



Technical Memorandum

Karuk Tribe Klamath River Toxic Algae and Microcystin Monitoring Results through August 11, 2010

Prepared for: Karuk Tribe of California
Natural Resources Department

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Date: August 16, 2010

This memo provides results received to date from the Karuk Tribe's Klamath River public health monitoring program for toxic cyanobacteria. These results are shown below (Table 1; Appendix II) with the additional pending cell density and microcystin toxin results shown as blanks. As of August 11th, all available cell density and toxin results were below World Health Organization and State Water Resources Control Board/Office of Environmental Health and Hazard Assessment public health guideline levels (Table 1). *Microcystis aeruginosa* was detected at Station IB (928 cells/ml) and *Anabaena flos-aquae* was detected at stations HC (976 cells/ml) and BB (72 cells/ml). There were no detections of *Planktothrix (Oscillatoria)* at any of the river stations on August 11th. As further results are received from Aquatic Analysts (data shown herein are only for a sub-set of stations for which Aquatic Analysts performed a "rush" analysis) and the USEPA Region 9 Laboratory, an updated technical memorandum will be provided.

Disclaimer

Due to the patchy nature of blue-green algal blooms and limitations in the spatial coverage of algal sampling programs, water users should always avoid contact with water whenever noticeable surface concentrations of algae or an obvious green to blue-green appearance are evident.

Table 1. Cumulative results for cell density and risk exceedance for toxigenic cyanobacteria in the Klamath River, 2010.

Date	Station Name	RM	Sample Event	Station Description	Depth	Microcystis aeruginosa (cells/ml)	Planktothrix (Oscillatoria) sp. (cells/ml)	Anabaena sp. (cells/ml)	Microcystin Total (µg/L)	Exceedance of SWRCB ¹ risk level of 40,000 cells/ml Microcystis or Planktothrix (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)
6/9/10	SA	0	PH	Salmon River	OC				ND		0
6/9/10	SC	0	PH	Scott River	OC				ND		0
6/9/10	SH	0	PH	Shasta River	OC				ND		0
6/9/10	OR	59.1	PH	Orleans	OC				ND		0
6/9/10	OR	59.1	PH	Orleans	SG	0	0	0		0	
6/9/10	HC	108.4	PH	Happy Camp	OC				ND		0
6/9/10	HC	108.4	PH	Happy Camp	SG	0	0	0	ND	0	0
6/9/10	SV	128.5	PH	Seiad Valley	OC				ND		0
6/9/10	SV	128.5	PH	Seiad Valley	SG	0	0	0	ND	0	0
6/9/10	SD	128.5	PH	Seiad Valley Dup	SG	0	0	0	ND	0	0
6/9/10	BB	150	PH	Brown Bear	SG	0	0	0	ND	0	0
6/9/10	WA	157	PH	Walker Bridge	OC				ND		0
6/9/10	IB	176	PH	IB (I5 Bridge)	SG	0	0	0		0	
6/23/10	OR	59.1	PH	Orleans	OC				ND		0
6/23/10	OR	59.1	PH	Orleans	SG	0	0	0		0	
6/23/10	HC	108.4	PH	Happy Camp	SG	0	0	0	ND	0	0
6/23/10	WA	157	PH	Walker Bridge	OC				ND		0
6/23/10	SV	128.5	PH	Seiad Valley	OC				ND		0
6/23/10	SV	128.5	PH	Seiad Valley	SG	0	0	0	ND	0	0
6/23/10	SD	128.5	PH	Seiad Valley Dup	OC				ND		0
6/23/10	BB	150	PH	Brown Bear	SG	0	0	0	ND	0	0
6/23/10	IB	176	PH	IB (I5 Bridge)	SG	0	0	74		0	
6/23/10	IG	189.7	PH	Below Iron Gate	OC				ND		0
7/8/2010	SH	0	PH	Shasta River	OC				ND		0
7/8/2010	OR	59.1	PH	Orleans	OC				ND		0
7/8/2010	OR	59.1	PH	Orleans	SG	0	0	0	ND	0	0
7/8/2010	HC	108.4	PH	Happy Camp	OC				ND		0
7/8/2010	HC	108.4	PH	Happy Camp	SG	0	0	0	ND	0	0
7/8/2010	WA	157	PH	Walker Bridge	OC				0.15		0.02
7/8/2010	SV	128.5	PH	Seiad Valley	OC				ND		0
7/8/2010	SV	128.5	PH	Seiad Valley	SG	0	0	0	ND	0	0
7/8/2010	SD	128.5	PH	Seiad Valley Dup	OC				ND		0
7/8/2010	SD	128.5	PH	Seiad Valley Dup	SG	0	0	0	ND	0	0
7/8/2010	BB	150	PH	Brown Bear	SG	0	0	0	ND	0	0
7/8/2010	IB	176	PH	IB (I5 Bridge)	SG	0	0	59	ND	0	0
7/21/2010	SH	0	PH	Shasta River	OC				0.16		0.02
7/21/2010	OR	59.1	PH	Orleans	OC				ND		0
7/21/2010	OR	59.1	PH	Orleans	SG	0	0	0	0.15	0	0.02
7/21/2010	HC	108.4	PH	Happy Camp	SG	0	0	0	0.15	0	0.02
7/21/2010	WA	157	PH	Walker Bridge	OC				0.17		0.02
7/21/2010	SV	128.5	PH	Seiad Valley	OC				0.16		0.02
7/21/2010	SV	128.5	PH	Seiad Valley	SG	0	0	0	0.15	0	0.02
7/21/2010	BB	150	PH	Brown Bear	SG	0	0	0	0.18	0	0.02
7/21/2010	IB	176	PH	IB (I5 Bridge)	SG	0	0	124	0.25	0	0.03
7/21/2010	IG	189.7	PH	Below Iron Gate	OC	0	0	0	0.28	0	0.04

Date	Station Name	RM	Sample Event	Station Description	Depth	Microcystis aeruginosa (cells/ml)	Planktothrix (Oscillatoria) sp. (cells/ml)	Anabaena sp. (cells/ml)	Microcystin Total (µg/L)	Exceedance of SWRCB ¹ risk level of 40,000 cells/ml Microcystis or Planktothrix (x greater than 4 ⁵ cells/ml)	Exceedance of microcystin TDI of 0.04 µg/kg/day for a 20kg (44lb) child ingesting 100 ml ² (x greater than TDI)
8/4/2010	OR	59.1	PH	Orleans	SG	0	0	0	0	0	
8/4/2010	HC	108.4	PH	Happy Camp	SG	0	0	0	0	0	
8/4/2010	SV	128.5	PH	Seiad Valley	SG	0	0	0	0	0	
8/4/2010	SD	128.5	PH	Seiad Valley Dup	SG	0	0	0	0	0	
8/4/2010	BB	150	PH	Brown Bear	SG	0	0	0	0	0	
8/4/2010	IB	176	PH	IB (I5 Bridge)	SG	1552	0	0	0	0	
8/11/2010	OR	59.1	PH	Orleans	SG	0	0	0	0	0	
8/11/2010	HC	108.4	PH	Happy Camp	SG	0	0	976	0	0	
8/11/2010	SV	128.5	PH	Seiad Valley	SG	0	0	0	0	0	
8/11/2010	BB	150	PH	Brown Bear	SG	0	0	72	0	0	
8/11/2010	IB	176	PH	IB (I5 Bridge)	SG	928	0	0	0	0	

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)

²The TDI or tolerable daily intake (e.g., WHO 1999):

http://www.who.int/water_sanitation_health/resourcesquality/toxiccyanbact/en/ as computed here for a 20kg child is equivalent to the exceedance of the 8µg/L microcystin value as shown in Appendix 6 of document in footnote 1 above.

³OC denotes sampling near mid-channel mixed region

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

Appendix I

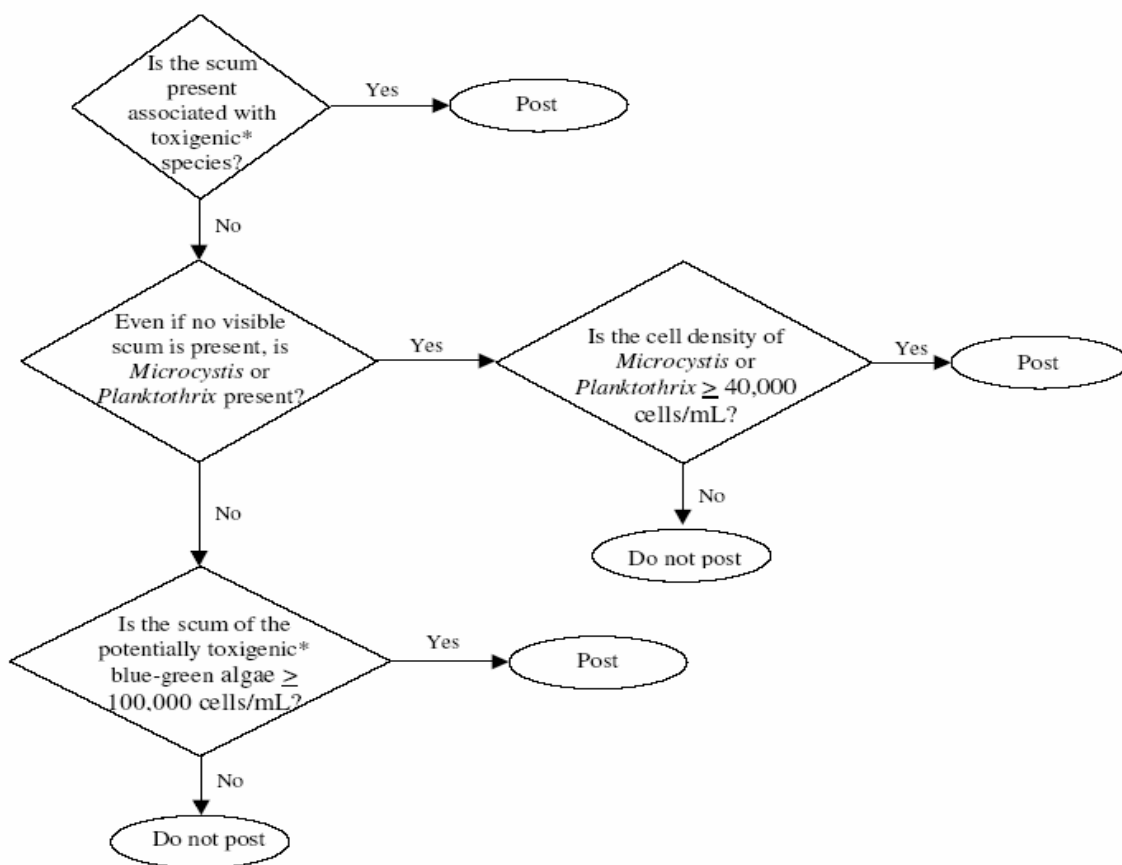
From: Blue Green Algae Work Group of the State Water Resources Control Board and Office of Environmental Health and Hazard Assessment

Cyanobacteria in California Recreational Water Bodies Providing Voluntary Guidance about Harmful Algal Blooms, Their Monitoring, and Public Notification (DRAFT June 2007)

<http://www.waterboards.ca.gov/bluegreenalgae/index.html>

Posting Decisions:

- If visible scum is present: Post warning signs and distribute informational brochures.
- When sampling with microbial identification is available, the following decision chart is recommended:



*Potentially toxic blue-green algae that have been detected in California include those of the genera *Anabaena*, *Microcystis*, *Aphanizomenon*, and *Gloeotrichia*. Additional blue-green algae that are known to be potentially toxic may be added to this list.

Appendix II: Aquatic Analysts Phytoplankton Lab Sheets**Phytoplankton Sample Analysis**

Sample: Klamath Basin
Sample Site: BB
Sample Depth: SG
Sample Date: 11-Aug-10

Total Density (#/mL): 794
Total Biovolume (um³/mL): 337,059
Trophic State Index: 42.0

Species	Density #/mL	Density Percent	Biovolume um³/mL	Biovolume Percent	Group
1 Cocconeis placentula	476	60.0	219,078	65.0	diatom
2 Nitzschia frustulum	79	10.0	10,478	3.1	diatom
3 Navicula cryptocephala	36	4.5	6,675	2.0	diatom
4 Navicula cryptocephala veneta	29	3.6	2,742	0.8	diatom
5 Achnanthes minutissima	29	3.6	1,443	0.4	diatom
6 Rhoicosphenia curvata	22	2.7	2,533	0.8	diatom
7 Amphora perpusilla	14	1.8	2,396	0.7	diatom
8 Gomphonema angustatum	14	1.8	2,598	0.8	diatom
9 Diatoma tenue	14	1.8	4,185	1.2	diatom
10 Nitzschia palea	14	1.8	2,598	0.8	diatom
11 Cryptomonas erosa	7	0.9	3,752	1.1	cryptophyte
12 Gomphonema clevei	7	0.9	649	0.2	diatom
13 Synedra ulna	7	0.9	14,360	4.3	diatom
14 Rhodomonas minuta	7	0.9	144	0.0	cryptophyte
15 Anabaena flos-aquae	7	0.9	4,835	1.4	bluegreen
16 Asterionella formosa	7	0.9	1,588	0.5	diatom
17 Cymbella mexicana	7	0.9	39,688	11.8	diatom
18 Gomphonema subclavatum	7	0.9	4,330	1.3	diatom
19 Cymbella affinis	7	0.9	12,989	3.9	diatom

Anabaena flos-aquae cells/mL = 72

Aquatic Analysts

Sample ID: NS82

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: SV
Sample Depth: SG
Sample Date: 11-Aug-10

Total Density (#/mL): 1,394
Total Biovolume (um³/mL): 951,610
Trophic State Index: 49.5

Species	Density	Density	Biovolume	Biovolume	Group
	#/mL	Percent	um ³ /mL	Percent	
1 <i>Cocconeis placentula</i>	633	45.5	291,376	30.6	diatom
2 <i>Nitzschia frustulum</i>	190	13.6	22,803	2.4	diatom
3 <i>Achnanthes minutissima</i>	127	9.1	6,334	0.7	diatom
4 <i>Synedra ulna</i>	89	6.4	211,767	22.3	diatom
5 <i>Epithemia sores</i>	89	6.4	101,095	10.6	diatom
6 <i>Gomphoneis herculeana</i>	38	2.7	205,230	21.6	diatom
7 <i>Navicula cryptocephala</i>	38	2.7	7,031	0.7	diatom
8 <i>Cymbella sinuata</i>	25	1.8	3,547	0.4	diatom
9 <i>Cymbella affinis</i>	25	1.8	45,607	4.8	diatom
10 <i>Navicula cryptocephala veneta</i>	13	0.9	1,204	0.1	diatom
11 <i>Gomphonema subclavatum</i>	13	0.9	15,202	1.6	diatom
12 <i>Chlamydomonas</i> sp.	13	0.9	4,117	0.4	green
13 <i>Diatoma vulgare</i>	13	0.9	24,830	2.6	diatom
14 <i>Selenastrum minutum</i>	13	0.9	253	0.0	green
15 <i>Navicula decussis</i>	13	0.9	2,432	0.3	diatom
16 <i>Synedra mazamaensis</i>	13	0.9	3,243	0.3	diatom
17 <i>Cyclotella ocellata</i>	13	0.9	1,584	0.2	diatom
18 <i>Amphora perpusilla</i>	13	0.9	2,103	0.2	diatom
19 <i>Nitzschia paleacea</i>	13	0.9	1,242	0.1	diatom
20 <i>Fragilaria construens venter</i>	13	0.9	608	0.1	diatom

Aquatic Analysts

Sample ID: NS86

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: OR
Sample Depth: SG
Sample Date: 11-Aug-10

Total Density (#/mL): 1,897
Total Biovolume (um³/mL): 1,814,989
Trophic State Index: 54.1

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent	Group
1 Epithemia sorex	734	38.7	920,147	50.7	diatom
2 Cocconeis placentula	412	21.7	189,348	10.4	diatom
3 Diatoma tenue	125	6.6	36,331	2.0	diatom
4 Synedra ulna	72	3.8	142,459	7.8	diatom
5 Cymbella affinis	72	3.8	128,857	7.1	diatom
6 Gomphonema angustatum	54	2.8	9,664	0.5	diatom
7 Melosira varians	36	1.9	46,532	2.6	diatom
8 Cymbella sinuata	36	1.9	5,011	0.3	diatom
9 Gomphoneis herculeana	36	1.9	193,286	10.6	diatom
10 Rhodomonas minuta	36	1.9	716	0.0	cryptophyte
11 Nitzschia frustulum	36	1.9	8,590	0.5	diatom
12 Gomphonema ventricosum	18	0.9	15,212	0.8	diatom
13 Diatoma vulgare	18	0.9	35,078	1.9	diatom
14 Amphora ovalis	18	0.9	10,344	0.6	diatom
15 Navicula graciloides	18	0.9	7,785	0.4	diatom
16 Synedra mazamaensis	18	0.9	4,582	0.3	diatom
17 Nitzschia palea	18	0.9	3,221	0.2	diatom
18 Scenedesmus quadricauda	18	0.9	4,653	0.3	green
19 Amphora perpusilla	18	0.9	2,971	0.2	diatom
20 Fragilaria vaucheriae	18	0.9	5,154	0.3	diatom
21 Fragilaria construens venter	18	0.9	3,436	0.2	diatom
22 Rhoicosphenia curvata	18	0.9	2,094	0.1	diatom
23 Navicula pupula	18	0.9	4,832	0.3	diatom
24 Fragilaria construens	18	0.9	28,062	1.5	diatom
25 Cymbella minuta	18	0.9	6,622	0.4	diatom

Aquatic Analysts

Sample ID: NS88

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: HC
Sample Depth: SG
Sample Date: 11-Aug-10

Total Density (#/mL): 1,171
Total Biovolume (um³/mL): 1,119,152
Trophic State Index: 50.7

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent	Group
1 Epithemia sorex	542	46.3	679,752	60.7	diatom
2 Cocconeis placentula	260	22.2	119,688	10.7	diatom
3 Anabaena sp.	65	5.6	66,349	5.9	bluegreen
4 Nitzschia frustulum	54	4.6	6,505	0.6	diatom
5 Achnanthes minutissima	43	3.7	2,168	0.2	diatom
6 Navicula cryptocephala	43	3.7	8,023	0.7	diatom
7 Synedra ulna	33	2.8	84,140	7.5	diatom
8 Diatoma vulgare	22	1.9	42,498	3.8	diatom
9 Cymbella affinis	11	0.9	19,514	1.7	diatom
10 Nitzschia linearis	11	0.9	16,522	1.5	diatom
11 Nitzschia palea	11	0.9	1,951	0.2	diatom
12 Nitzschia capitellata	11	0.9	3,903	0.3	diatom
13 Tetraedron minimum	11	0.9	1,951	0.2	green
14 Gomphonema angustatum	11	0.9	1,951	0.2	diatom
15 Diatoma tenue	11	0.9	3,144	0.3	diatom
16 Navicula cryptocephala veneta	11	0.9	1,030	0.1	diatom
17 Cymbella sinuata	11	0.9	1,518	0.1	diatom
18 Gomphoneis herculeana	11	0.9	58,543	5.2	diatom

Anabaena sp. cells/mL = 976

Aquatic Analysts

Sample ID: NS89

Phytoplankton Sample Analysis

Sample: Klamath Basin
Sample Site: IB
Sample Depth: SG
Sample Date: 11-Aug-10

Total Density (#/mL): 1,002
Total Biovolume (um³/mL): 553,352
Trophic State Index: 45.6

Species	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent	Group
1 Cocconeis placentula	575	57.4	264,552	47.8	diatom
2 Microcystis aeruginosa	93	9.3	7,421	1.3	bluegreen
3 Nitzschia frustulum	65	6.5	7,792	1.4	diatom
4 Rhodomonas minuta	46	4.6	928	0.2	cryptophyte
5 Cryptomonas erosa	28	2.8	14,471	2.6	cryptophyte
6 Gomphonema herculeana	28	2.8	195,353	35.3	diatom
7 Aphanizomenon flos-aquae	28	2.8	22,791	4.1	bluegreen
8 Navicula cryptocephala veneta	19	1.9	1,762	0.3	diatom
9 Gomphonema angustatum	19	1.9	3,339	0.6	diatom
10 Nitzschia dissipata	19	1.9	4,990	0.9	diatom
11 Ankistrodesmus falcatus	9	0.9	232	0.0	green
12 Asterionella formosa	9	0.9	2,041	0.4	diatom
13 Synedra ulna	9	0.9	18,459	3.3	diatom
14 Nitzschia sp.	9	0.9	1,113	0.2	diatom
15 Cymbella minuta	9	0.9	3,432	0.6	diatom
16 Achnanthes lanceolata	9	0.9	1,670	0.3	diatom
17 Amphora perpusilla	9	0.9	1,540	0.3	diatom
18 Nitzschia paleacea	9	0.9	909	0.2	diatom
19 Navicula cascadenis	9	0.9	557	0.1	diatom

Microcystis aeruginosa cells/mL = 928
 Aphanizomenon flos-aquae cells/mL = 362

Aquatic Analysts

Sample ID: NS91