

Technical Memorandum BCWA



Date: February 18, 2019
To: Bear Creek Watershed Association
From: Russell N. Clayshulte, Manager
Re: BCWA TM 2018.09 BCR Phytoplankton Summary

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Phytoplankton samples are taken at the Site 40 buoy in BCR for the July, August, September, and October sample periods. The samples are 1-liter composites taken at -1 meter. Samples are taken for laboratory analyses. This resulted in 5 sample sets. The phytoplankton summary data provides general species composition, average biodensity and average total density. The *BCWA MSD17 Phytoplankton Master* spreadsheet maintains the full phytoplankton record and data analyses.



Figure 1 Phytoplankton Sampled at Site 40 in Center of Reservoir

Table 1 Phytoplankton for Monitoring Season

Species	Mid July to Mid-October				
	Density	Density	Biovolume	Biovolume	Group
	#/mL	Percent	um ³ /mL	Percent	
Anabaena flos-aquae	55	1.7	222,184	29.9	bluegreen
Aphanizomenon flos-aquae	37	1.1	23,213	3.1	bluegreen
Aphanizomenon flos-aquae	43	2.5	40,667	2.6	bluegreen
Aphanizomenon flos-aquae	51	0.7	97,305	1.8	bluegreen
Lyngbya sp.	74	2.3	2,211	0.3	bluegreen
Microcystis aeruginosa	2,137	65.9	37,613	5.1	bluegreen
Microcystis aeruginosa	559	32.1	1,083,089	70.5	bluegreen
Oscillatoria sp.	55	1.7	68,534	9.2	bluegreen
Chrysococcus rufescens	14	1.0	1,166	0.2	chrysophyte
Dinobryon sp.	41	3.1	5,144	0.7	chrysophyte
Kephyrion littorale	82	6.1	7,818	1.1	chrysophyte
Cryptomonas erosa	18	0.6	9,580	1.3	cryptophyte
Cryptomonas erosa	274	20.4	142,652	19.6	cryptophyte
Cryptomonas erosa	3,655	47.0	1,900,790	34.7	cryptophyte
Rhodomonas minuta	111	3.4	2,211	0.3	cryptophyte
Rhodomonas minuta	41	3.1	823	0.1	cryptophyte
Rhodomonas minuta	839	48.1	16,783	1.1	cryptophyte
Rhodomonas minuta	2,860	85.4	57,192	15.0	cryptophyte
Rhodomonas minuta	463	6.0	9,267	0.2	cryptophyte
Achnanthes lanceolata	14	1.0	2,469	0.3	diatom
Achnanthes linearis	37	1.1	4,864	0.7	diatom
Achnanthes linearis	22	1.2	2,840	0.2	diatom
Achnanthes minutissima	111	3.4	5,527	0.7	diatom
Achnanthes minutissima	165	12.2	8,230	1.1	diatom
Achnanthes minutissima	43	2.5	3,228	0.2	diatom
Achnanthes minutissima	54	1.6	2,723	0.7	diatom
Achnanthes minutissima	721	9.3	39,643	0.7	diatom
Amphora perpusilla	14	1.0	4,554	0.6	diatom
Amphora perpusilla	51	0.7	8,546	0.2	diatom
Asterionella formosa	261	19.4	131,871	18.1	diatom
Asterionella formosa	27	0.8	5,992	1.6	diatom
Cocconeis placentula	103	1.3	47,365	0.9	diatom
Cyclotella meneghiniana	27	0.8	10,349	2.7	diatom
Cyclotella meneghiniana	103	1.3	39,128	0.7	diatom
Cymbella minuta	18	0.6	6,817	0.9	diatom
Cymbella minuta	55	4.1	20,300	2.8	diatom
Cymbella minuta	27	0.8	10,077	2.6	diatom
Cymbella sinuata	27	2.0	3,841	0.5	diatom
Diatoma vulgare	92	2.8	216,657	29.2	diatom
Diatoma vulgare	82	2.4	208,179	54.6	diatom
Diatoma vulgare	1,339	17.2	2,623,626	47.8	diatom
Fragilaria vaucheria	18	0.6	5,306	0.7	diatom
Fragilaria vaucheria	27	2.0	7,901	1.1	diatom
Fragilaria vaucheria	27	0.8	7,843	2.1	diatom
Gomphonema angustatum	18	0.6	3,316	0.4	diatom
Gomphonema angustatum	206	2.6	37,068	0.7	diatom
Gomphonema clevei	14	1.0	1,234	0.2	diatom
Gomphonema subclavatum	18	0.6	11,054	1.5	diatom
Gomphonema subclavatum	27	0.8	16,341	4.3	diatom

Species	Mid July to Mid-October				
	Density #/mL	Density Percent	Biovolume um ³ /mL	Biovolume Percent	Group
Melosira ambigua	151	11.2	346,591	47.6	diatom
Melosira granulata	18	0.6	30,398	4.1	diatom
Melosira granulata angustissima	14	1.0	3,429	0.5	diatom
Meridion circulare	14	1.0	5,281	0.7	diatom
Meridion circulare	54	1.6	20,970	5.5	diatom
Navicula cascadenis	14	1.0	823	0.1	diatom
Navicula cryptocephala	111	3.4	20,450	2.8	diatom
Navicula cryptocephala	27	2.0	5,075	0.7	diatom
Navicula cryptocephala	22	1.2	3,981	0.3	diatom
Navicula cryptocephala	51	0.7	9,525	0.2	diatom
Navicula cryptocephala veneta	103	1.3	9,782	0.2	diatom
Navicula radiosa	14	1.0	4,458	0.6	diatom
Navicula sp.	55	1.7	8,290	1.1	diatom
Navicula viridula	51	0.7	23,168	0.4	diatom
Nitzschia acicularis	27	0.8	7,626	2.0	diatom
Nitzschia frustulum	18	0.6	2,211	0.3	diatom
Nitzschia palea	18	0.6	3,316	0.4	diatom
Nitzschia palea	54	1.6	9,804	2.6	diatom
Nitzschia paleacea	22	1.2	2,109	0.1	diatom
Pinnularia borealis	14	1.0	3,018	0.4	diatom
Pinnularia sp.	27	0.8	10,894	2.9	diatom
Pinnularia sp.	51	0.7	20,594	0.4	diatom
Rhoicosphenia curvata	18	0.6	2,156	0.3	diatom
Rhoicosphenia curvata	103	1.3	12,047	0.2	diatom
Stauroneis sp.	27	0.8	9,260	2.4	diatom
Stephanodiscus astraeca minutula	43	2.5	15,062	1.0	diatom
Stephanodiscus hantzschii	18	0.6	2,211	0.3	diatom
Stephanodiscus hantzschii	22	1.2	2,582	0.2	diatom
Stephanodiscus hantzschii	103	1.3	12,356	0.2	diatom
Stephanodiscus niagarae	43	2.5	344,275	22.4	diatom
Stephanodiscus niagarae	51	0.7	411,872	7.5	diatom
Synedra cyclopus	14	1.0	11,590	1.6	diatom
Synedra radians	14	1.0	4,938	0.7	diatom
Synedra rumpens	37	1.1	5,158	0.7	diatom
Synedra rumpens	27	0.8	3,813	1.0	diatom
Synedra ulna	18	0.6	36,662	4.9	diatom
Ankistrodesmus falcatus	74	2.3	1,842	0.2	green
Ankistrodesmus falcatus	27	2.0	1,029	0.1	green
Chlamydomonas sp.	18	0.6	5,988	0.8	green
Chlamydomonas sp.	43	2.5	13,986	0.9	green
Chlamydomonas sp.	412	5.3	133,858	2.4	green
Scenedesmus bijuga	51	0.7	14,416	0.3	green
Scenedesmus quadricauda	43	2.5	8,392	0.5	green
Sphaerocystis schroeteri	18	0.6	3,869	0.5	green
Sphaerocystis schroeteri	14	1.0	3,841	0.5	green
Ulothrix sp.	103	1.3	32,950	0.6	green

Table 2 Phytoplankton Summary by Sample Set

	9-Jul-18	10-Aug-18	10-Sep-18	26-Sep-18	15-Oct-18
Total Density (#/mL):	3,242	1,344	1,743	3,350	7,774
Total Biovolume (um³/mL):	742,006	728,076	1,536,993	381,062	5,483,305
Trophic State Index:	47.7	47.6	52.9	42.9	62.1

Table 3 Species Diversity, Density and Biovolume by Functional Group

Functional Group	Species	Seasonal Ave Density #/ml	Seasonal Ave Biovolume, um ³ /mL
Bluegreen	5	315	181,402
chrysophyte	5	463	143,145
Diatom	39	59	56,418
Green	6	70	18,721

Table 4 Dominate Species During Seasonal Sampling

Species with >100,000 Biovolume um ³ /mL	
Anabaena flos-aquae	Bluegreen
Aphanizomenon flos-aquae	
Microcystis aeruginosa	
Cryptomonas erosa	Chrysophyte
Asterionella formosa	Diatom
Diatoma vulgare	
Melosira ambigua	
Stephanodiscus niagarae	
Chlamydomonas sp.	Green

Table 5 Peak Species Density and Biovolume

Species	Peak Density #/ml	Peak Biovolume um ³ /mL
Microcystis aeruginosa	2,137	1,083,089
Cryptomonas erosa	3,655	1,900,790
Diatoma vulgare	1,339	2,623,626

Table 6 Average Seasonal Phytoplankton Species

Species	Mid July to Mid October				Functional Group
	Density #/ml	% Density	Biovolume um ³ /mL	% Biovolume	
<i>Anabaena flos-aquae</i>	55	1.7	222,184	29.9	Bluegreen
<i>Aphanizomenon flos-aquae</i>	44	1.4	53,728	2.5	Bluegreen
<i>Lyngbya sp.</i>	74	2.3	2,211	0.3	Bluegreen
<i>Microcystis aeruginosa</i>	1,348	49.0	560,351	37.8	Bluegreen
<i>Oscillatoria sp.</i>	55	1.7	68,534	9.2	Bluegreen
<i>Chrysococcus rufescens</i>	14	1.0	1,166	0.2	chrysophyte
<i>Dinobryon sp.</i>	41	3.1	5,144	0.7	chrysophyte
<i>Kephyrion littorale</i>	82	6.1	7,818	1.1	chrysophyte

Species	Mid July to Mid October				Functional Group
	Density #/ml	% Density	Biovolume um ³ /mL	% Biovolume	
<i>Cryptomonas erosa</i>	1,316	22.7	684,341	18.5	chrysophyte
<i>Rhodomonas minuta</i>	863	29.2	17,255	3.3	chrysophyte
<i>Achnanthes lanceolata</i>	14	1.0	2,469	0.3	Diatom
<i>Achnanthes linearis</i>	29	1.2	3,852	0.4	Diatom
<i>Achnanthes minutissima</i>	219	5.8	11,870	0.7	Diatom
<i>Amphora perpusilla</i>	33	0.8	6,550	0.4	Diatom
<i>Asterionella formosa</i>	144	10.1	68,931	9.8	Diatom
<i>Cocconeis placentula</i>	103	1.3	47,365	0.9	Diatom
<i>Cyclotella meneghiniana</i>	65	1.1	24,738	1.7	Diatom
<i>Cymbella minuta</i>	34	1.8	12,398	2.1	Diatom
<i>Cymbella sinuata</i>	27	2.0	3,841	0.5	Diatom
<i>Diatoma vulgare</i>	504	7.5	1,016,154	43.9	Diatom
<i>Fragilaria vaucheria</i>	24	1.1	7,017	1.3	Diatom
<i>Gomphonema angustatum</i>	112	1.6	20,192	0.6	Diatom
<i>Gomphonema clevei</i>	14	1.0	1,234	0.2	Diatom
<i>Gomphonema subclavatum</i>	23	0.7	13,697	2.9	Diatom
<i>Melosira ambigua</i>	151	11.2	346,591	47.6	Diatom
<i>Melosira granulata</i>	18	0.6	30,398	4.1	Diatom
<i>Melosira granulata angustissima</i>	14	1.0	3,429	0.5	Diatom
<i>Meridion circulare</i>	34	1.3	13,126	3.1	Diatom
<i>Navicula cascadiensis</i>	14	1.0	823	0.1	Diatom
<i>Navicula cryptocephala</i>	53	1.8	9,758	1.0	Diatom
<i>Navicula cryptocephala veneta</i>	103	1.3	9,782	0.2	Diatom
<i>Navicula radiosa</i>	14	1.0	4,458	0.6	Diatom
<i>Navicula sp.</i>	55	1.7	8,290	1.1	Diatom
<i>Navicula viridula</i>	51	0.7	23,168	0.4	Diatom
<i>Nitzschia acicularis</i>	27	0.8	7,626	2.0	Diatom
<i>Nitzschia frustulum</i>	18	0.6	2,211	0.3	Diatom
<i>Nitzschia palea</i>	36	1.1	6,560	1.5	Diatom
<i>Nitzschia paleacea</i>	22	1.2	2,109	0.1	Diatom
<i>Pinnularia borealis</i>	14	1.0	3,018	0.4	Diatom
<i>Pinnularia sp.</i>	39	0.7	15,744	1.6	Diatom
<i>Rhoicosphenia curvata</i>	61	0.9	7,101	0.3	Diatom
<i>Stauroneis sp.</i>	27	0.8	9,260	2.4	Diatom
<i>Stephanodiscus astraea minutula</i>	43	2.5	15,062	1.0	Diatom
<i>Stephanodiscus hantzschii</i>	48	1.0	5,716	0.2	Diatom
<i>Stephanodiscus niagarae</i>	47	1.6	378,073	15.0	Diatom
<i>Synedra cyclopum</i>	14	1.0	11,590	1.6	Diatom
<i>Synedra radians</i>	14	1.0	4,938	0.7	Diatom
<i>Synedra rumpens</i>	32	1.0	4,486	0.8	Diatom
<i>Synedra ulna</i>	18	0.6	36,662	4.9	Diatom
<i>Ankistrodesmus falcatus</i>	51	2.2	1,436	0.2	Green
<i>Chlamydomonas sp.</i>	158	2.8	51,277	1.4	Green
<i>Scenedesmus bijuga</i>	51	0.7	14,416	0.3	Green
<i>Scenedesmus quadricauda</i>	43	2.5	8,392	0.5	Green
<i>Sphaerocystis Schroeteri</i>	16	0.8	3,855	0.5	Green
<i>Ulothrix sp.</i>	103	1.3	32,950	0.6	Green

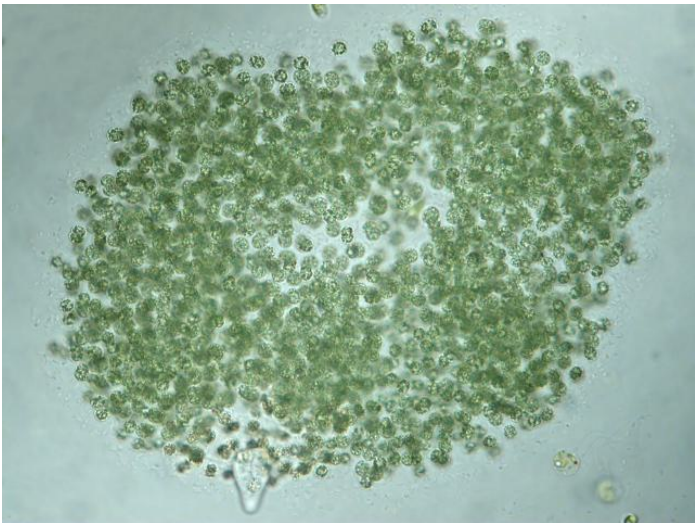


Figure 2 *Microcystis aeruginosa*

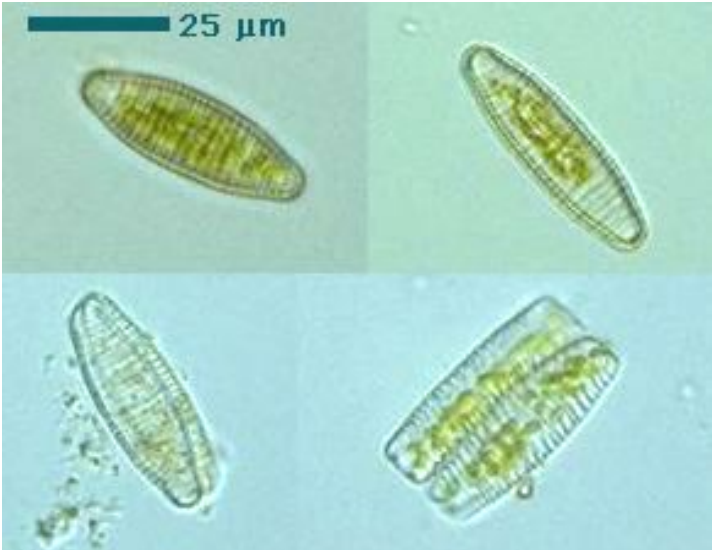


Figure 3 *Diatoma vulgare*

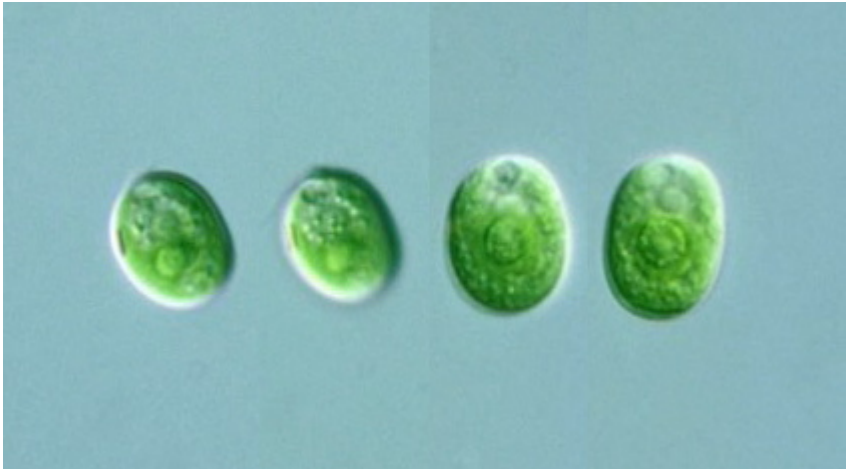


Figure 4 *Cryptomonas erosa*

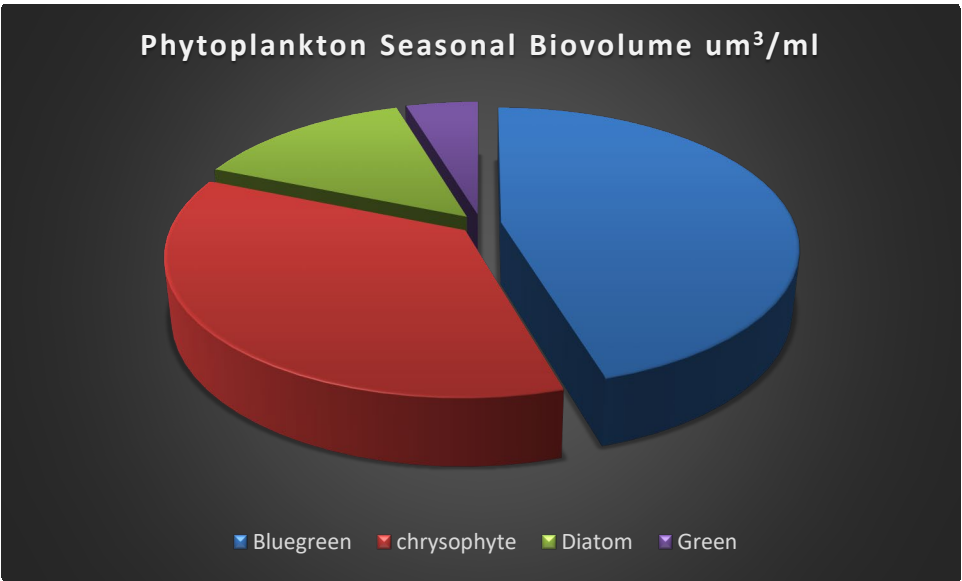


Figure 5 Seasonal Average Biovolumes by Functional Groups

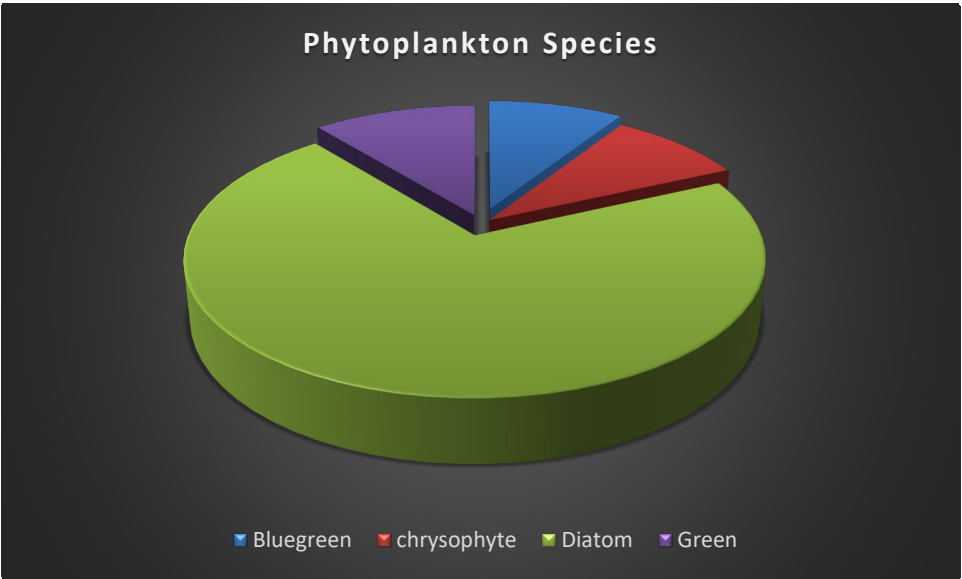


Figure 6 Phytoplankton Species Diversity