

Table S1. Bloom samples collected in 2021 and 2022. Sample number, sampling location, total relative abundance of MAAs, Chl A levels, dry weight per methanol extraction and genera observed are reported in the table.

Bloom Sample No.	Location	Date	Coordinates (DMS)	LCMS ID	MAA (Total)	Chl a (654-656 nm)	MAA/Chl a	Dry weight (mg)	Genera observed
1	Öbyviken, Tammisaari	21.6.2021	59°55'28.2"N 23°09'32.7"E	G111	0	697	0	5	cf <i>Limnoraphis robusta</i>
2	Munkkiniemi, Helsinki	30.6.2021	60°12'01.1"N 24°51'26.3"E	G112	724	1361	0,5319618	5	cf <i>Aphanizomenon flos-aquae</i> , cf <i>Dolichospermum</i>
3	Koivusaari, Helsinki	1.7.2021	60°09'42.6"N 24°51'16.5"E	G113	1468	3442	0,4264962	5	cf <i>Aphanizomenon flos-aquae</i> , cd <i>Dolichospermum</i>
4	Laajalahti, Espoo	8.7.2021	60°12'21.0"N 24°50'16.0"E	G129	140691	61415	2,2908247	5	cf <i>Aphanizomenon flos-aquae</i> , cf <i>Dolichospermum</i>
5	Eningsholmintie, Kustavi	2.8.2021	60°30'12.7"N 21°17'10.4"E	G153	28441	19606	1,4506274	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i>
6	Lyökki, Uusikaupunki	2.8.2021	60°51'36.2"N 21°11'22.2"E	G147	35822	18199	1,9683499	5	cf <i>Nodularia spumigena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i>
7	Taivassalo	2.8.2021	60°33'44.6"N 21°32'09.7"E	G148	22483	27608	0,8143654	5	cf <i>Nodularia spumigena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i>
8	Soukka, Espoo	3.8.2021	60°08'11.0"N 24°39'06.3"E	G149	25399	22443	1,1317114	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i>
9	Westend beach, Espoo	9.8.2021	60°10'07.3"N 24°48'37.2"E	G154	47045	30098	1,5630607	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i>
10	Matinkylä beach	9.8.2021	60°09'03.0"N 24°45'22.4"E	G155	50955	18973	2,6856586	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i>
11	Aurinkolahti beach	9.8.2021	60°12'07.4"N 25°09'35.2"E	G156	26986	13936	1,9364237	5	cf <i>Dolichospermum</i> , cf <i>Nodularia spumigena</i>
12	Laajasalo beach	9.8.2021	60°10'37.6"N 25°03'50.4"E	G157	25075	11018	2,2758214	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i> , cf <i>Nodularia spumigena</i>
13	Suomenlinna west	12.8.2021	60°08'42.3"N 24°58'47.6"E	G158	11849	19722	0,6008011	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i> , cf <i>Nodularia spumigena</i>
14	Suomenlinna east	12.8.2021	60°08'28.4"N 24°59'13.8"E	G159	12964	30397	0,4264895	5	cf <i>Dolichospermum</i> , cf <i>Nodularia spumigena</i>
15	Munkkiniemi beach	12.8.2021	60°09'15.0"N 24°56'37.2"E	G160	46327	20365	2,2748343	5	cf <i>Dolichospermum</i>
16	Kaivopuiston ranta	12.8.2021	60°09'15.0"N 24°56'37.2"E	G161	9907	17047	0,581158	5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon flos-aquae</i> , cf <i>Nodularia spumigena</i>
17	Norrbyviken, Parainen	24.8.2021	60°18'48.4"N 22°17'51.1"E	G165	40001	65240	0,6131361	5	cf <i>Nodularia spumigena</i> , cf <i>Aphanizomenon flos-aquae</i>
18	Naantali marina	24.8.2021	60°28'11.1"N 22°00'56.7"E	G166	47191	30936	1,5254396	5	cf <i>Nodularia spumigena</i> , cf <i>Aphanizomenon flos-aquae</i> , cf <i>Dolichospermum</i>
19	Kvarnholm, Parainen	24.8.2021	60°19'21.8"N 22°20'31.1"E	G167	40099	70723	0,5669867	5	cf <i>Nodularia spumigena</i>

20	Hiirsalmi, Piikkiö, Turku	24.8.2021	60°24'07.7"N 22°29'18.0"E	G168	35691	34209	1,0433219	5	cf <i>Nodularia spumigena</i> , cf <i>Aphanizomenon flos-aquae</i> , cf <i>Dolichospermum</i>
21	Rajasaari	5.7.2022	60°10'57.7"N 24°54'37.0"E	GG01	1522	1785	0,8526611	5,4	cf <i>Nodularia</i> , cf <i>Anabaena</i> , cf <i>Aphanizomenon</i>
22	Rajasaari	8.7.2022	60°10'50.3"N 24°54'29.9"E	GG02	2246	2873	0,7817612	5,5	cf <i>Nodularia</i> , cf <i>Anabaena</i> , cf <i>Aphanizomenon</i>
23	Munkkiniemi	11.7.2022	60°12'03.0"N 24°51'24.4"E	GG03	1	89	0,011236	4,5	cf <i>Anabaena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i>
24	Rajasaari	11.7.2022	60°10'52.1"N 24°54'33.1"E	GG04	527	3590	0,1467967	5	cf <i>Nodularia</i> , cf <i>Anabaena</i> , cf <i>Aphanizomenon</i>
25	Puotila	11.7.2022	60°12'22.0"N 25°06'09.3"E	GG05	120	1847	0,0649702	5,1	cf <i>Nodularia</i> , cf <i>Anabaena</i> , cf <i>Aphanizomenon</i>
26	Puotila beach	11.7.2022	60°12'30.7"N 25°06'32.7"E	GG06	16	2016	0,0079365	5	cf <i>Anabaena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i>
27	Munkkiniemi	11.7.2022	60°12'12.3"N 24°51'06.8"E	GG07	0	1378	0	4,8	cf <i>Anabaena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i>
28	Klobben	18.7.2022	60°08'06.2"N 24°38'52.3"E	GG08	93	1479	0,0628803	5,1	cf <i>Anabaena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i>
29	Munkkiniemi	19.7.2022	60°12'03.0"N 24°51'24.4"E	GG09	821	3488	0,2353784	5,2	cf <i>Anabaena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
30	Rajasaari	28.7.2022	60°10'59.1"N 24°54'35.7"E	GG20	7027	4239	1,6577023	5,9	cf <i>Anabaena</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
31	Laajasalo beach	1.8.2022	60°10'34.9"N 25°03'48.6"E	GG22	737	1495	0,4929766	6,08	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
32	Lapinlahti	2.8.2022	60°10'05.2"N 24°54'54.1"E	GG24	3909	3490	1,1200573	5,07	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
33	Rajasaari	5.8.2022	60°10'57.6"N 24°54'37.5"E	GG35	1628	1454	1,1196699	5,3	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
34	Pikisaari beach	9.8.2022	60°10'57.6"N 24°54'37.5"E	GG41	2021	1952	1,0353484	6	cf <i>Aphanizomenon</i>
35	Vesiläntie	9.8.2022	60°35'11.8"N 21°49'26.4"E	GG50	518	1717	0,301689	6,7	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Anabena</i> , cf <i>Dolichospermum</i>
36	Kultaranta	9.8.2022	60°27'47.4"N 22°00'12.2"E	GG52	1906	5555	0,3431143	5,9	cf <i>Nodularia</i> , cf <i>Anabaena</i> , cf <i>Dolichospermum</i>
37	Laajasalo beach	10.8.2022	60°10'34.9"N 25°03'48.6"E	GG57	990	1719	0,5759162	5,5	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Anabena</i> , cf <i>Dolichospermum</i>
38	Marjaniemi Beach	10.8.2022	60°11'54.7"N 25°04'34.8"E	GG62	714	1994	0,3580742	5,4	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Anabena</i> , cf <i>Dolichospermum</i>
39	Rajasaari (Boat club)	10.8.2022	60°10'52.1"N 24°54'33.1"E	GG77	116	2226	0,0521114	5,7	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Anabena</i> , cf <i>Dolichospermum</i>
40	Rajasaari	10.8.2022	60°10'57.7"N 24°54'37.4"E	GG78	515	3582	0,1437744	5,5	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Anabena</i> , cf <i>Dolichospermum</i>
41	Rajasaari	10.8.2022	60°10'57.7"N 24°54'37.4"E	GG79	1146	5817	0,1970088	6,7	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>

42	Rajasaari (Boat club)	12.8.2022	60°10'52.1"N 24°54'29.3"E	GG80	1090	6150	0,1772358	6,5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
43	Rajasaari (Boat club)	12.8.2022	60°10'52.5"N 24°54'34.0"E	GG82	897	4922	0,182243	5,7	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
44	Kirjalansaari, Parainen	16.8.2022	60°19'42.6"N 22°23'21.1"E	GG91	1035	3434	0,3013978	5,6	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
45	Hovirinta marina, Kaarina	16.8.2022	60°23'43.7"N 22°22'19.6"E	GG96	2663	4222	0,6307437	5,5	cf <i>Nodularia</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i>
46	Harvaluodon uimaranta	16.8.2022	60°22'14.7"N 22°30'58.8"E	GG99	1008	3452	0,2920046	5,8	cf <i>Nodularia</i> , cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> ,
47	Katajanokka	18.8.2022	60°10'09.2"N 24°57'50.4"E	GG106	1149	4549	0,252583	5,4	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Dolichospermum</i>
48	Katajanokka	18.8.2022	60°10'08.9"N 24°57'57.4"E	GG108	987	4815	0,2049844	5,5	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Dolichospermum</i>
49	Ruoholahti	18.8.2022	60°09'42.5"N 24°54'49.6"E	GG111	288	2407	0,119651	5,5	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
50	Otaniemi	18.8.2022	60°11'03.0"N 24°50'16.9"E	GG115	445	4689	0,094903	5,1	cf <i>Dolichospermum</i> , cf <i>Nodularia</i>
51	Otaniemi	24.8.2022	60°11'10.7"N 24°50'17.2"E	GG125	307	5318	0,0577285	4,9	Cells broken, fragments hard to identify
52	Siltatie, Kemiö	25.8.2022	60°09'13.4"N 22°36'50.5"E	GG127	6	123	0,0487805	4,9	Cells broken, fragments hard to identify
53	Dragsfjärd	25.8.2022	60°04'24.3"N 22°28'02.3"E	GG143	1317	2555	0,5154599	5,1	cf <i>Dolichospermum</i> , cf <i>Aphanizomenon</i>
54	Dalsbruk	25.8.2022	60°01'10.9"N 22°30'13.0"E	GG136	19	1554	0,0122265	4,9	cf <i>Nodularia</i> , other broken cell fragments
55	Sundvik	25.8.2022	60°03'48.2"N 22°46'02.5"E	GG138	623	3560	0,175	5	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i> , cf <i>Dolichospermum</i>
56	Finby	25.8.2022	60°06'48.8"N 22°57'24.9"E	GG140	1660	6002	0,2765745	4,9	cf <i>Nodularia</i> , other broken cell fragments: cf <i>Aphanizomenon</i>
57	Laajalahti	24.8.2022	60°12'11.0"N 24°49'45.2"E	GG144	119	1409	0,0844571	5,6	cf <i>Aphanizomenon</i> , cf <i>Nodularia</i>
58	Merimasku	30.8.2022	60°28'58.2"N 21°52'15.5"E	GG147	62	1241	0,0499597	5,4	cf <i>Aphanizomenon</i> , cf <i>Dolichospermum</i> , cf <i>Nodularia</i>
59	Naantali	30.8.2022	60°28'11.3"N 22°00'56.3"E	GG151	10	233	0,0429185	5,2	cf <i>Aphanizomenon</i> , cf <i>Dolichospermum</i>

Table S2. Strain number, origin, and assembly and descriptive statistics for the draft and complete genomes of *Anabaena*, *Dolichospermum* and *Aphanizomenon* used in the phylogenomic analysis.

Strain	Location	Assembly	Completeness (%)	Contamination (%)	Contigs	Largest contig	Total length	GC (%)	N50	N75	L50	L75	# N's per 100 kbp
<i>Anabaena aphanizomenioides</i> LEGE 00250	Europe	GCA_015207835_1	98.78	0.22	399	112128	5585676	37.59	23683	13073	67	147	0
<i>Anabaena azotica</i> FACHB119	Asia	GCA_014697625_1	99.56	0.89	122	311233	8048170	41.34	127363	79827	21	42	0
<i>Anabaena catenula</i> FACHB362	Asia	GCA_014698735_1	99.89	0.00	109	435731	6234385	39.37	120473	57818	18	36	0
<i>Anabaena cylindrica</i> FACHB170	Asia	GCA_014696775_1	99.19	0.00	71	723181	7003498	41.26	208506	96332	10	21	0
<i>Anabaena cylindrica</i> FACHB243	Asia	GCA_014697335_1	99.44	0.00	96	418195	6890297	38.77	143668	78453	16	31	0
<i>Anabaena cylindrica</i> FACHB318	Asia	GCA_014696465_1	99.07	0.00	73	726430	6957411	41.27	208452	90174	11	23	0
<i>Anabaena cylindrica</i> PCC7122	Europe	GCA_000317695_1	99.44	0.00	7	6395836	7063285	38.79	6395836	6395836	1	1	0
<i>Anabaena cylindrica</i> UHCC 0172	Europe	GCA_034931625.1	99.15	0.00	154	195863	6371687	38.66	66312	39261	33	63	28.25
<i>Anabaena lutea</i> FACHB196	Asia	GCA_014698305_1	99.67	0.00	63	529190	6059416	39.25	192513	109373	10	21	0
<i>Anabaena minutissima</i> FACHB250	Asia	GCA_014697125_1	99.33	0.00	119	597336	7065205	41.08	161999	74121	14	31	0
<i>Anabaena</i> sp. 4-3	North America	GCA_001597745_1	98.89	0.22	62	496013	5598787	41.4	206377	129956	10	19	105.4
<i>Anabaena</i> sp. 49628 E55	North America	GCA_021300315_1	99.22	0.00	112	215540	4873444	37.29	79416	45159	21	40	6.5
<i>Anabaena</i> sp. 49633 E8	North America	GCA_021300225_1	99.56	0.22	318	223937	8566965	38.07	38235	21334	69	144	4.13
<i>Anabaena</i> sp. 54	Europe	GCA_017355725_1	99.11	0.45	69	482238	5567125	38.33	122796	73166	12	26	0
<i>Anabaena</i> sp. 90	Europe	GCA_000312705_1	91.38	77.41	5	4329264	5305675	38.1	4329264	4329264	1	1	0
<i>Anabaena</i> sp. AL09	North America	GCA_001672255_1	98.33	0.19	109	261741	4657189	38.14	64976	38711	23	46	94.2
<i>Anabaena</i> sp. AL93	North America	GCA_001672085_1	99.67	0.00	217	133848	5662506	38.36	46343	28501	44	83	0
<i>Anabaena</i> sp. CA ATCC 33047	North America	GCA_001597855_1	98.11	0.00	67	578591	5549443	41.39	201628	114799	9	18	230.04
<i>Anabaena</i> sp. CoA2 C59	North America	GCA_021297915_1	99.67	0.52	162	111287	4225696	37.03	41432	22791	35	69	0
<i>Anabaena</i> sp. CRKS33	North America	GCA_001672075_1	98.56	0.22	865	55883	4860204	37.52	13640	6103	105	238	0
<i>Anabaena</i> sp. FACHB1237	Asia	GCA_014696225_1	99.44	0.22	95	224844	4647682	34.96	97967	43396	15	32	0
<i>Anabaena</i> sp. FACHB1250	Asia	GCA_014696335_1	99.67	1.78	107	170919	4436573	37.64	72652	43942	23	42	0
<i>Anabaena</i> sp. FACHB1391	Asia	GCA_014696755_1	98.67	0.00	90	208994	4497192	37.64	102015	57036	17	32	0

<i>Anabaena</i> sp. FACHB709	Asia	GCA_014696765_1	99.00	0.33	80	657653	7102143	41.26	205481	89988	12	24	0
<i>Anabaena</i> sp. FACHB83	Asia	GCA_014697485_1	99.22	0.33	116	516073	8511586	40.64	190745	73849	14	32	0
<i>Anabaena sphaerica</i> FACHB251	Asia	GCA_014696825_1	99.19	0.00	46	846047	6198606	38.79	296026	132715	6	15	0
<i>Anabaena</i> sp. LE011 02	North America	GCA_001672225_1	99.48	0.11	122	215935	4740750	38.08	64747	33199	23	49	45.06
<i>Anabaena</i> sp. MDT14b	North America	GCA_001672195_1	99.22	0.11	1059	34317	4890627	38.74	8249	4605	176	376	0
<i>Anabaena</i> sp. PCC7108	Europe	GCA_000332135_1	97.17	4.22	3	5714552	5886741	38.78	5714552	5714552	1	1	16.99
<i>Anabaena</i> sp. SpSt 373	North America	GCA_011332035_1	99.63	0.07	153	244587	7193660	40.87	83043	49100	29	57	0
<i>Anabaena</i> sp. UBA12330	North America	GCA_003525565_1	99.56	0.44	81	204597	4285598	36.99	90280	54352	18	34	357.8
<i>Anabaena</i> sp. UHCC 0204	Europe	GCA_009711975_1	98.56	0.22	83	344565	5744555	37.57	131886	78143	13	26	161.04
<i>Anabaena</i> sp. UHCC 0253	Europe	GCA_009712085_1	99.22	0.22	28	945358	6116306	37.55	553243	326530	4	8	1475.11
<i>Anabaena</i> sp. UHCC 0399	Europe	GCA_034931465.1	97.67	0.44	118	229763	6570125	41.04	90169	60776	24	46	117.32
<i>Anabaena</i> sp. UHCC 0451	Europe	GCA_034931405.1	99.78	0.22	74	348687	5621773	37.86	140240	80181	15	27	306.61
<i>Anabaena</i> sp. WA102	North America	GCA_001277295_1	99.89	0.44	2	5705437	5782034	38.38	5705437	5705437	1	1	0
<i>Anabaena</i> sp. WA113	North America	GCA_001672155_1	99.33	0.00	261	172747	4687987	37.23	71945	35358	22	44	0
<i>Anabaena</i> sp. YBS01	Asia	GCA_009498015_1	99.22	0.00	1	7013200	7013200	41.43	7013200	7013200	1	1	0
<i>Anabaena subtropica</i> FACHB260	Asia	GCA_014697105_1	99.33	0.22	105	342035	5809825	40.83	108475	56412	17	36	0
<i>Anabaena variabilis</i> FACHB164	Asia	GCA_014698355_1	99.67	0.00	33	648438	5986679	39.32	394797	243352	6	11	0
<i>Anabaena variabilis</i> FACHB171	Asia	GCA_014697155_1	99.33	0.22	87	478819	7067220	41.27	185514	89988	13	26	0
<i>Aphanizomenon flos aquae</i> 2012KM1D3	Europe	GCA_000789435_1	87.52	7.22	325	120451	5741771	38.22	25535	14018	73	148	0.47
<i>Aphanizomenon flos aquae</i> CCAP 14461C	North America	GCA_019800585_1	98.11	0.00	286	181707	6756227	38.75	37602	20260	53	114	17.11
<i>Aphanizomenon flos aquae</i> CCAP 14461C	North America	GCA_019800605_1	98.33	0.00	254	177696	6761576	38.75	43156	24189	49	100	24.57
<i>Aphanizomenon flos aquae</i> Clear A1	North America	GCA_014654815_1	99.89	0.22	60	381826	4442226	37.14	120880	84307	11	23	56.28
<i>Aphanizomenon flos aquae</i> CP01	North America	GCA_017355665_1	99.22	0.89	152	295745	4356503	36.95	54035	33983	22	46	0
<i>Aphanizomenon flos aquae</i> DEX188	North America	GCA_017346855_1	99.89	0.00	1	4538078	4538078	37.06	4538078	4538078	1	1	0
<i>Aphanizomenon flos aquae</i>	Asia	GCA_014696815_1	99.22	0.11	155	163255	5786747	38.4	58342	37171	31	62	0

FACHB1040													
<i>Aphanizomenon flos aquae</i> FACHB1171	Asia	GCA_014697315_1	99.44	0.00	91	214077	4343146	37.04	78897	47174	19	36	0
<i>Aphanizomenon flos aquae</i> FACHB1249	Asia	GCA_014698725_1	99.89	0.00	97	321580	4350034	37.01	83039	44916	18	35	0
<i>Aphanizomenon flos aquae</i> FACHB1265	Asia	GCA_014698705_1	99.89	0.00	88	223715	4343226	37.02	85704	41837	16	34	0
<i>Aphanizomenon flos aquae</i> FACHB1287	Asia	GCA_014698755_1	99.89	0.00	85	223784	4347270	37.03	85728	49088	16	33	0
<i>Aphanizomenon flos aquae</i> FACHB1290	Asia	GCA_014698295_1	99.67	0.22	136	156477	4314391	37.01	55341	28108	26	55	0
<i>Aphanizomenon flos aquae</i> FACHB1416	Asia	GCA_014698695_1	99.89	0.22	162	137305	4287223	37.13	43168	25223	32	62	0
<i>Aphanizomenon flos aquae</i> KM1D3 PB	Europe	GCA_017346875_1	99.44	0.22	1	6071322	6071322	38.39	6071322	6071322	1	1	0
<i>Aphanizomenon flos aquae</i> LD13	North America	GCA_001672165_1	99.67	0.37	199	160417	4401776	37.03	55961	29540	27	53	0
<i>Aphanizomenon flos aquae</i> SRR3727505	Europe	Unpublished data	99.00	1.00	399	50419	4132940	37.09	14233	8522	93	186	102.83
<i>Aphanizomenon flos aquae</i> MDT14a	North America	GCA_001672095_1	99.44	0.56	171	242078	4623430	37.09	60437	33975	27	52	0
<i>Aphanizomenon flos aquae</i> NIES-81	Asia	GCA_000521175_1	99.67	0.22	38	2605121	5831251	38.47	1857322	1857322	2	2	2894.34
<i>Aphanizomenon flos aquae</i> UKL13 PB	North America	GCA_001593825_2	99.89	3.60	15	958282	4484012	37.04	767568	398059	3	5	0
<i>Aphanizomenon flos aquae</i> WA102	North America	GCA_001672105_1	98.48	11.36	1106	119846	5923586	39.11	24228	11348	68	154	0
<i>Aphanizomenon</i> sp. FACHB1399	Asia	GCA_014698245_1	99.67	0.00	100	331699	4348078	37.01	76250	42563	19	37	0
<i>Aphanizomenon</i> sp. FACHB1401	Asia	GCA_014698265_1	99.67	0.00	104	153821	4349063	37.05	75924	41787	21	40	0
<i>Aphanizomenon</i> sp. UHCC 0183	Europe	GCA_009712065_1	99.22	0.22	182	177534	5579684	38.36	56985	26535	31	69	593.74
<i>Chroococciopsis thermalis</i> PCC 7203	Europe	GCA_000317125_1	99.63	1.44	3	6315792	6689401	44.47	6315792	6315792	1	1	0
<i>Cuspidothrix issatschenkoi</i> CHARLIE1	Europe	GCA_002934005_1	97.78	0.00	243	160023	4547138	37.67	35946	19639	42	87	93.25
<i>Cuspidothrix issatschenkoi</i> LEGE	Europe	GCA_015207795_1	100.00	0.11	333	97409	5113591	37.75	29781	15454	55	111	0.06

03284													
<i>Dolichospermum circinale</i> AWQC131C	Oceania	GCA_000426905_1	99.78	0.00	121	254267	4445648	37.33	80443	52884	17	34	867.21
<i>Dolichospermum circinale</i> AWQC310F	Oceania	GCA_000426925_1	99.78	0.00	82	360115	4405846	37.49	119350	65648	13	25	425.25
<i>Dolichospermum circinale</i> Clear D4	North America	GCA_014654715_1	92.05	6.49	560	117237	5029933	36.96	18484	6545	75	192	224.66
<i>Dolichospermum compactum</i> NIES806	Asia	GCA_002368115_1	99.33	0.22	1	5165988	5165988	38.06	5165988	5165988	1	1	1587.63
<i>Dolichospermum flos aquae</i> CCAP 140313F	North America	GCA_012516395_1	99.67	0.44	2	5151752	5220684	38.15	5151752	5151752	1	1	0
<i>Dolichospermum flos aquae</i> LEGE 04289	Europe	GCA_015207785_1	99.00	0.41	135	295537	4435098	37.65	54871	32276	27	54	0
<i>Dolichospermum flos aquae</i> UHCC 0037	Europe	GCA_009712125_1	99.00	0.63	9	1818114	5563105	38.33	1095036	613144	2	4	136.74
<i>Dolichospermum planctonicum</i> NIES-80	Asia	GCA_005402965_1	99.22	0.33	152	221952	4556907	37.7	75157	45488	20	39	0
<i>Dolichospermum planctonicum</i> UHCC 0167	Europe	GCA_009712075_1	97.55	0.19	33	564450	4900328	37.47	253071	206132	7	12	3391.04
<i>Dolichospermum</i> sp. BR01	North America	GCA_018447705_1	99.89	4.11	3	5439257	5575959	38.19	5439257	5439257	1	1	0
<i>Dolichospermum</i> sp. DET50	North America	GCA_018295975_1	99.67	0.22	3	5825454	6065531	37.8	5825454	5825454	1	1	0
<i>Dolichospermum</i> sp. DET66	North America	GCA_018295985_1	99.67	0.00	3	5835936	6113795	37.79	5835936	5835936	1	1	0
<i>Dolichospermum</i> sp. DET67	North America	GCA_018295965_1	99.67	0.00	5	5835936	6126501	37.79	5835936	5835936	1	1	0
<i>Dolichospermum</i> sp. DET69	North America	GCA_017355425_1	99.67	0.00	2	5839262	6040057	37.8	5839262	5839262	1	1	0
<i>Dolichospermum</i> sp. DET73	North America	GCA_017355625_1	99.67	0.00	286	120710	5233469	38.06	31278	16316	56	113	0
<i>Dolichospermum</i> sp. DEX182a	North America	GCA_017355645_1	99.67	1.11	4	3410753	5014232	38.29	3410753	1583037	1	2	0
<i>Dolichospermum</i> sp. DEX189	North America	GCA_017355655_1	98.22	1.11	8	3703826	6054507	38.39	3703826	895365	1	2	0
<i>Dolichospermum</i> sp. DL01	North America	GCA_017346835_1	97.67	0.11	1	4827232	4827232	38.19	4827232	4827232	1	1	0
<i>Dolichospermum</i> sp. FACHB1091	Asia	GCA_014697585_1	99.67	0.00	59	252710	4516276	37.5	124205	71273	13	25	0
<i>Dolichospermum</i> sp. JUN01	North America	GCA_017355635_1	99.55	0.45	253	234876	5023336	38.33	75344	31935	24	50	0
<i>Dolichospermum</i> sp. LBC05a	North America	GCA_017346815_1	94.19	3.74	1	5178591	5178591	38.21	5178591	5178591	1	1	0

<i>Dolichospermum</i> sp. LEGE 00240	Europe	GCA_015207875_1	99.67	0.11	172	201700	5192325	38.42	55172	30510	29	60	0
<i>Dolichospermum</i> sp. LEGE 00246	Europe	GCA_015207865_1	100.00	0.96	779	48182	5708300	38.77	10796	5958	162	340	0
<i>Dolichospermum</i> sp. OL01	North America	GCA_018447755_1	98.33	0.44	2	5178840	5274066	38.19	5178840	5178840	1	1	0.02
<i>Dolichospermum</i> sp. SB001	North America	GCA_016462165_1	99.67	0.11	965	24387	4311702	38.35	5456	3411	254	505	184.85
<i>Dolichospermum</i> sp. UHCC 0187	Europe	GCA_009712035.1	90.96	0.56	76	759950	5308777	38.2	161299	84937	8	19	88.34
<i>Dolichospermum</i> sp. UHCC 0259	Europe	GCA_009711935_1	99.89	0.67	316	181958	5630158	38	34021	18346	50	108	30.34
<i>Dolichospermum</i> sp. UHCC 0260	Europe	GCA_009711985_1	99.22	0.00	113	184152	4921436	38.09	74043	38012	23	45	603.67
<i>Dolichospermum</i> sp. UHCC 0299	Europe	GCA_009711965_1	99.67	0.22	288	160154	5118028	38.05	31633	17653	52	106	8.11
<i>Dolichospermum</i> sp. UHCC 0315A	Europe	GCA_008121535_1	99.67	0.22	4	5407479	5642022	38.16	5407479	5407479	1	1	0
<i>Dolichospermum</i> sp. UHCC 0352	Europe	GCA_009711925_1	99.44	0.00	314	88234	5122584	38.01	31029	16542	54	110	32.89
<i>Dolichospermum</i> sp. UHCC 0406	Europe	GCA_009712025_1	99.22	0.22	42	515837	5178080	38.04	354243	181847	6	12	109.21
<i>Dolichospermum</i> sp. UHCC 0684	Europe	GCA_034931665.1	96.59	0.00	274	83516	4841461	38.05	27888	14602	57	116	121.86
<i>Dolichospermum</i> sp. UKL201	North America	GCA_017346795_1	99.67	0.00	1	5294355	5294355	38.2	5294355	5294355	1	1	0
<i>Dolichospermum</i> sp. WA123	North America	GCA_018447775_1	99.67	0.00	3	4881389	4984963	38.28	4881389	4881389	1	1	0

Table S3. Number of strains, MAA biosynthetic gene clusters and the relative abundance of MAA biosynthetic gene clusters in the genomes of 101 analyzed *Anabaena*, *Dolichospermum*, *Aphanizomenon* (ADA) strains.

Species/group	Number of strains	Number of MAA biosynthetic gene clusters	Relative abundance (%)
ADA-1	10	0	0.00
ADA-2	22	13	59.09
ADA-3	11	3	27.27
ADA-4	19	19	100.00
ADA-5	1	0	0.00
ADA-6	4	0	0.00
ADA-7	2	1	50.00
ADA-8	2	0	0.00
ADA-9	1	0	0.00
ADA-10	1	0	0.00
ADA-11	1	0	0.00
ADA-12	1	0	0.00
All ADA	75	36	48.00
Others	26	11	42.30
All	101	47	46.53

Table S4. The strain number, year of isolation, growth medium, and sampling location for the *Dolichospermum* strains (Halinen *et al.*, 2007 and Halinen *et al.*, 2008). Z8 growth medium (Kotai, 1972) *supplemented with NaCl and MgSO₄. + Approximated coordinates. N/A indicates coordinates not available.

UHCC code	Strain	Year	Suppl*	Location	Coordinates	MAA
UHCC 0652	BIR3	2003	+	The Gulf of Finland	60.10, 26.15 ⁺	-
UHCC 0762	BIR4	2003	+	The Gulf of Finland	60.10, 26.15 ⁺	-
UHCC 0680	BIR25	2004	-	The Gulf of Finland	59.2901, 23.5702	-
UHCC 0631	BIR28	2004	-	The Gulf of Finland	59.2901, 23.5702	-
UHCC 0626	BIR30	2004	+	The Gulf of Finland	59.2901, 23.5702	-
UHCC 0310	BIR49	2004	+	The Gulf of Finland	59.2901, 23.5702	-
UHCC 0650	BIR50	2004	-	The Gulf of Finland	59.5701, 24.4500	+
UHCC 0627	BIR50	2004	+	The Gulf of Finland	59.3515, 24.0700	-
UHCC 0640	BIR52	2004	-	The Gulf of Finland	59.3515, 24.0700	+
UHCC 0639	BIR53	2004	-	The Gulf of Finland	59.3515, 24.0700	-
UHCC 0641	BIR56	2004	-	The Gulf of Finland	59.3515, 24.0700	-
UHCC 0656	BIR66	2004	-	The Gulf of Finland	59.2551, 22.5206	-
UHCC 0643	BIR73	2004	-	The Gulf of Finland	59.5701, 24.4500	-
UHCC 0638	BIR78	2004	-	The Gulf of Finland	59.5701, 24.4500	-
UHCC 0658	BIR84	2004	-	The Gulf of Finland	59.2551, 22.5206	-
UHCC 0671	BIR94	2004	-	The Gulf of Finland	59.3882, 23.3903	-
UHCC 0661	BIR130	2004	-	The Gulf of Finland	59.3020, 22.4031	-
UHCC 0663	BIR162	2004	-	The Gulf of Finland	59.1259, 22.1894	-
UHCC 0753	BIR169	2004	-	The Gulf of Finland	59.1259, 22.1894	-
UHCC 0291	BIR202	2004	+	The Gulf of Finland	59.3250, 23.1000	-

UHCC 0676	BIR208	2004	-	The Gulf of Finland	59.3250, 23.1000	-
UHCC 0620	BIR232	2004	+	The Gulf of Finland	59.2802, 22.3858	-
UHCC 0677	BIR241	2004	-	The Gulf of Finland	N/A	-
UHCC 0767	BIR246	2004	-	The Gulf of Finland	60.0400, 26.2087	+
UHCC 0684	BIR258	2004	-	The Gulf of Finland	60.0400, 26.2087	+
UHCC 0259	BIR259	2004	-	The Gulf of Finland	60.0400, 26.2087	-
UHCC 0260	BIR260	2004	-	The Gulf of Finland	60.0400, 26.2087	+
UHCC 0629	BIR272	2004	-	The Gulf of Finland	59.3218, 22.5014	-
UHCC 0624	BIR348	2004	+	The Gulf of Finland	59.2400, 22.2551	-
UHCC 0623	BIR358	2004	+	The Gulf of Finland	59.2400, 22.2551	-
UHCC 0673	BIR370A	2004	-	The Gulf of Finland	59.1330, 22.2851	-
UHCC 0633	BIR370B	2004	-	The Gulf of Finland	59.1330, 22.2851	-
UHCC 0634	BIR374	2004	-	The Gulf of Finland	59.1701, 22.4700	-
UHCC 0625	BIR406	2004	+	The Gulf of Finland	59.4181, 23.5798	-
UHCC 0635	BIR441	2004	-	The Gulf of Finland	59.3515, 24.0700	-
UHCC 0315	315	1997	-	Seurasaari, Finland	N/A	

Table S5. The relative abundances (%) of porphyrin-334 and shinorine detected at 334 nm in five strains of *Dolichospermum* normalized against *Dolichospermum* sp. UHCC 0684. The culture producing higher relative abundance of MAAs were used for LC/MS-QTOF analysis and are highlighted in green.

MAA	UHCC 0650	UHCC 0640	UHCC 0767	UHCC 0684	UHCC 0260
Porphyrin-334	3.5	10	0.5	63.5	22.5
Shinorine	7	15.7	1.3	36.5	39.6

Table S6. The experienced mass-to-charge ratio (m/z), ion intensity, theoretical mass-to-charge ratio (m/z), mass error (ppm), molecular formula and putative fragmentations of porphyra-334 (m/z 347.1449) and shinorine.

No	Porphyra-334, R = CH ₃				Shinorine, R = H			
	Molecular formula	Theoretical (m/z)	Δ (ppm)	I (x 1000)	Theoretical (m/z)	Δ (ppm)	I (x 100)	Neutral loss
1	C ₁₄ H ₂₃ N ₂ O ₈ ⁺	347.14489	-1.3	195	333.12924	-2.1	88	N/A
2	C ₁₃ H ₂₀ N ₂ O ₈ ^{**}	332.12142	-1.7	3	318.10577	-11.7	2	d
3	C ₁₃ H ₁₈ N ₂ O ₇ ^{**}	314.11085	-1.0	7	300.09520	4.2	9	d, H ₂ O
4	C ₁₂ H ₁₉ N ₂ O ₇ ⁺	303.11868	-0.8	147	303.11868	-0.4	6	k
5	C ₁₂ H ₁₉ N ₂ O ₆ ⁺	301.13941	0.1	9	287.12376	3.8	8	m
6	C ₁₃ H ₁₆ N ₂ O ₆ ^{**}	296.10029	-1.8	7	282.08464	3.2	8	d, 2xH ₂ O
7	C ₁₂ H ₂₀ N ₂ O ₆ ^{**}	288.13159	-1.5	11	274.11594	1.5	10	a/m, d
8	C ₁₁ H ₁₅ N ₂ O ₇ ⁺	287.08738	-0.8	19	287.08738	-2.9	6	d, k
9	C ₁₃ H ₁₅ N ₂ O ₅ ⁺	279.09755	-2.5	10	265.08190	-2.8	15	f, g, l
10	C ₁₂ H ₁₈ N ₂ O ₅ ^{**}	270.12102	-1.4	10	256.10537	-9.4 ^a	19	a, d, H ₂ O
11	C ₁₂ H ₁₇ N ₂ O ₅ ⁺	269.11320	-3.5	9	255.09755	0.4	50	e, f, g
12	C ₁₂ H ₁₆ N ₂ O ₅ ^{**}	268.10537	-3.4	8	254.08972	1.7	8	e, f, g
13	C ₁₁ H ₂₀ N ₂ O ₄ ^{**}	244.14176	-2.9	27	230.12611	-0.3	25	a, d, m
14	C ₁₀ H ₁₆ N ₂ O ₅ ^{**}	244.10537	-4.6	20	244.10537	-5.8	4	a/m, d, k
15	C ₁₀ H ₁₅ N ₂ O ₅ ⁺	243.09755	-3.3	37	243.09755	-3.7	12	e, g, k
16	C ₁₀ H ₁₃ N ₂ O ₅ ⁺	241.08190	-1.5	25	241.08190	1.5	19	e, g, k
17	C ₁₀ H ₁₅ N ₂ O ₄ ⁺	227.10263	0.5	31	227.10263	1.4	6	(j, H ₂ O)/(b, k, H ₂ O)/(a/m, g, k)
18	C ₁₀ H ₁₃ N ₂ O ₃ ⁺	209.09207	1.8	29	209.09207	2.8	12	a/m, f, g, k
19	C ₉ H ₁₆ N ₂ O ₃ ^{**}	200.11554	-0.4	116	200.11554	4.5	16	a, d, k, m
20	C ₉ H ₁₅ N ₂ O ₃ ⁺	199.10772	-0.9	49	199.10772	5.2	24	a, d, k, m
21	C ₉ H ₁₃ N ₂ O ₃ ⁺	197.09207	-0.6	71	197.09207	-2.6	56	e, f, j
22	C ₉ H ₁₁ N ₂ O ₃ ⁺	195.07642	2.7	29	195.07642	5.8	12	f, g, j
23	C ₈ H ₁₄ N ₂ O ₃ ^{**}	186.09989	1.9	95	186.09989	0.9	64	a, d, j
24	C ₈ H ₁₃ N ₂ O ₃ ⁺	185.09207	1.5	40	185.09207	-1.7	9	e, g, j
25	C ₉ H ₁₁ N ₂ O ₂ ⁺	179.08150	0.8	23	179.08150	0.8	12	(a/m, e, f, g, k)/(b, e, f, h, k)/(e, f, h, j)
26	C ₈ H ₁₀ NO ₃ ⁺	168.06552	2.0	28	168.06552	-1.0	11	e, g, i
27	C ₉ H ₁₁ N ₂ O ⁺	163.08659	2.2	23	163.08659	-3.9	16	a/m, f, g, k
28	C ₈ H ₁₁ N ₂ O ⁺	151.08659	2.4	34	151.08659	-3.6	15	(a, j)/(b, k, m), f, g
29	C ₈ H ₉ N ₂ O ⁺	149.07094	5.4	61	149.07094	5.4	21	(b, f, g, k, m)/(a, f, g, j)/(b, f, h, j)
30	C ₇ H ₉ N ₂ O ⁺	137.07094	4.5	52	137.07094	3.7	23	b, f, g, j
31	C ₇ H ₈ NO ⁺	122.06004	5.0	20	122.06004	5.8	8	(b, i)/(c, j), f, g
32	C ₆ H ₈ NO ⁺	110.06004	4.6	13	110.06004	4.6	5	(b, i)/(c, j), e, g
33	C ₇ H ₈ N ⁺	106.06512	2.2	13	106.06512	6.9	4	a/(k, m), e, f, g, i

Table S7. The observed retention times and peak areas of compounds with absorption maxima at 334 nm detected from the 36 analyzed *Dolichospermum* strains in the UPLC analysis. **A.** Compound assigned tentatively as porphyra-334. **B.** Compound assigned tentatively as shinorine.

A. Porphyra-334			B. Shinorine	
Strain	Retention time (min)	Peak area	Retention time (min)	Peak area
UHCC 0684	6.29	14470.504	6.71	400.688
UHCC 0260	6.29	5127.837	6.71	436.244

Table S8. The maximum absorption, molecular weights, mass of protonated molecules, molar extinction coefficients and molecular formulas of porphyra-334 and shinorine (as reported in La Barre *et al.*, 2014).

MAA	Absorbance λ_{max} (nm)	Molecular weight (g/mol)	[M + H] ⁺ (m/z)	Extinction coefficient ϵ (L/mol/cm)	Molecular formula
Porphyra-334	334	346.336	347.1	42300	C ₁₄ H ₂₂ N ₂ O ₈
Shinorine	334	332.31	333.1	44668	C ₁₃ H ₂₀ N ₂ O ₈

Table S9. Obtained adjusted p values from the Kruskal–Wallis tests with post hoc Dunn’s test.

Comparison	Adjusted p
2021 Helsinki vs. 2021 Turku	2.734166e-01
2021 Helsinki vs. 2021 Helsinki	1.737499e-04
2021 Turku vs. 2022 Helsinki	2.659849e-05
2021 Helsinki vs. 2022 Turku	2.827127e-03
2021 Turku vs. 2022 Turku	3.263397e-04
2022 Helsinki vs. 2022 Turku	7.591861e-01

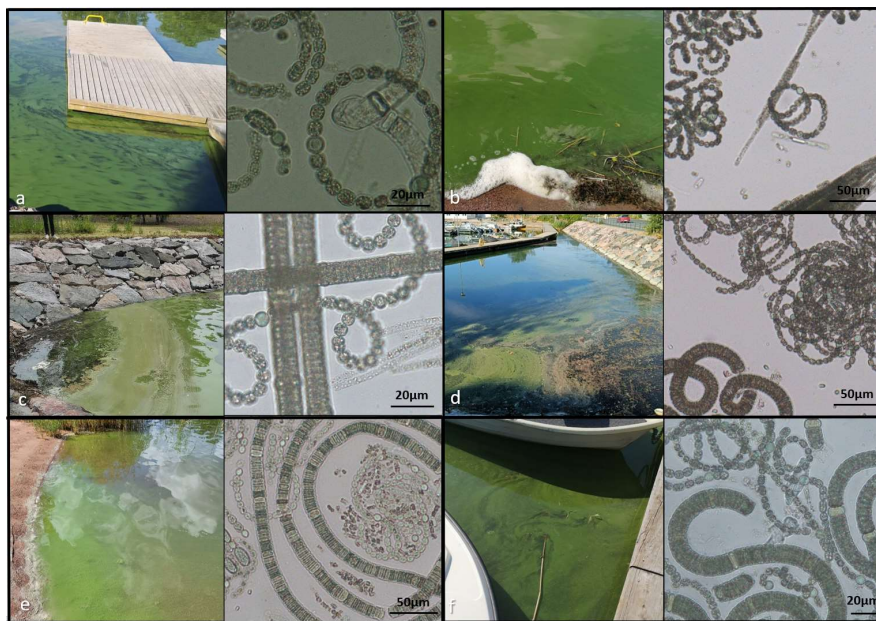


Figure S1. Blooms samples and microscopy images. (a) Rajasaari, Helsinki, 08.07.2022 (b) Munkkiniemi, Helsinki 19.07.2022 (c) Rajasaari, Helsinki, 05.08.2022 (d) Rajasaari, Helsinki, 09.08.2022 (e) Kultaranta, Turku (09.08.2022) (f) Kaarina, Turku, 16.08.2022.

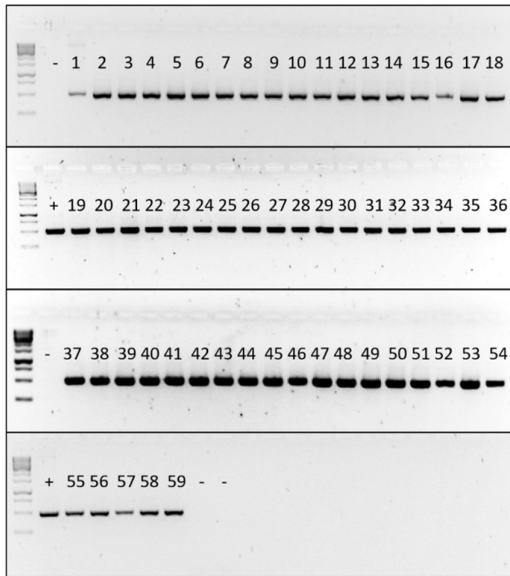


Figure S2. PCR amplification of *mysB* gene from 59 samples of surface blooms collected in 2021 and 2022. – indicates the negative control (DNAse/RNAse free water), + indicates the positive control (UHCC 0260).

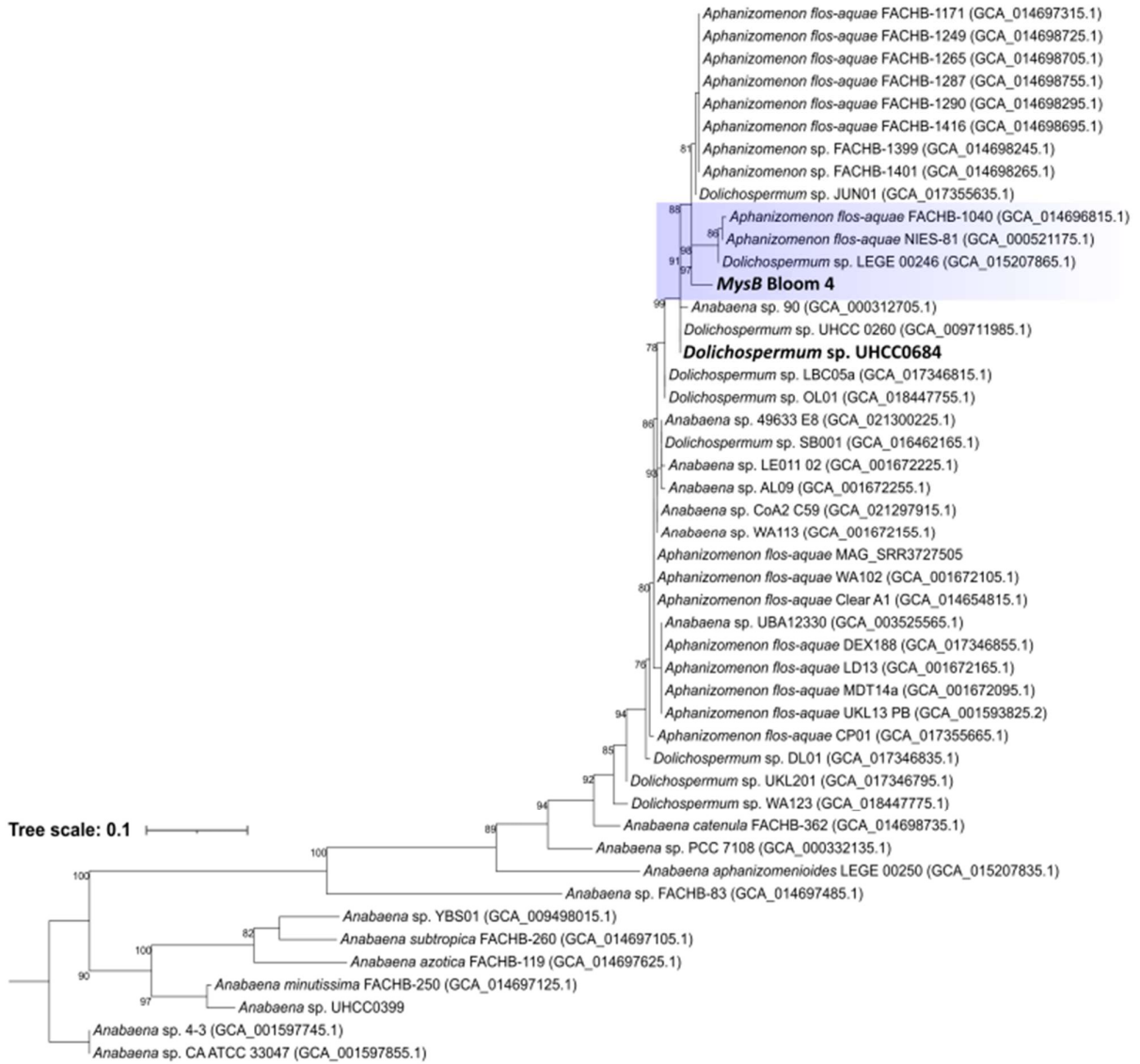


Figure S3. The phylogenetic tree of ADA clade showing position of the *mysB* gene amplified and sequenced from bloom sample no. 4.

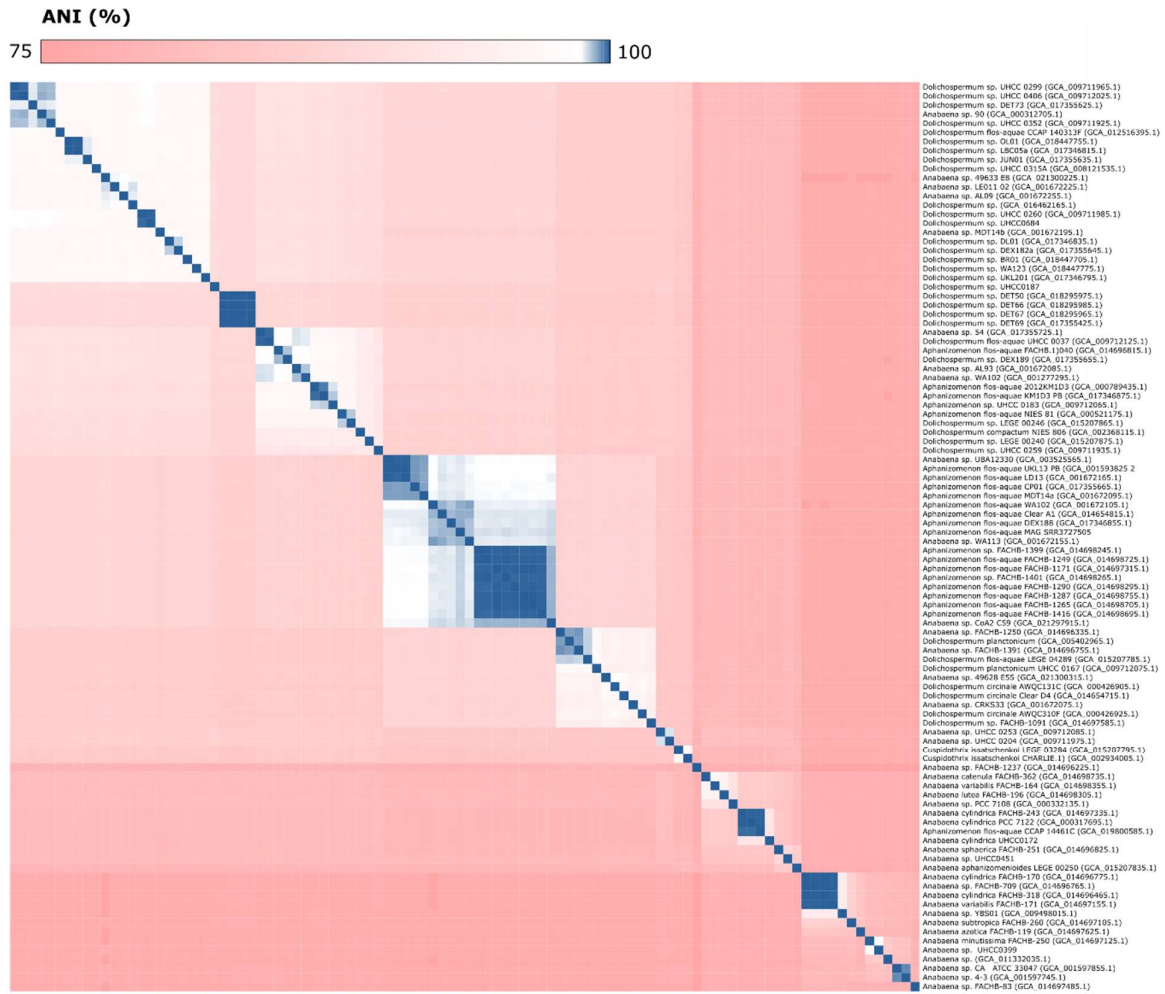


Figure S4. The Average Nucleotide Identities (ANI) of 101 *Anabaena*, *Dolichospermum* and *Aphanizomeon* complete of draft genomes analyzed (Table S4).

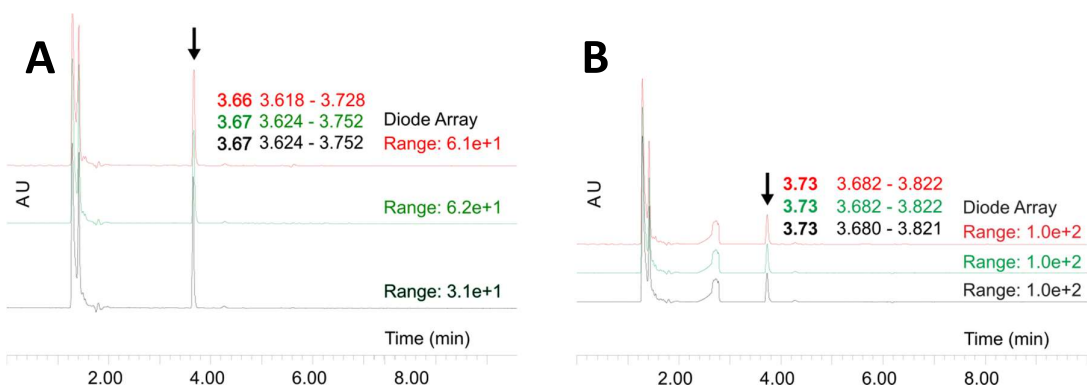


Figure S5. Collected porphyra-334 fractions from three injections of MAA methanol extracts from analyzed *Dolichospermum* samples. Collected peaks indicated by arrow, retention time (min) in bold and collected fraction (min) reported next to the peak. **A.** *Dolichospermum* sp. UHCC 0684, 1 μ l injection in black, 2 μ l injections in green and red. **B.** *Dolichospermum* sp. UHCC 0260, 1 μ l injection in black, 2 μ l injections in green and red.

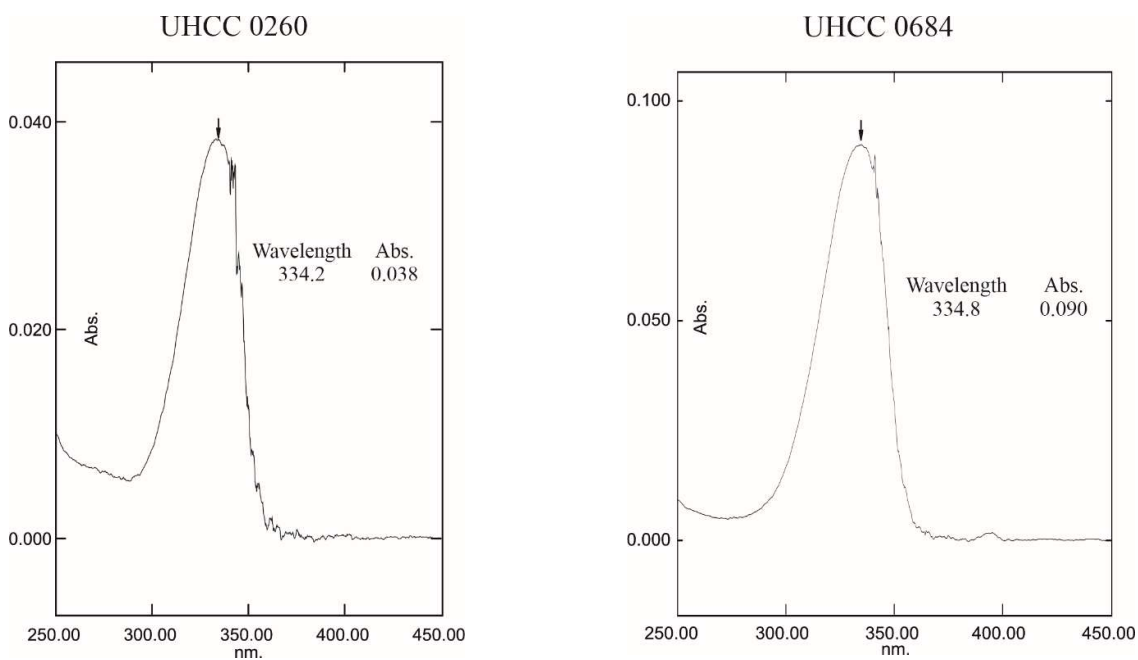


Figure S6. Purification of shininone and porphyra-334 from *Dolichospermum* spp. UHCC 0260 and UHCC 0684.

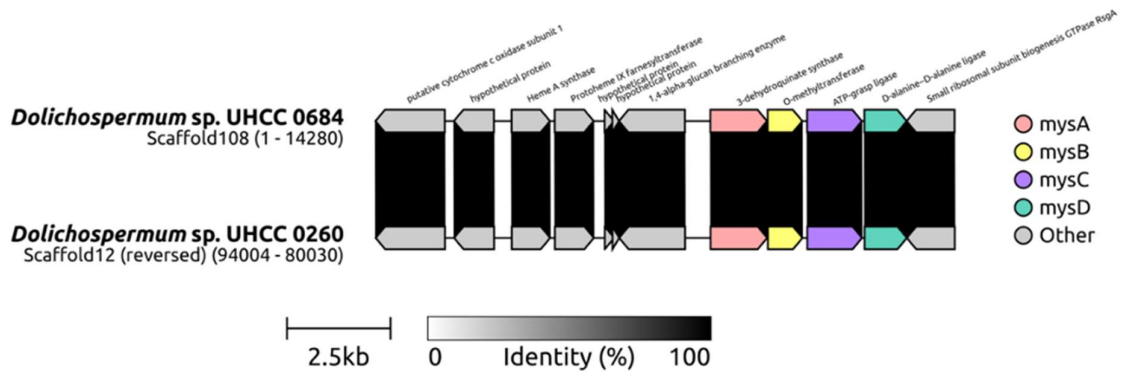


Figure S7. The comparison of MAA biosynthetic gene clusters from *Dolichospermum* spp. UHCC 0684 and UHCC 0260. The *mysA-mysB* genes and promoter region from *Dolichospermum* sp. UHCC 0684 and *Dolichospermum* sp. UHCC 0260 are 100 % identical at the nucleotide level.

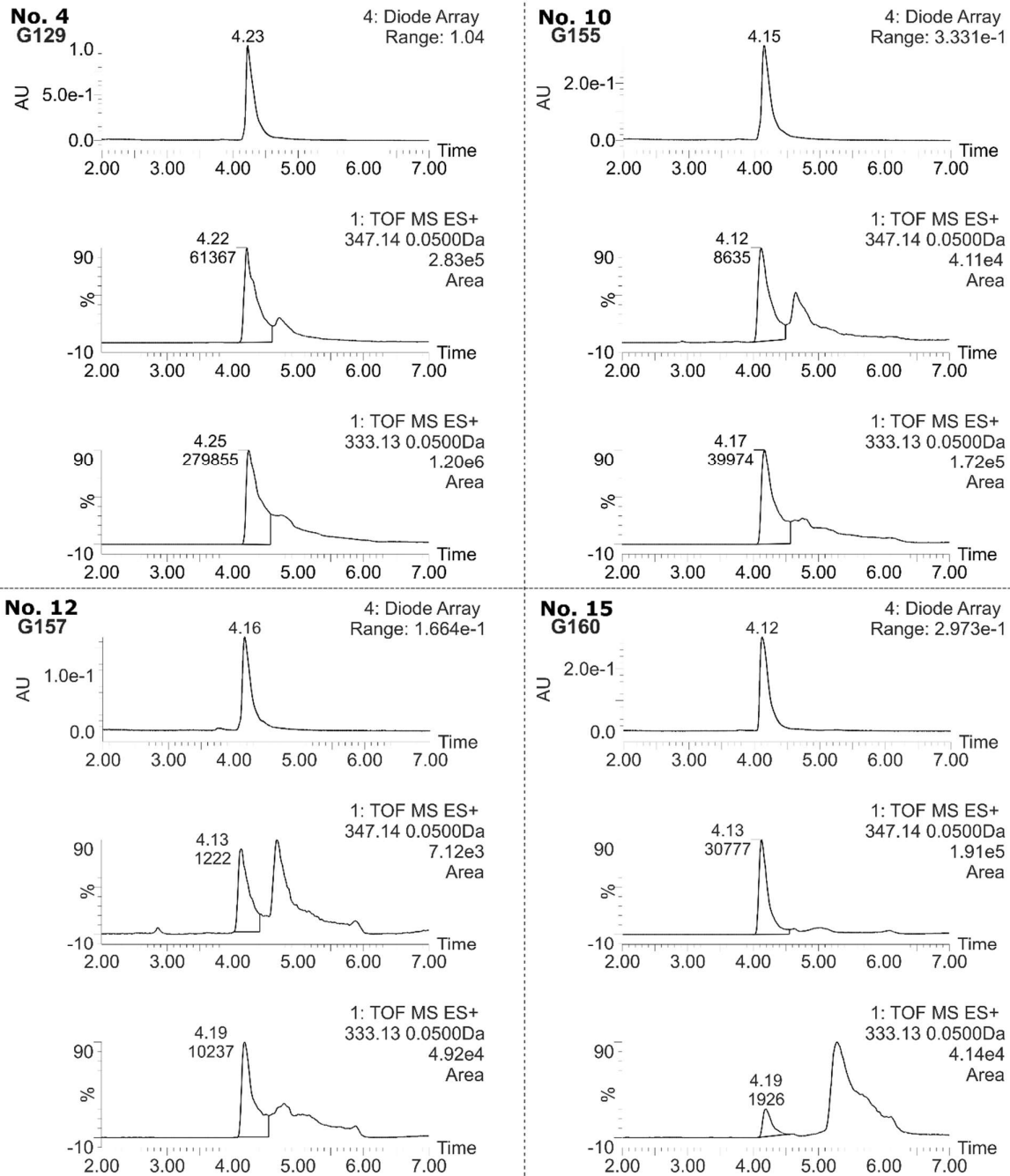


Figure S8. UV and MS ES⁺ chromatograms of the high MAA producing bloom samples no. 4, 10, 12 and 15 collected during the summer of 2021. (Porphyrin-334: 347.14 Da, Shinorine: 333.13 Da)