



JACOB KANN, Ph.D.
AQUATIC ECOLOGIST
295 East Main St., Suite 7
Ashland, OR 97520
Voice: 541-482-1575
Fax: 541-552-1024
Email: jacobkann@aol.com

September 12, 2008

Technical Memorandum

Klamath River *Microcystis aeruginosa* and microcystin concentrations for “rushed” samples during late August and early September, 2008

To all concerned:

As noted in the memo of September 8th 2008, several phytoplankton cell count results for August 19th, August 27th, and September 2nd were received from Aquatic Analysts (see lab data in Appendix I). Results received were only for a sub-set of stations for which Aquatic Analysts performed a “rush” analysis. Likewise, although laboratory ELISA results for microcystin toxin from the USEPA Region 9 Laboratory in Richmond, CA are pending for the majority of samples from these dates, the USEPA lab provided preliminary (meaning all QA criteria were met but peer and final QA review has not yet occurred) results for several of the river samples that had MSAE cell densities exceeding public health notification guidelines (see attached USEPA email containing results in Appendix II).

These preliminary microcystin results show that locally higher MSAE concentrations in samples from the river shoreline stations (i.e., KRBI, SVFD, BRBE, and BVFI) were associated with microcystin concentrations that exceeded the World Health Organization tolerable daily intake level (TDI; as defined in Table 1) by 1.5 to 105x (Table 1). An additional station, SVMN (for which no cell density data were collected), also exceeded the TDI by 7.9x (Table 1). These results confirm earlier public health postings based on MSAE cell count data exceeding 40,000 cells/ml (Table 1). They also indicate that, unlike 2007 when high September MSAE densities in Copco and Iron Gate Reservoirs and in the Klamath River below were not associated with high levels of microcystin (Kann 2007¹), that MSAE in September of 2008 is associated with continuing production of microcystin that can exceed public health guideline values.

This memo will again be updated when other pending laboratory data are received.

Disclaimer

*Due to the patchy nature of blue-green algal blooms it is possible for higher *Microcystis aeruginosa* densities (and therefore higher microcystin toxin concentrations) to have been present in locations not covered in this survey, particularly along shorelines or protected coves and backwaters during calm conditions of little to no wind. Recreational users should always avoid contact with water whenever noticeable surface concentrations of algae are evident. Moreover, because pets or other domestic animals are the most likely to ingest contaminated water, these animals should not be allowed access to areas of either noticeable surface concentrations of algae or when an obvious green to blue-green appearance is evident*

¹ Kann, J. 2007. Technical Memorandum: Toxic Cyanobacteria Results for Copco/Iron Gate Reservoirs: October 29-30, 2007. TM provided to the Karuk Tribe of California. November 6, 2007. Orleans, CA.

Table 1. Cell density, microcystin toxin concentration, and risk exceedance for toxigenic cyanobacteria in the Klamath River, 2008.

DATE	STATION NAME	Station Description	DEPTH	<i>Microcystis aeruginosa</i> (cells/ml)	<i>Planktothrix (Oscillatoria) sp.</i> (cells/ml)	<i>Anabaena sp.</i> (cells/ml)	Microcystin Total (µg/L)	Exceedance of SWRCB ¹ risk level of 40,000 cells/ml <i>Microcystis</i> or <i>Planktothrix</i> (x greater than 4 ⁵ cells/ml)	Exceedance of microcystin TDI of 0.04 µg/kg/day for a 20kg (44lb) child ingesting 100 mls ² (x greater than TDI)
8/19/2008	KRBI	Below Iron Gate	0C ³	32,805	0	0	pending	0.8	pending
8/19/2008	WA	Walker Bridge	0C	8,448	0	0	pending	0.2	pending
8/19/2008	SV	Seiad Valley	0C	1,450	0	44	pending	0.0	pending
8/19/2008	OR	Orleans	0C	1,514	0	0	pending	0.0	pending
8/27/2008	KRBI	Below Iron Gate	0C	6,968	0	0	pending	0.2	pending
8/27/2008	KRBI	Below Iron Gate	SG ⁴	1,394,139	0	6,461	n/a	34.9	n/a
9/2/2008	KRBI	Below Iron Gate	0C	8,116	0	0	pending	0.2	pending
9/2/2008	KRBI	Below Iron Gate	SG	349,672	0	1,474	12	8.7	1.5
9/2/2008	WA	Walker Bridge	0C	272	0	0	pending	0.0	pending
9/2/2008	SV	Seiad Valley	0C	1,284	0	0	pending	0.0	pending
9/2/2008	SVMN	Mining claim river access upstream of Seiad (town)	SG	n/a	n/a	n/a	63	n/a	7.9
9/2/2008	SVFD	River edge ~3 miles upstream of SV	SG	178,547	0	0	230	4.5	28.8
9/2/2008	BRBE	River edge at Brown Bear River Access	SG	401,672	0	0	840	10.0	105.0
9/2/2008	BVFI	River edge ~1 mile above Beaver Creek	SG	251,305	0	0	110	6.3	13.8
9/2/2008	OR	Orleans	0C	3,237	0	0	pending	0.1	pending

¹From: Blue Green Algae Work Group of the State Water Resources Control Board and Office of Environmental Health and Hazard Assessment: *Cyanobacteria in California Recreational Water Bodies Providing Voluntary Guidance about Harmful Algal Blooms, Their Monitoring, and Public Notification (DRAFT June 2007)*

²Exceedance of the TDI or tolerable daily intake (e.g., WHO 1999: [http://www.who.int/water_sanitation_health/resourcesquality/toxicyanbact/en/](http://www.who.int/water_sanitation_health/resourcesquality/toxiccyanbact/en/)) as computed here for a 20kg child is equivalent to exceedance of the 8µg/L microcystin value as shown in Appendix 6 of the document in footnote 1 above.

³0C denotes sampling near mid-channel mixed region

⁴SG denotes surface grab-sampling near shoreline region of low mixing

Appendix I-- Aquatic Analysts Phytoplankton Analyses

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRBI
Sample Depth: 0C
Sample Date: 19-Aug-08

Total Density (#/mL): 1,067
Total Biovolume (um³/mL): 641,697
Trophic State Index: 46.6

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Nitzschia palea	420	39.4	75,587	11.8
2 Aphanizomenon flos-aquae	227	21.3	214,288	33.4
3 Microcystis aeruginosa	176	16.5	262,437	40.9
4 Cocconeis placentula	76	7.1	34,770	5.4
5 Cryptomonas erosa	50	4.7	26,203	4.1
6 Ankistrodesmus falcatus	34	3.1	840	0.1
7 Rhodomonas minuta	25	2.4	504	0.1
8 Nitzschia frustulum	17	1.6	2,016	0.3
9 Nitzschia amphibia	8	0.8	806	0.1
10 Rhoicosphenia curvata	8	0.8	983	0.2
11 Synedra ulna	8	0.8	16,713	2.6
12 Gomphonema subclavatum	8	0.8	5,039	0.8
13 Gomphonema angustatum	8	0.8	1,512	0.2

Microcystis aeruginosa cells/mL = 32,805

Aphanizomenon flos-aquae cells/mL = 3,401

Aphanizomenon flos-aquae heterocysts/mL = 25

Note: toxic species counted 4X as much as others.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: WA
Sample Depth: 0C
Sample Date: 19-Aug-08

Total Density (#/mL): 953
Total Biovolume (um³/mL): 419,590
Trophic State Index: 43.6

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Cocconeis placentula	474	49.7	217,938	51.9
2 Nitzschia palea	109	11.5	19,680	4.7
3 Microcystis aeruginosa	56	5.8	67,583	16.1
4 Rhoicosphenia curvata	55	5.7	6,396	1.5
5 Nitzschia frustulum	36	3.8	4,373	1.0
6 Navicula cryptocephala veneta	36	3.8	3,462	0.8
7 Navicula tripunctata	18	1.9	20,409	4.9
8 Gomphonema angustatum	18	1.9	3,280	0.8
9 Navicula sp.	18	1.9	2,733	0.7
10 Navicula cryptocephala	18	1.9	3,371	0.8
11 Gomphonema ventricosum	18	1.9	15,489	3.7
12 Aphanizomenon flos-aquae	14	1.4	8,610	2.1
13 Nitzschia microcephala	9	1.0	911	0.2
14 Melosira varians	9	1.0	5,922	1.4
15 Nitzschia sp.	9	1.0	1,093	0.3
16 Synedra socia	9	1.0	3,007	0.7
17 Diatoma vulgare	9	1.0	17,858	4.3
18 Melosira granulata	9	1.0	5,011	1.2
19 Fragilaria construens	9	1.0	6,123	1.5
20 Nitzschia amphibia	9	1.0	875	0.2
21 Gomphonema subclavatum	9	1.0	5,467	1.3

Microcystis aeruginosa cells/mL = 8,448

Aphanizomenon flos-aquae cells/mL = 137

Note: Toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: SV
Sample Depth: 0C
Sample Date: 19-Aug-08

Total Density (#/mL): 329
Total Biovolume ($\mu\text{m}^3/\text{mL}$): 169,990
Trophic State Index: 37.1

Species	Density #/mL	Density Percent	Biovolume $\mu\text{m}^3/\text{mL}$	Biovolume Percent
1 Cocconeis placentula	176	53.6	81,186	47.8
2 Nitzschia frustulum	28	8.6	3,744	2.2
3 Navicula cryptocephala	16	4.8	2,915	1.7
4 Nitzschia palea	16	4.8	2,836	1.7
5 Rhoicosphenia curvata	16	4.8	2,950	1.7
6 Microcystis aeruginosa	7	2.2	11,598	6.8
7 Gomphoneis herculeana	6	1.9	34,038	20.0
8 Navicula cryptocephala veneta	6	1.9	599	0.4
9 Gomphonema tenellum	6	1.9	1,324	0.8
10 Gomphonema ventricosum	3	1.0	2,679	1.6
11 Gomphonema angustatum	3	1.0	567	0.3
12 Navicula tripunctata	3	1.0	3,530	2.1
13 Melosira varians	3	1.0	2,049	1.2
14 Gyrosigma spencerii	3	1.0	1,418	0.8
15 Nitzschia paleacea	3	1.0	309	0.2
16 Nitzschia volcanica	3	1.0	504	0.3
17 Achnanthes minutissima	3	1.0	158	0.1
18 Glenodinium sp.	3	1.0	2,206	1.3
19 Nitzschia amphibia	3	1.0	303	0.2
20 Synedra ulna	3	1.0	6,272	3.7
21 Ankistrodesmus falcatus	3	1.0	79	0.0
22 Stephanodiscus astraea minutula	3	1.0	1,103	0.6
23 Amphora perpusilla	3	1.0	523	0.3
24 Cymbella minuta	3	1.0	1,166	0.7
25 Aphanizomenon flos-aquae	3	1.0	2,978	1.8
26 Anabaena flos-aquae	1	0.2	2,956	1.7

Microcystis aeruginosa cells/mL = 1,450

Anabaena flos-aquae cells/mL = 44

Aphanizomenon flos-aquae cells/mL = 47

Note: Toxic species counted 4X more than other species.

Aquatic Analysts

Sample ID: LX46

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: OR
Sample Depth: 0C
Sample Date: 19-Aug-08

Total Density (#/mL): 268
Total Biovolume (um³/mL): 206,606
Trophic State Index: 38.5

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Cocconeis placentula	93	34.5	42,629	20.6
2 Epithemia sorex	75	27.8	93,613	45.3
3 Scenedesmus quadricauda	15	5.8	6,024	2.9
4 Microcystis aeruginosa	14	5.1	12,115	5.9
5 Nitzschia palea	10	3.8	1,853	0.9
6 Cymbella sinuata	8	2.9	1,081	0.5
7 Synedra ulna	8	2.9	19,978	9.7
8 Nitzschia paleacea	5	1.9	505	0.2
9 Nitzschia frustulum	5	1.9	618	0.3
10 Ankistrodesmus falcatus	5	1.9	129	0.1
11 Melosira granulata	5	1.9	11,326	5.5
12 Rhoicosphenia curvata	5	1.9	602	0.3
13 Rhodomonas minuta	5	1.9	103	0.0
14 Navicula cryptocephala	3	1.0	476	0.2
15 Gomphonema angustatum	3	1.0	463	0.2
16 Oocystis sp.	3	1.0	1,158	0.6
17 Nitzschia fonticola	3	1.0	108	0.1
18 Epithemia turgida	3	1.0	10,940	5.3
19 Navicula tripunctata	3	1.0	2,883	1.4

Microcystis aeruginosa cells/mL = 1,514

Note: Toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRBI
Sample Depth: 0C
Sample Date: 27-Aug-08

Total Density (#/mL): 811
Total Biovolume (um³/mL): 754,033
Trophic State Index: 47.8

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	427	52.6	564,420	74.9
2 Cocconeis placentula	102	12.5	46,725	6.2
3 Cryptomonas erosa	102	12.5	52,820	7.0
4 Nitzschia frustulum	61	7.5	20,478	2.7
5 Microcystis aeruginosa	28	3.5	55,745	7.4
6 Nitzschia palea	20	2.5	3,657	0.5
7 Chromulina sp.	10	1.3	203	0.0
8 Unidentified microflagellate	10	1.3	203	0.0
9 Nitzschia amphibia	10	1.3	975	0.1
10 Gomphonema subclavatum	10	1.3	6,095	0.8
11 Ankistrodesmus falcatus	10	1.3	254	0.0
12 Rhoicosphenia curvata	10	1.3	1,188	0.2
13 Unident. green cell	10	1.3	1,270	0.2

Microcystis aeruginosa cells/mL = 6,968

Aphanizomenon flos-aquae cells/mL = 8,959

Aphanizomenon flos-aquae heterocysts/mL = 122

Note: Toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRBI
Sample Depth: SG
Sample Date: 27-Aug-08

Total Density (#/mL): 33,276
Total Biovolume (um³/mL): 31,101,691
Trophic State Index: 74.6

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Cocconeis placentula	10,361	31.1	7,148,959	23.0
2 Microcystis aeruginosa	7,618	22.9	11,153,108	35.9
3 Nitzschia palea	3,047	9.2	548,514	1.8
4 Nitzschia frustulum	2,438	7.3	292,541	0.9
5 Synedra ulna	1,828	5.5	3,638,473	11.7
6 Nitzschia paleacea	914	2.7	89,591	0.3
7 Gomphoneis herculeana	914	2.7	4,936,622	15.9
8 Navicula cryptocephala veneta	914	2.7	86,848	0.3
9 Amphora coffeiformes	914	2.7	86,848	0.3
10 Aphanizomenon flos-aquae	670	2.0	929,182	3.0
11 Gomphonema ventricosum	609	1.8	518,041	1.7
12 Nitzschia sp.	609	1.8	73,135	0.2
13 Gomphonema subclavatum	609	1.8	548,514	1.8
14 Melosira varians	305	0.9	198,074	0.6
15 Navicula minima	305	0.9	13,408	0.0
16 Anabaena sp.	305	0.9	414,432	1.3
17 Sphaerocystis schroeteri	305	0.9	341,297	1.1
18 Nitzschia amphibia	305	0.9	29,254	0.1
19 Gomphonema angustatum	305	0.9	54,851	0.2

Microcystis aeruginosa cells/mL = 1,394,139

Anabaena sp. cells/mL = 6,095

Anabaena sp. heterocysts/mL = 366

Aphanizomenon flos-aquae cells/mL = 14,749

Aphanizomenon flos-aquae heterocysts/mL = 213

Note: Toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRBI
Sample Depth: 0C
Sample Date: 2-Sep-08

Total Density (#/mL): 742
Total Biovolume (um³/mL): 639,819
Trophic State Index: 46.6

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	453	61.0	513,174	80.2
2 Rhodomonas minuta	77	10.3	1,534	0.2
3 Cryptomonas erosa	61	8.3	31,907	5.0
4 Cocconeis placentula	38	5.2	17,641	2.8
5 Microcystis aeruginosa	28	3.8	64,932	10.1
6 Rhoicosphenia curvata	23	3.1	2,692	0.4
7 Chromulina sp.	15	2.1	307	0.0
8 Chlamydomonas sp.	15	2.1	4,986	0.8
9 Gomphonema angustatum	8	1.0	1,381	0.2
10 Unidentified microflagellate	8	1.0	153	0.0
11 Ankistrodesmus falcatus	8	1.0	192	0.0
12 Nitzschia frustulum	8	1.0	920	0.1

Aphanizomenon flos-aquae cells/mL = 8,146
 Aphanizomenon flos-aquae heterocysts/mL = 107

Microcystis aeruginosa cells/mL = 8,116

Note: Toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath River
Sample Station: KRBI
Sample Depth: SG
Sample Date: 2-Sep-08

Total Density (#/mL): 9,985
Total Biovolume ($\mu\text{m}^3/\text{mL}$): 7,551,425
Trophic State Index: 64.4

Species	Density #/mL	Density Percent	Biovolume $\mu\text{m}^3/\text{mL}$	Biovolume Percent
1 Cocconeis placentula	3,685	36.9	1,694,935	22.4
2 Nitzschia palea	1,105	11.1	198,971	2.6
3 Microcystis aeruginosa	897	9.0	2,797,379	37.0
4 Gomphonema subclavatum	737	7.4	442,157	5.9
5 Amphora coffeiformes	737	7.4	70,008	0.9
6 Nitzschia frustulum	737	7.4	114,961	1.5
7 Gomphonema ventricosum	614	6.2	521,991	6.9
8 Rhoicosphenia curvata	368	3.7	43,110	0.6
9 Synedra ulna	246	2.5	488,829	6.5
10 Aphanizomenon flos-aquae	246	2.5	386,887	5.1
11 Navicula cryptocephala veneta	246	2.5	23,336	0.3
12 Gomphonema angustatum	123	1.2	22,108	0.3
13 Anabaena sp.	123	1.2	83,519	1.1
14 Gomphoneis herculeana	123	1.2	663,235	8.8

Microcystis aeruginosa cells/mL = 349,672

Aphanizomenon flos-aquae cells/mL = 6,141
 Aphanizomenon flos-aquae heterocysts/mL = 246

Anabaena sp. cells/mL = 1,228
 Anabaena sp. heterocysts/mL = 246

Note: Toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: WA
Sample Depth: 0C
Sample Date: 2-Sep-08

Total Density (#/mL): 398
Total Biovolume ($\mu\text{m}^3/\text{mL}$): 278,924
Trophic State Index: 40.7

Species	Density #/mL	Density Percent	Biovolume $\mu\text{m}^3/\text{mL}$	Biovolume Percent
1 Aphanizomenon flos-aquae	168	42.3	169,715	60.8
2 Cocconeis placentula	136	34.2	62,656	22.5
3 Nitzschia frustulum	15	3.8	1,816	0.7
4 Nitzschia paleacea	11	2.8	1,112	0.4
5 Rhoicosphenia curvata	8	1.9	885	0.3
6 Navicula tripunctata	8	1.9	8,475	3.0
7 Cryptomonas erosa	8	1.9	3,935	1.4
8 Navicula cryptocephala veneta	8	1.9	719	0.3
9 Microcystis aeruginosa	7	1.7	2,179	0.8
10 Nitzschia sp.	4	0.9	454	0.2
11 Rhodomonas minuta	4	0.9	76	0.0
12 Chromulina sp.	4	0.9	76	0.0
13 Navicula cryptocephala	4	0.9	700	0.3
14 Epithemia sorex	4	0.9	4,313	1.5
15 Nitzschia dissipata	4	0.9	1,018	0.4
16 Gomphoneis herculeana	4	0.9	20,431	7.3
17 Nitzschia amphibia	4	0.9	363	0.1

Aphanizomenon flos-aquae cells/mL = 2,694
 Aphanizomenon flos-aquae heterocysts/mL = 30

Microcystis aeruginosa cells/mL = 272

Note: toxic species counted 4X more than other species.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: SV
Sample Depth: 0C
Sample Date: 2-Sep-08

Total Density (#/mL): 675
Total Biovolume (um³/mL): 426,812
Trophic State Index: 43.7

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Cocconeis placentula	184	27.2	84,486	19.8
2 Aphanizomenon flos-aquae	161	23.8	171,935	40.3
3 Navicula cryptocephala	82	12.1	15,101	3.5
4 Navicula cryptocephala veneta	68	10.1	6,462	1.5
5 Nitzschia frustulum	41	6.0	4,898	1.1
6 Synedra ulna	20	3.0	52,794	12.4
7 Cryptomonas erosa	20	3.0	10,612	2.5
8 Rhodomonas minuta	14	2.0	272	0.1
9 Rhoicosphenia curvata	14	2.0	1,592	0.4
10 Nitzschia amphibia	14	2.0	1,306	0.3
11 Microcystis aeruginosa	12	1.7	10,269	2.4
12 Cyclotella meneghiniana	7	1.0	2,585	0.6
13 Navicula decussis	7	1.0	1,306	0.3
14 Cymbella affinis	7	1.0	12,244	2.9
15 Navicula tripunctata	7	1.0	7,619	1.8
16 Gomphoneis herculeana	7	1.0	36,733	8.6
17 Cymbella minuta	7	1.0	2,517	0.6
18 Gomphonema subclavatum	7	1.0	4,081	1.0

Aphanizomenon flos-aquae cells/mL = 2,729
 Aphanizomenon flos-aquae heterocysts/mL = 14

Microcystis aeruginosa cells/mL = 1,284

Note: toxic species counted 4X as much as others.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: SVFD
Sample Depth: SG
Sample Date: 2-Sep-08

Total Density (#/mL): 14,889
Total Biovolume (um³/mL): 9,187,580
Trophic State Index: 65.8

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Cocconeis placentula	4,634	31.1	2,131,438	23.2
2 Aphanizomenon flos-aquae	3,243	21.8	3,065,101	33.4
3 Navicula cryptocephala	1,545	10.4	285,736	3.1
4 Nitzschia frustulum	1,545	10.4	185,342	2.0
5 Microcystis aeruginosa	525	3.5	1,428,373	15.5
6 Gomphonema subclavatum	463	3.1	278,014	3.0
7 Rhoicosphenia curvata	463	3.1	54,213	0.6
8 Gomphonema ventricosum	309	2.1	262,568	2.9
9 Nitzschia amphibia	309	2.1	29,655	0.3
10 Synedra ulna	154	1.0	307,360	3.3
11 Diatoma vulgare	154	1.0	302,726	3.3
12 Achnanthes lanceolata	154	1.0	27,801	0.3
13 Nitzschia linearis	154	1.0	235,385	2.6
14 Nitzschia palea	154	1.0	27,801	0.3
15 Fragilaria construens	154	1.0	172,986	1.9
16 Navicula cryptocephala veneta	154	1.0	14,673	0.2
17 Melosira varians	154	1.0	200,788	2.2
18 Navicula sp.	154	1.0	23,168	0.3
19 Synedra ulna contracta	154	1.0	54,058	0.6
20 Diatoma tenue	154	1.0	44,791	0.5
21 Gomphonema angustatum	154	1.0	55,603	0.6

Aphanizomenon flos-aquae cells/mL = 48,652
 Aphanizomenon flos-aquae heterocysts/mL = 108

Microcystis aeruginosa cells/mL = 178,547

Note: Toxic species counted 4X as much as others.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: BRBE
Sample Depth: SG
Sample Date: 2-Sep-08

Total Density (#/mL): 19,203
Total Biovolume ($\mu\text{m}^3/\text{mL}$): 14,893,570
Trophic State Index: 69.3

Species	Density #/mL	Density Percent	Biovolume $\mu\text{m}^3/\text{mL}$	Biovolume Percent
1 Aphanizomenon flos-aquae	9,513	49.5	7,791,377	52.3
2 Cocconeis placentula	2,114	11.0	972,469	6.5
3 Nitzschia frustulum	1,762	9.2	274,828	1.8
4 Microcystis aeruginosa	1,409	7.3	3,213,375	21.6
5 Navicula cryptocephala	705	3.7	130,367	0.9
6 Gomphonema subclavatum	705	3.7	507,375	3.4
7 Nitzschia palea	529	2.8	95,133	0.6
8 Synedra ulna	352	1.8	701,164	4.7
9 Gomphonema angustatum	352	1.8	63,422	0.4
10 Rhoicosphenia curvata	352	1.8	41,224	0.3
11 Gomphonema truncatum	352	1.8	479,188	3.2
12 Scenedesmus quadricauda	176	0.9	45,805	0.3
13 Gomphonema gracile	176	0.9	43,162	0.3
14 Fragilaria construens	176	0.9	394,625	2.6
15 Achnanthes lanceolata	176	0.9	31,711	0.2
16 Navicula cryptocephala veneta	176	0.9	16,736	0.1
17 Cryptomonas erosa	176	0.9	91,609	0.6

Aphanizomenon flos-aquae cells/mL = 123,673
 Aphanizomenon flos-aquae heterocysts/mL = 881

Microcystis aeruginosa cells/mL = 401,672

Note: toxic species counted 4X as much as others.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: BVFI
Sample Depth: SG
Sample Date: 2-Sep-08

Total Density (#/mL): 23,225
Total Biovolume (um³/mL): 15,380,251
Trophic State Index: 69.6

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Aphanizomenon flos-aquae	7,146	30.8	7,203,296	46.8
2 Cocconeis placentula	5,757	24.8	2,648,037	17.2
3 Nitzschia frustulum	3,176	13.7	457,352	3.0
4 Navicula cryptocephala veneta	1,390	6.0	132,005	0.9
5 Gomphonema subclavatum	993	4.3	595,511	3.9
6 Nitzschia palea	794	3.4	142,923	0.9
7 Navicula cryptocephala	596	2.6	110,169	0.7
8 Navicula tripunctata	596	2.6	666,972	4.3
9 Microcystis aeruginosa	397	1.7	2,010,444	13.1
10 Rhoicosphenia curvata	397	1.7	46,450	0.3
11 Synedra ulna	397	1.7	790,044	5.1
12 Cryptomonas erosa	199	0.9	103,222	0.7
13 Nitzschia innominata	199	0.9	9,528	0.1
14 Gomphonema angustatum	199	0.9	35,731	0.2
15 Cyclotella meneghiniana	199	0.9	75,431	0.5
16 Cymbella minuta	199	0.9	73,446	0.5
17 Rhodomonas minuta	199	0.9	3,970	0.0
18 Fragilaria construens	199	0.9	266,789	1.7
19 Navicula minuscula	199	0.9	8,933	0.1

Aphanizomenon flos-aquae cells/mL = 114,338
 Aphanizomenon flos-aquae heterocysts/mL = 199

Microcystis aeruginosa cells/mL = 251,305

Note: toxic species counted 4X as much as others.

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Station: OR
Sample Depth: 0C
Sample Date: 2-Sep-08

Total Density (#/mL): 1,129
Total Biovolume (um³/mL): 686,521
Trophic State Index: 47.1

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent
1 Epithemia sorex	237	21.0	351,780	51.2
2 Cocconeis placentula	227	20.1	104,226	15.2
3 Navicula cryptocephala	129	11.5	23,953	3.5
4 Nitzschia frustulum	119	10.5	14,242	2.1
5 Rhodomonas minuta	65	5.7	1,295	0.2
6 Navicula cryptocephala veneta	54	4.8	5,125	0.7
7 Aphanizomenon flos-aquae	44	3.9	30,656	4.5
8 Rhoicosphenia curvata	43	3.8	5,049	0.7
9 Scenedesmus quadricauda	32	2.9	14,096	2.1
10 Microcystis aeruginosa	27	2.4	25,895	3.8
11 Cymbella affinis	22	1.9	38,842	5.7
12 Achnanthes minutissima	22	1.9	1,079	0.2
13 Chlamydomonas sp.	11	1.0	3,507	0.5
14 Cyclotella meneghiniana	11	1.0	4,100	0.6
15 Diatoma vulgare	11	1.0	42,295	6.2
16 Nitzschia sp.	11	1.0	1,295	0.2
17 Nitzschia palea	11	1.0	1,942	0.3
18 Synedra mazamaensis	11	1.0	2,762	0.4
19 Fragilaria vaucheriae	11	1.0	3,107	0.5
20 Dinobryon sp.	11	1.0	4,046	0.6
21 Cryptomonas erosa	11	1.0	5,611	0.8
22 Navicula sp.	11	1.0	1,618	0.2

Aphanizomenon flos-aquae cells/mL = 487

Microcystis aeruginosa cells/mL = 3,237

Note: toxic species counted 4X as much as others.

Appendix II—USEPA Preliminary Microcystin Results

Subj: **Rush microcystin results**
Date: 9/9/2008 1:38:15 P.M. Pacific Daylight Time
From: Lincoff.Andy@epamail.epa.gov
To: klamathbga@lists.berkeley.edu

The following are preliminary results for 5 rush Klamath samples submitted by Susan Corum. All QA criteria for these analyses were met, however these results have not been through peer and final QA review.

KRBI090208-SG	12 ppb
SVMN090208-SG	63 ppb
SVFD090208-SG	230 ppb
BVFI090208-SG	110 ppb
BRBE090208-SG	840 ppb

Andrew Lincoff
US EPA Region 9 Lab
1337 S. 46th St., Bldg. 201
Richmond, CA 94804

510 412 2330
fax 510 412 2304
lincoff.andy@epa.gov