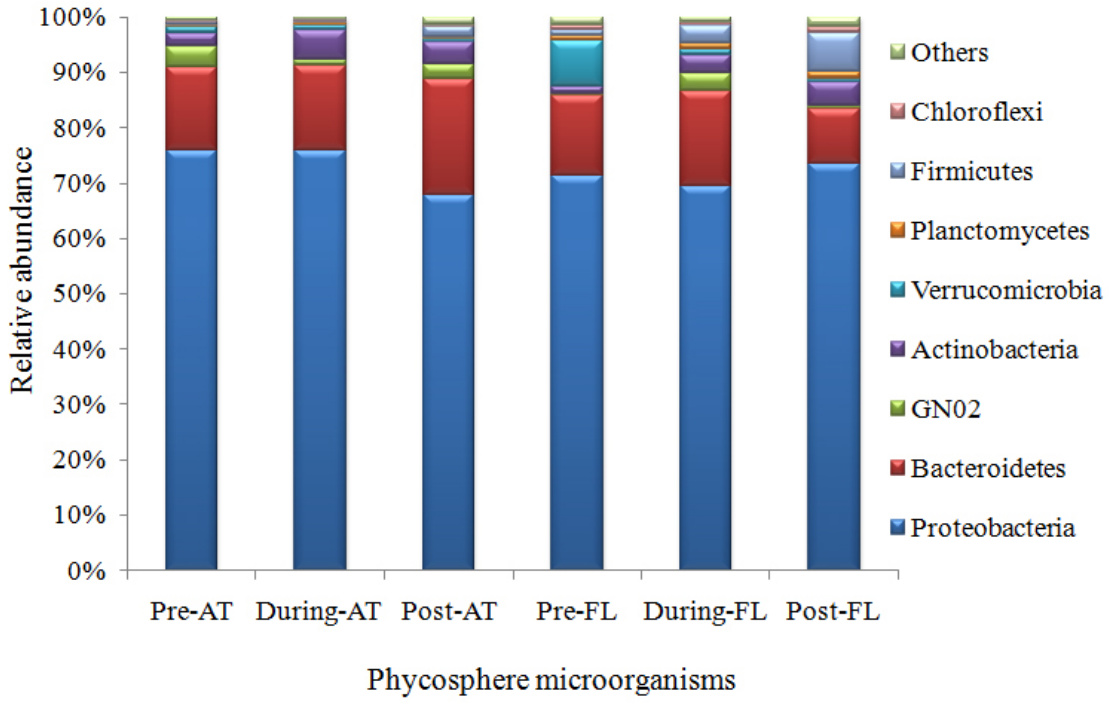
Supplementary Figure 3. Venn diagram showing the overlap of OTUs between sample types.



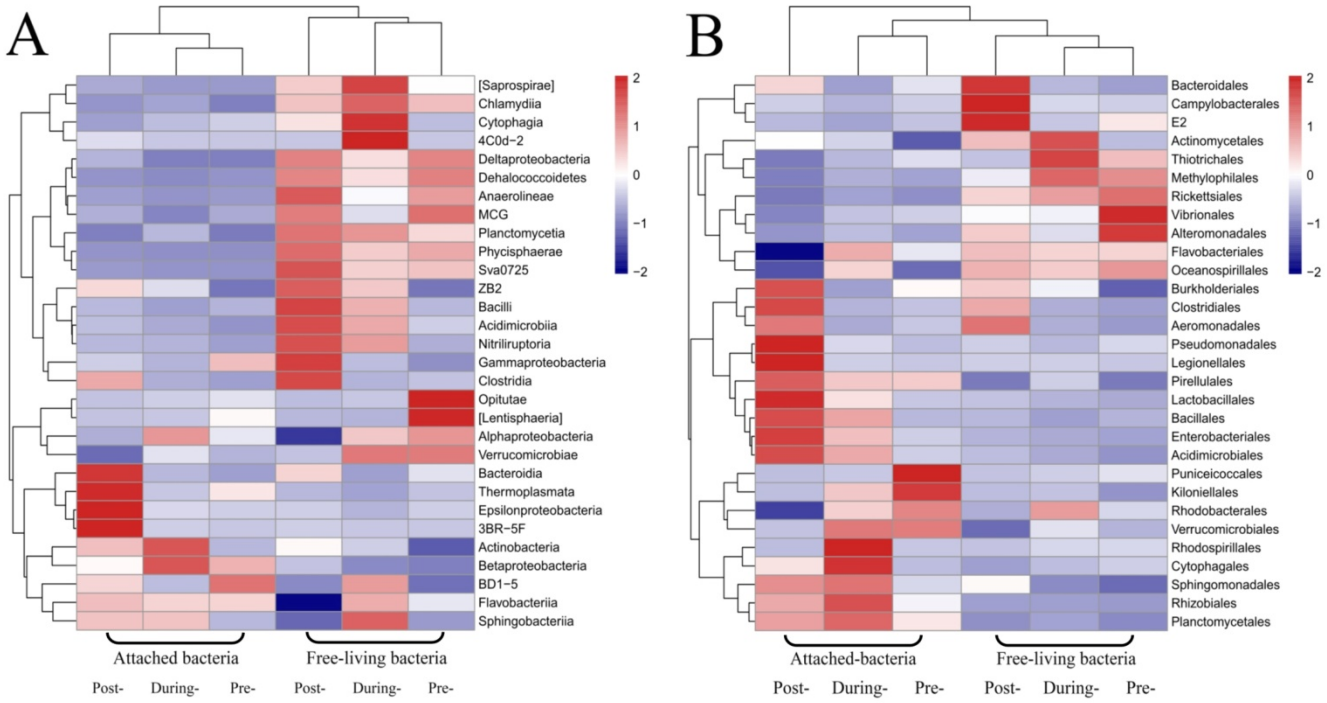
Supplementary Figure 4. LEfSe diagram showing the difference of OTUs among the different bloom stages.



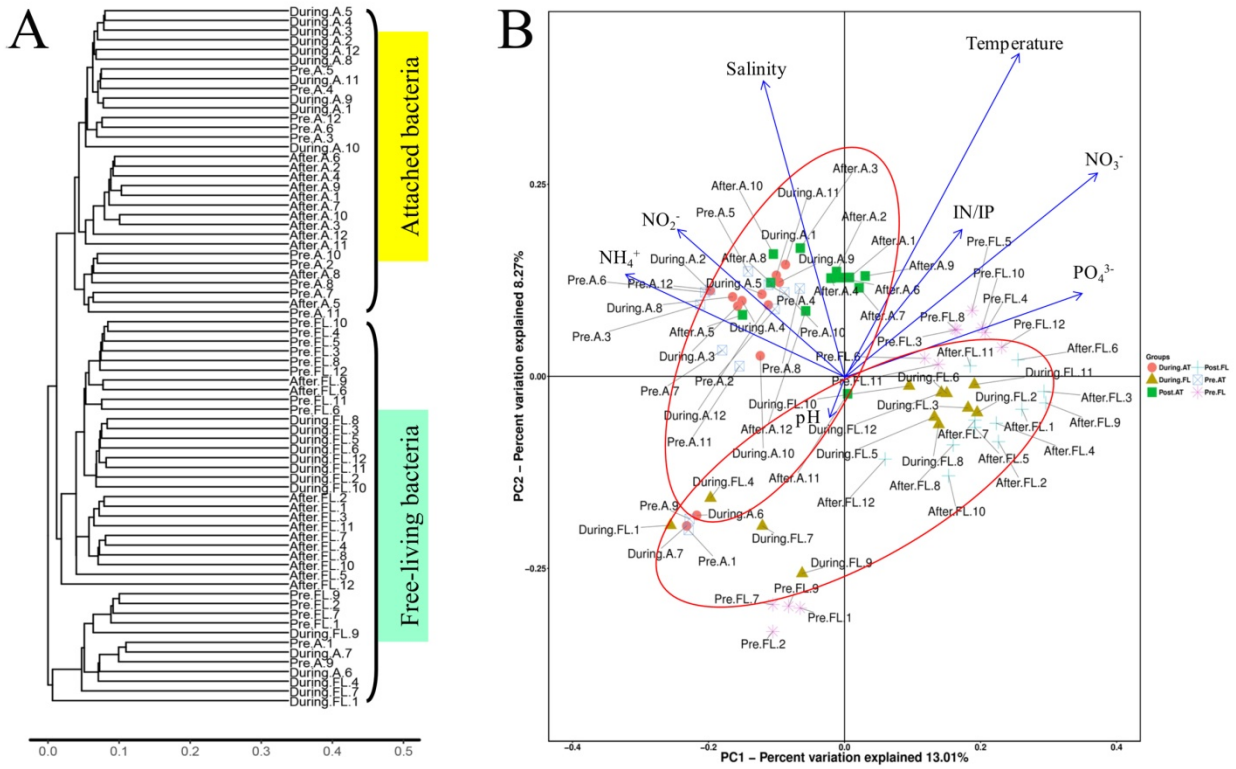
Supplementary Figure 5. Relative abundance of bacteria at phylum level.



Supplementary Figure 6. Heat-map of microbial communities at family (A) and genus (B) levels. AT, attached bacteria; FL, free-living bacteria.



Supplementary Figure 7. (A) Bray-Curtis similarity-based dendrogram at the OTU level illustrating groups in samples. (B) Correspondence canonical analysis (CCA) based on microbial communities (OTUs) and environmental parameters sampled during the bloom.



Supplementary Figure 8. Correlation analysis between relative abundances of the 100 most abundant bacterial OTUs and environmental variables based on Pearson correlations. Correlation values depict r-values of Pearson correlations. Statistical significance: $^{+}$, P<0.05; *, P<0.01.