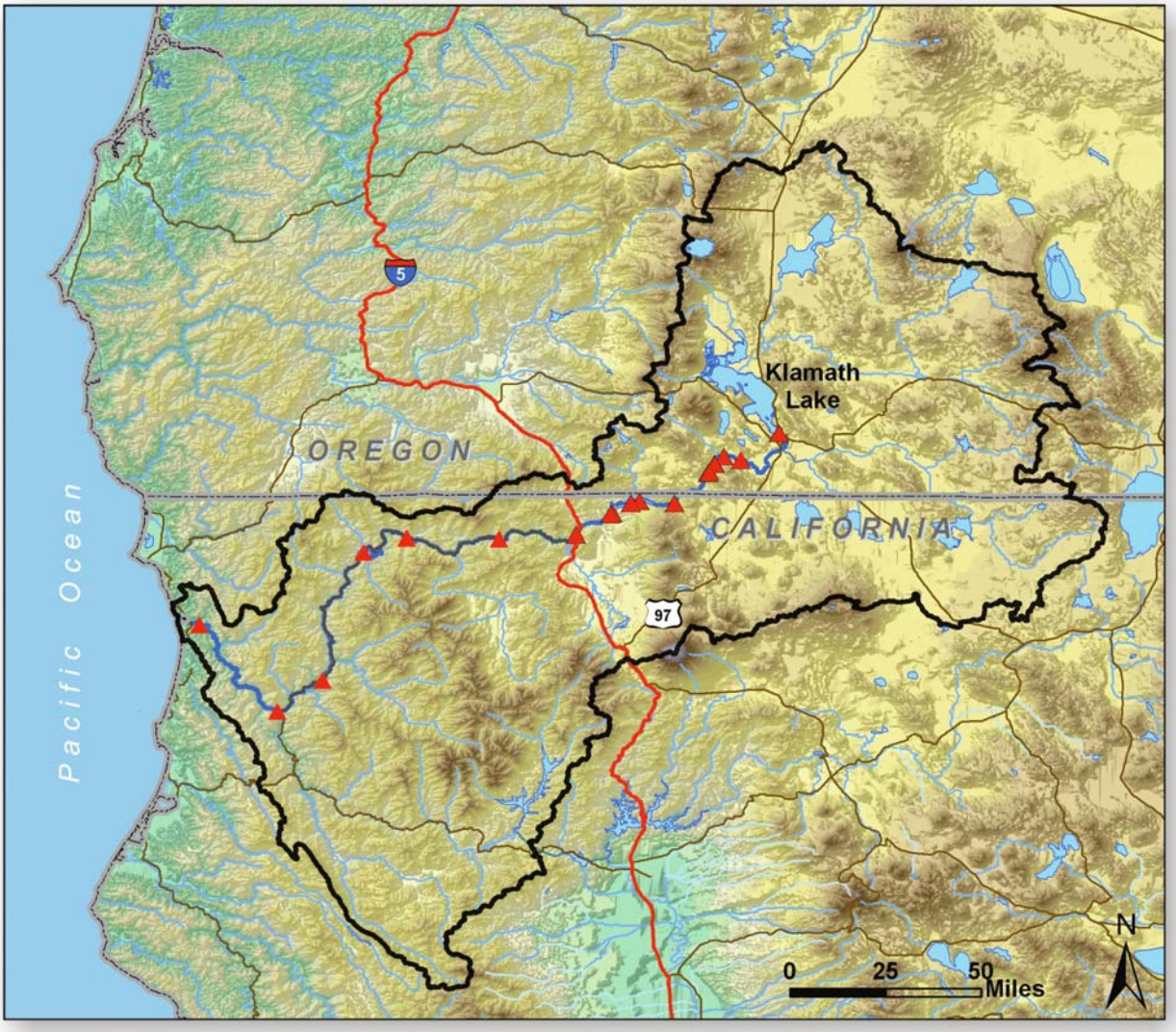
Results of 2007 Phytoplankton Sampling in the Klamath River and Klamath Hydroelectric Project (FERC 2082)



E&S Environmental Chemistry, Inc.

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Results of 2007 Phytoplankton Sampling in the Klamath River and Klamath Hydroelectric Project (FERC 2082)

Final Report

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Introduction

This report presents the results of phytoplankton sampling conducted by PacifiCorp during 2007 in the vicinity of the Klamath Hydroelectric Project (Project). The phytoplankton sampling during 2007 was a continuation of sampling that PacifiCorp has conducted over the last several years. PacifiCorp initiated the phytoplankton sampling in 2001, primarily in the Project reservoirs. The sampling was expanded in 2002 to include a number of river stations in the vicinity of the Project. The purpose of the phytoplankton sampling is to characterize the phytoplankton community and to identify the typical seasonal succession of phytoplankton in the Klamath River system in the vicinity of the Project.

The phytoplankton sampling is part of a larger program of water quality studies and management activities related to the Project. The intent of the program is to characterize water quality conditions of the Klamath River and reservoirs in the Project area, and to provide information to assist in the assessment of management actions aimed at water quality protection and enhancement.

Phytoplankton are important water quality indicators because of their high sensitivity to environmental change and short life span. Phytoplankton are also useful indicators of high nutrient concentration in water because of their propensity to multiply rapidly. Under the right conditions they can undergo rapid population growth, or “blooms”.

Measurements of chlorophyll *a* provide an index of algal productivity within the aquatic system. An understanding of the current conditions in the waters within the Project can be derived from measurement of phytoplankton indicators such as chlorophyll, algal biomass, and algal community species composition. As used in this report the term "algal” includes blue-green bacteria (cyanobacteria).

The Project is located along the 100 miles of the Klamath River immediately downstream of Upper Klamath Lake. Upper Klamath Lake is highly enriched with nutrients and supports a large population of the cyanobacteria *Aphanizomenon flos-aquae* and a smaller population of *Microcystis aeruginosa*. As water from the lake flows into the Klamath River it carries a large load of nutrient and organic material in the form of algal cells and associated metabolic products. This organic and nutrient load, combined with the additional inputs to Lake Ewauna from various sources, provides the input that drives the growth, species composition, and abundance of phytoplankton in the vicinity of the Project.

Methods

PacifiCorp began sampling phytoplankton in the Project in 2001, primarily in the Project reservoirs. The program was expanded in 2002 to include a number of river stations in the vicinity of the Project. The sampling program was designed to characterize the phytoplankton community and to identify the typical seasonal succession of phytoplankton in the system. In 2007 samples were collected from 21 locations, depicted in Figure 1 and listed in Table 1.

Phytoplankton samples for this report were collected on 29 dates, comprising 12 separate biweekly events, between June 6 and November 29, 2007. Samples were collected from approximately 0.5 m depth in the current at the river sites and from 0.5 to 1.0 m depth in the reservoir sites. In addition, an integrated sample of the top 8 m of water in Copco and Iron Gate reservoirs was collected at the site near the dam in each reservoir.

Grab samples at the river sites were collected by lowering a Kemmerer sampler from a bridge, or throwing from the shore, into the current. The sampler was retrieved, emptied into a churn splitter, and dispensed into sample containers supplied by the laboratory. The integrated samples from Copco and Iron Gate reservoirs were collected by lowering a weighted tube to 8 m, clamping off the top, retrieving the tube and draining it into a container. The contents of the container were mixed and dispensed into sample

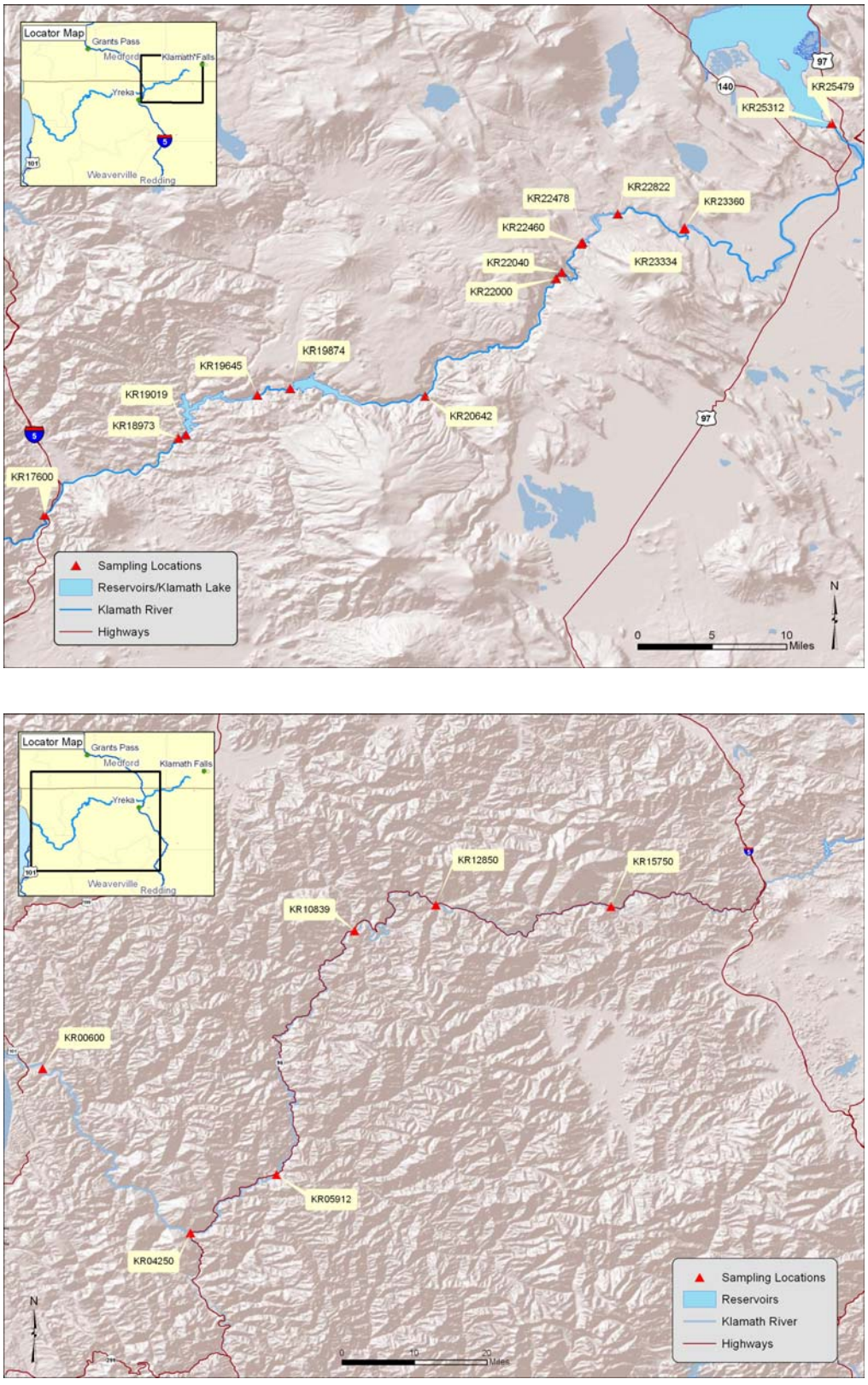

Figure 1. Location of phytoplankton collection sites in 2007.

Table 1. Phytoplankton sample sites in the Klamath Hydroelectric project in 2007.

Site ID	River Mile	Site Name	Latitude	Longitude
KR00600	6	Klamath River at Turwar	41.515	-124.001
KR04250	42.5	Klamath River at Weitchpec	41.186	-123.705
KR05912	59.1	Klamath River at Orleans	41.303	-123.533
KR10839	108.4	Klamath River at Happy Camp	41.790	-123.377
KR12850	128.5	Klamath River at Seiad Valley	41.842	-123.214
KR15750	157.5	Klamath River at Walker Bridge	41.839	-122.865
KR17600	176	Klamath River at I-5 Rest Area	41.855	-122.573
KR18973	189.7	Klamath River below Iron Gate Dam (Hatchery Bridge)	41.931	-122.442
KR19019	190.2	Iron Gate Reservoir at Log Boom	41.934	-122.435
KR19645	196.4	Klamath River below Copco 2 Powerhouse (above Iron Gate Reservoir)	41.973	-122.365
KR19874	198.7	Copco Reservoir Near Dam	41.979	-122.333
KR20642	206.4	Klamath River upstream of Shovel Creek	41.972	-122.202
KR22000	220	Klamath River below J. C. Boyle Powerhouse (Spring Island Landing)	42.088	-122.074
KR22040	220.4	Klamath River above J. C. Boyle Powerhouse (bypass)	42.094	-122.07
KR22460	224.6	Klamath River below Boyle Dam	42.121	-122.049
KR22478	224.8	J. C. Boyle Reservoir Lower End Near Log Boom	42.122	-122.047
KR22822	228.2	Klamath River above J. C. Boyle Reservoir	42.150	-122.014
KR23334	233.3	Klamath River below Keno Dam	42.135	-121.949
KR23360	233.6	Keno Reservoir at Log Boom	42.137	-121.949
KR25312	253.1	Link River at Mouth	42.219	-121.788
KR25479	254.8	Upper Klamath Lake at Fremont St Bridge	42.238	-121.805

containers. Approximately every 10th sample, but at least one sample in every sample set, was duplicated for quality control purposes. Phytoplankton samples were preserved in the field with Lugol's solution and kept on ice in the dark until shipped to the laboratory for analysis. Chlorophyll *a* samples were preserved with magnesium carbonate, kept in opaque bottles on ice in the dark until delivered to the laboratory.

Phytoplankton samples were analyzed in the laboratory for species identification, algal abundance, algal biovolume, and chlorophyll *a* concentration. Species identification and algal abundance in the samples were analyzed by counting a minimum of 100 algal units[1] at 1000x using phase contrast microscopy. Cells were identified to species in most cases. Samples were analyzed by Aquatic Analysts of White Salmon, Washington.

Quality assurance measures for this work included the collection and analysis of field replicates for phytoplankton samples and field replicates and field blanks for chlorophyll samples. Approximately 10 percent of samples analyzed were quality assurance samples.

[1] An algal unit is the typical natural growth form of the species. It can be an individual cell, a natural colony, or a group of cells such as a filament.

Statistical methods used in the analysis of phytoplankton data and quality assurance data included *t*-tests for the difference between means, and agglomerative hierarchical cluster analysis to group sample sites based on the frequency of occurrence of phytoplankton species.

Results

This section describes the results of phytoplankton sample analyses for algal abundance and biovolume, species identification, and chlorophyll *a* concentration. The measures of abundance exhibited a wide range of values (Table 2). The number of species observed in a sample ranged from 1 to 33. Algal abundance ranged from 121 to nearly 700,000 algal units/mL, biovolume ranged from approximately 37 x 10^3 to nearly 1 x 10^9 μm^3/mL, and chlorophyll *a* ranged from 0.2 to more than 1,000 µg/mL. The distribution of values for the variables was typically heavily skewed, with many high outlier values (Figure 2).

Table 2. Summary statistics for three measurements of algal conditions at the sample sites.

Statistic	Number of Species	Abundance (algal units)	Biovolume (μm^3/mL)	chlorophyll *a* (µg/L)
No. of observations	226	226	226	228
Minimum	1	121	37,442	0.2
Maximum	33	692,432	924,389,387	1,156
1st Quartile	5	456	239,687	3.7
Median	9	901	667,616	8.2
3rd Quartile	15	2,313	2,299,587	16.1
Mean	10	11,861	7,658,643	23.2

Species Quantification

The major groups of phytoplankton observed in 2007 the waters associated with the Project included:

- diatoms (kingdom Plantae, phylum Bacillariophyta)
- golden-brown algae (kingdom Chromista, phylum Ochrophyta)
- green algae (kingdom Plantae, phylum Chlorophyta)
- dinoflagellates (kingdom Protozoa, phylum Dinophyta)
- cryptomonads (kingdom Chromista, phylum Cryptophyta)
- microflagellates (kingdom Protozoa, phylum Engleozoa)
- blue-green bacteria (kingdom Bacteria, phylum Cyanobacteria)

Diatoms (70.1 percent) and cyanobacteria (27.6 percent) accounted for more than 97 percent of the total biovolume measured in 2007. Of the remaining phyla, only green algae (1.3 percent) accounted for more than one percent of total biovolume.

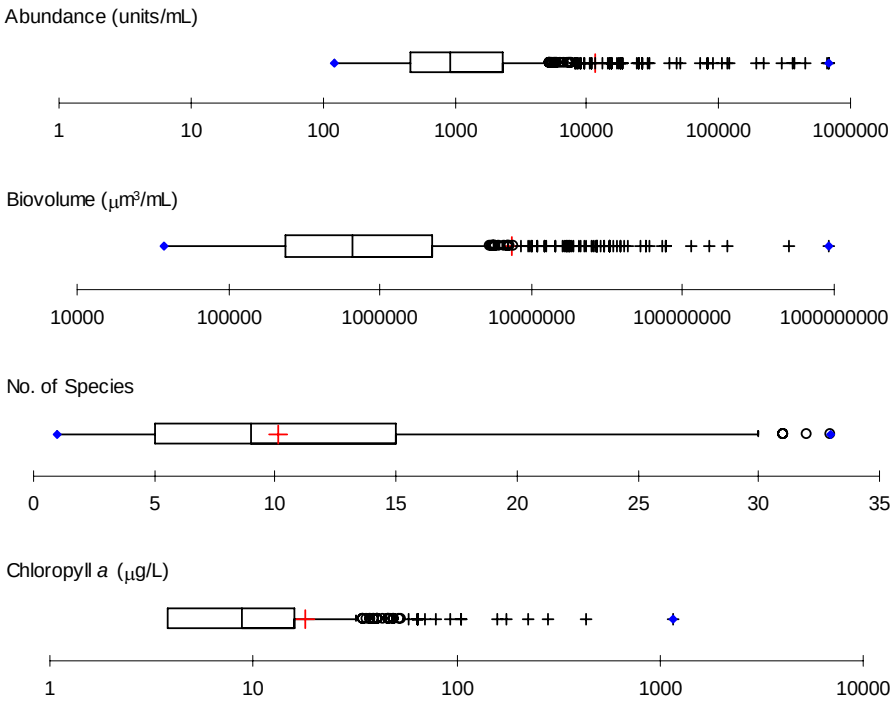

Figure 2. Box plots[2] showing the distribution of values for chlorophyll *a*, algal abundance, biovolume, and number of species per sample for sample collected in the Klamath River in 2007. Note that the scales for abundance, biovolume, and chlorophyll *a* are logarithmic.

Abundance and Biovolume

The abundance of phytoplankton in the Project, as reflected by total biovolume, varied seasonally, as presented in Figure 3 (top). Biovolume was relatively low in June, increased to high values in August, and then decreased to low values in mid-September. Algal abundance varied as well among the sites sampled (Figure 3 bottom). Median biovolume decreased by two orders of magnitude from the outlet of Upper Klamath Lake (River Mile [RM] 254.8) to below J.C. Boyle dam (RM 224.6), and increased from there to a peak in the Klamath River near Orleans (RM 59.1) before decreasing to a minimum near Turwar (RM 6).

The number of species observed varied among the sites. The average number of species observed among all sites was 15. River sites tended to have more species present than reservoir sites. The average number of species present at each site is shown in Figure 4. The highest species diversity was seen at sites in the Klamath River between J.C. Boyle dam and Copco reservoirs (median = 14 species). Upper Klamath Lake had the lowest median diversity (5 species). The largest number of species (33) was observed at the Spring Island landing site below the J. C. Boyle powerhouse.

[2] A box plot illustrates the characteristics of a set of data. The box represents the middle 50% of the measured values from the 25th to the 75th percentile. The vertical line within the box indicates the median (middle) value. The lines extending out from the box extend to the highest or lowest value that is not an outlier. Open circles represent outliers more than 1.5x the interquartile distance from the limits of the box. Crosses represent extreme outliers more than 3x the interquartile distance from the box. The mean is shown by a red cross.

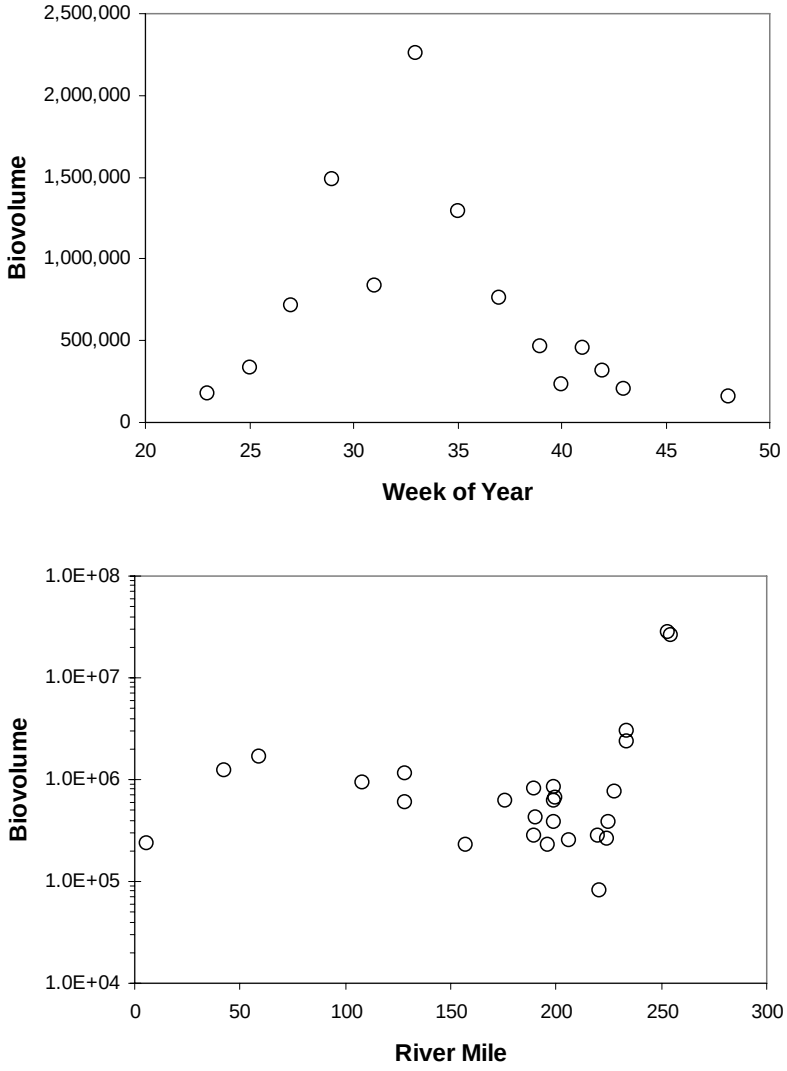

Figure 3. The seasonal and spatial pattern of algal abundance in the Klamath River represented by median total biovolume ($\mu m^3/mL$). Median biovolume at the sites sampled is shown by week of the year in the top graph, and median volume at the various sites during the days sampled is shown in the bottom graph.

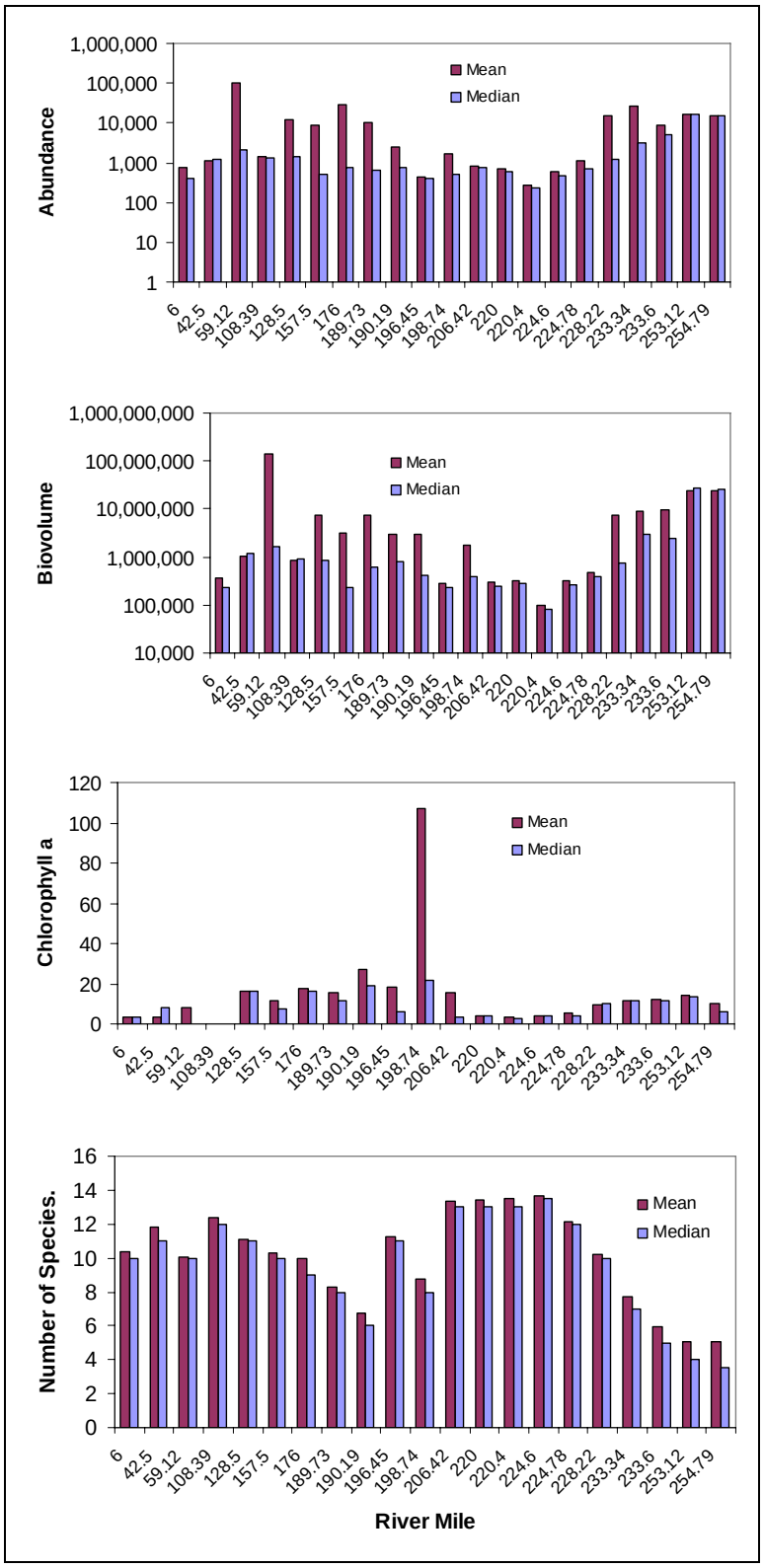

Figure 4. The average and median abundance, biovolume ($\mu m^3/mL$), chlorophyll *a*, and number of species observed at the various sites sampled in the Klamath River during 2007.

The species present at the river sites were typically different from those found in the reservoirs. The reservoir community had greater representation of pelagic (free-floating) species while the river sites tended toward more species that grow attached and are dislodged into the current. Table 3 shows the six most commonly observed species at each site sampled. The Spring Island site (RM 220), and the J. C. Boyle to Copco Reach in general, have the greatest variety of habitats contributing to the algal community. Species from the lake and reservoir habitats of Upper Klamath Lake and Keno Reservoir, fast-flowing, warm, high-nutrient river reaches between Keno and Boyle dams, and cool spring-fed waters from the bypass reach below J.C. Boyle dam all contribute species to the samples from this reach. The average number of species present at each site is shown in Figure 4.

There is a statistically significant positive relationship between phytoplankton abundance (units per mL) and biovolume, and an apparent positive relationship between biovolume and chlorophyll *a* that is not statistically significant as shown in Figure 5 and Table 4. However, abundance, biovolume, and chlorophyll *a* are all negatively correlated with number of species. This reflects the condition that often occurs in Upper Klamath Lake, Lake Ewauna, Copco reservoir, and Iron Gate reservoir when dense growths of algae are dominated by only one or a few species. The lower correlation of chlorophyll *a* with the other variable reflects the relatively high scatter of chlorophyll *a* relative to cell counts, a factor that can be influenced not only by the number of algal units present, but also by the species and general condition of the algae present.

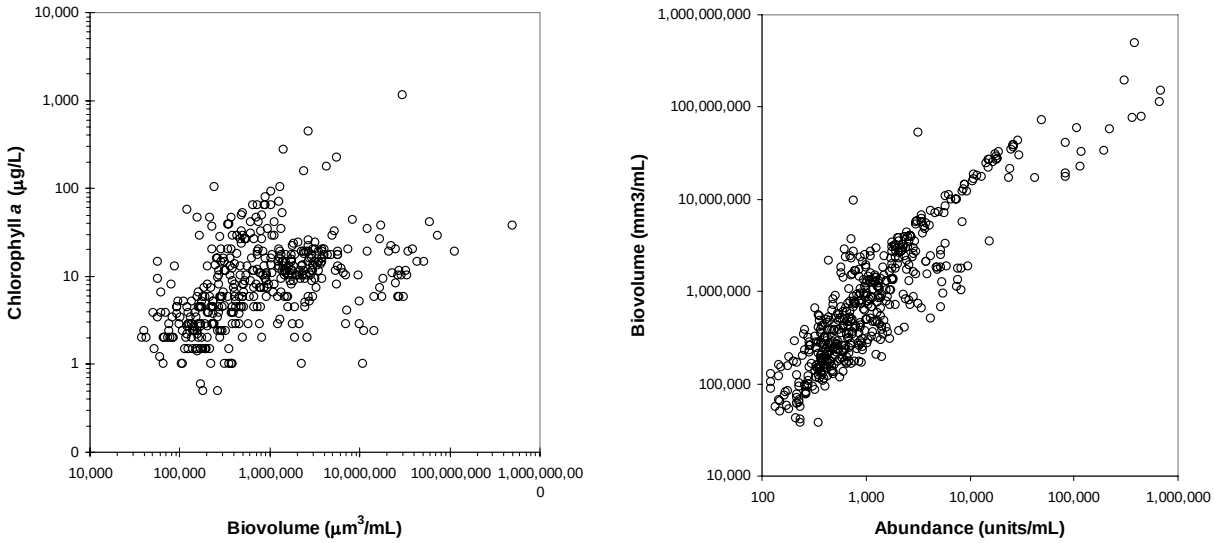

Figure 5. A scatter plot showing the relationship between algal abundance and biovolume (right side) and biovolume and chlorophyll *a* (left side) in phytoplankton samples collected from the Klamath River in 2007.

Table 3. The six most commonly observed species from the various sites sampled in the Klamath River in 2007. The sites are grouped according to categories determined through clustering analysis

River Mile	Site	Species					
190	KR19019	*Ankistrodesmus falcatus*	*Aphanizomenon flos-aquae*	*Cryptomonas erosa*	*Microcystis aeruginosa*	*Nitzschia palea*	*Rhodomonas minuta*
199	KR19874	*Ankistrodesmus falcatus*	*Aphanizomenon flos-aquae*	*Chlamydomonas sp.*	*Cryptomonas erosa*	*Microcystis aeruginosa*	*Rhodomonas minuta*
225	KR22478	*Cryptomonas erosa*	*Gomphonema angustatum*	*Nitzschia amphibia*	*Nitzschia palea*	*Rhodomonas minuta*	*Rhoicosphenia curvata*
176	KR17600	*Cocconeis placentula*	*Gomphonema angustatum*	*Navicula cryptocephala veneta*	*Nitzschia frustulum*	*Rhodomonas minuta*	*Rhoicosphenia curvata*
189	KR18973	*Chlamydomonas sp.*	*Cocconeis placentula*	*Cryptomonas erosa*	*Gomphonema subclavatum*	*Rhodomonas minuta*	*Rhoicosphenia curvata*
196	KR19645	*Ankistrodesmus falcatus*	*Cocconeis placentula*	*Cryptomonas erosa*	*Nitzschia frustulum*	*Rhodomonas minuta*	*Rhoicosphenia curvata*
206	KR20642	*Cocconeis placentula*	*Gomphonema angustatum*	*Navicula cryptocephala veneta*	*Nitzschia amphibia*	*Nitzschia frustulum*	*Rhoicosphenia curvata*
220	KR22000	*Cocconeis placentula*	*Navicula cryptocephala veneta*	*Nitzschia amphibia*	*Nitzschia frustulum*	*Rhodomonas minuta*	*Rhoicosphenia curvata*
225	KR22460	*Ankistrodesmus falcatus*	*Cocconeis placentula*	*Cryptomonas erosa*	*Navicula cryptocephala veneta*	*Nitzschia amphibia*	*Rhodomonas minuta*
228	KR22822	*Cocconeis placentula*	*Cryptomonas erosa*	*Gomphonema angustatum*	*Navicula cryptocephala veneta*	*Nitzschia amphibia*	*Nitzschia frustulum*
220	KR22040	*Achnanthes lanceolata*	*Achnanthes minutissima*	*Cocconeis placentula*	*Gomphonema angustatum*	*Navicula cryptocephala veneta*	*Nitzschia amphibia*
233	KR23334	*Ankistrodesmus falcatus*	*Aphanizomenon flos-aquae*	*Cryptomonas erosa*	*Nitzschia amphibia*	*Nitzschia palea*	*Rhodomonas minuta*
234	KR23360	*Ankistrodesmus falcatus*	*Aphanizomenon flos-aquae*	*Cryptomonas erosa*	*Nitzschia amphibia*	*Nitzschia palea*	*Rhodomonas minuta*
253	KR25312	*Aphanizomenon flos-aquae*	*Cocconeis placentula*	*Cryptomonas erosa*	*Fragilaria construens*	*Navicula cryptocephala veneta*	*Navicula pupula*
255	KR25479	*Aphanizomenon flos-aquae*	*Cryptomonas erosa*	*Fragilaria construens*	*Fragilaria construens venter*	*Rhodomonas minuta*	*Stephanodiscus astraea minutula*
6	KR00600	*Cocconeis placentula*	*Epithemia sorex*	*Rhodomonas minuta*	*Rhoicosphenia curvata*	*Scenedesmus quadricauda*	*Selenastrum minutum*
42	KR04250	*Cocconeis placentula*	*Epithemia sorex*	*Microcystis aeruginosa*	*Nitzschia frustulum*	*Rhodomonas minuta*	*Synedra ulna*
59	KR05912	*Cocconeis placentula*	*Diatoma vulgare*	*Epithemia sorex*	*Nitzschia frustulum*	*Rhoicosphenia curvata*	*Synedra ulna*
128	KR12850	*Amphora perpusilla*	*Ankistrodesmus falcatus*	*Chlamydomonas sp.*	*Chromulina sp.*	*Cocconeis pediculus*	*Cryptomonas erosa*

Table 4. A Pearson correlation coefficient matrix for phytoplankton indicator measurements of samples collected in the Klamath River in 2007. The values in the upper right are the correlation coefficients; in the lower left are the P values. Statistically significant values are in bold type.

Variables	Abundance	Biovolume	Species N	Chlorophyll
Abundance	---	**0.685**	-0.066	0.038
Biovolume	**< 0.0001**	---	**-0.113**	0.064
Species N	0.142	**0.012**	---	**-0.174**
Chlorophyll	0.436	0.186	**0.000**	---

Chlorophyll

Chlorophyll *a* concentration varied seasonally and spatially in 2007. Chlorophyll *a* concentration was greater and more variable in samples from the reservoirs than in samples from the river (Table 5). The highest median chlorophyll *a* concentration in the reservoirs was recorded in Copco reservoir (RM 199), the highest median chlorophyll *a* at the river sites was recorded at Seiad Valley (RM 129) as shown in Figure 6. The maximum single sample value for chlorophyll *a* among the river sites was 309 µg/L in the Klamath River near Shovel Creek (RM 206) on August 27th in a sample dominated by *Aphanizomenon flos-aquae*. The maximum value for chlorophyll *a* at the reservoir sites was 1156 µg/L in Copco reservoir on July 18th in a sample dominated by *Microcystis aeruginosa*. The highest aggregate of chlorophyll *a* concentration across all river and reservoir sites occurred during the week of September 13th (week 36) as shown in Figure 7.

Table 5. Summary statistics for chlorophyll *a* values measured in 2007 at river and reservoir sites in the Klamath River.

Statistic	River	Reservoirs
No. of observations	136	92
Minimum	0.2	0.6
Maximum	309.0	1156.0
Range	308.8	1155.4
1st Quartile	2.9	3.9
Median	5.8	8.9
3rd Quartile	11.7	26.6
Mean	11.0	41.3
Standard error of the mean	2.4	13.9

During the seasonal peak of chlorophyll *a* concentration in mid September (weeks 36-38) chlorophyll *a* values tended to decrease from Link River to below J. C. Boyle dam, and to increase from relatively low values below Iron Gate dam (RM 189) to relatively high values at Walker Bridge (RM 157) and Seiad Valley (RM 129) before decreasing further toward Turwar near the mouth (Figure 8).

The highest median chlorophyll *a* value in the reservoirs was observed in Copco reservoir (21.4 µg/L) while the highest median value at the river stations was observed at Seiad Valley (16.1 µg/L). Chlorophyll *a* values at Seiad Valley were greater than 10 µg/L for all samples between late July and the end of September with a high value of 41 µg/L observed on September 12th, the result of very high biovolume of two diatom species, *Cocconeis placentula* and *Gomphoneis herculeana* (see Figure 9).

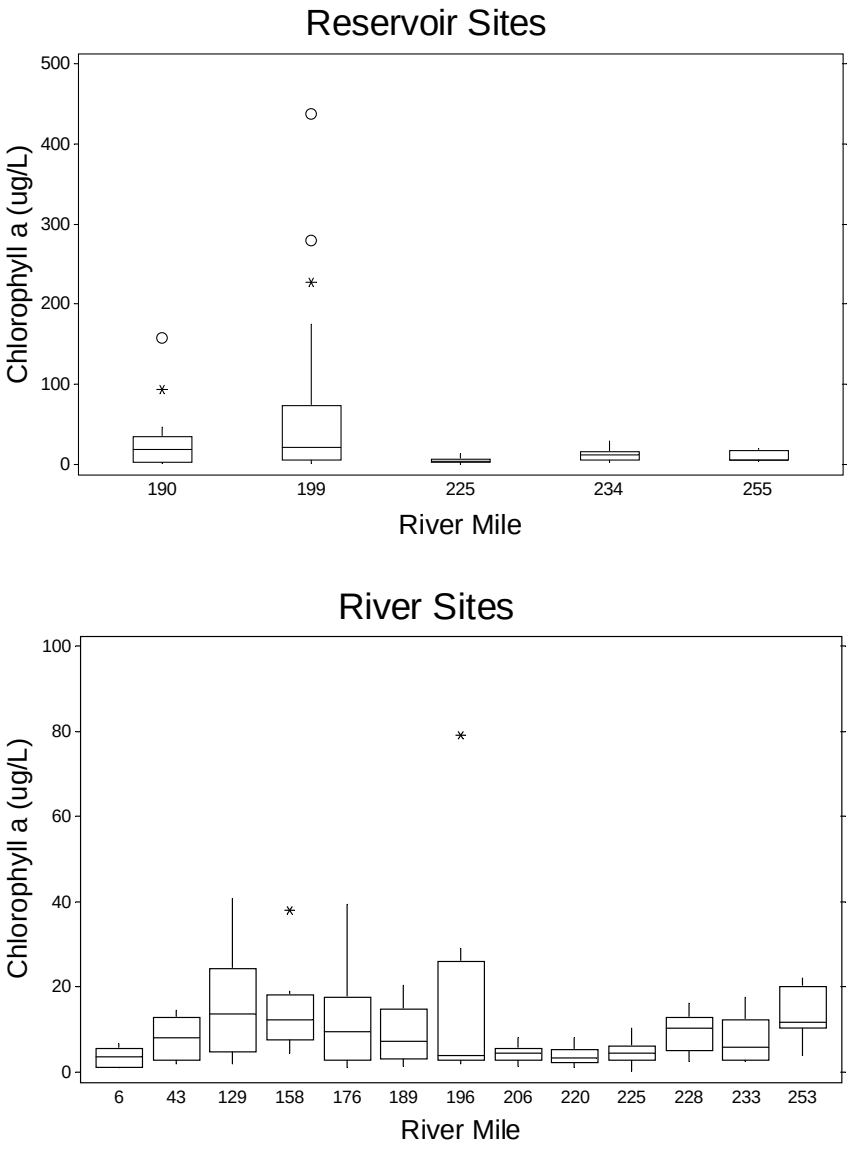

Figure 6. Box plots showing the distribution of chlorophyll *a* values measured in 2007 at reservoir sites (top panel) and river sites (bottom panel) in the Klamath River. A very high outlier value (mentioned in the text) has been excluded from each graph in order to improve legibility.

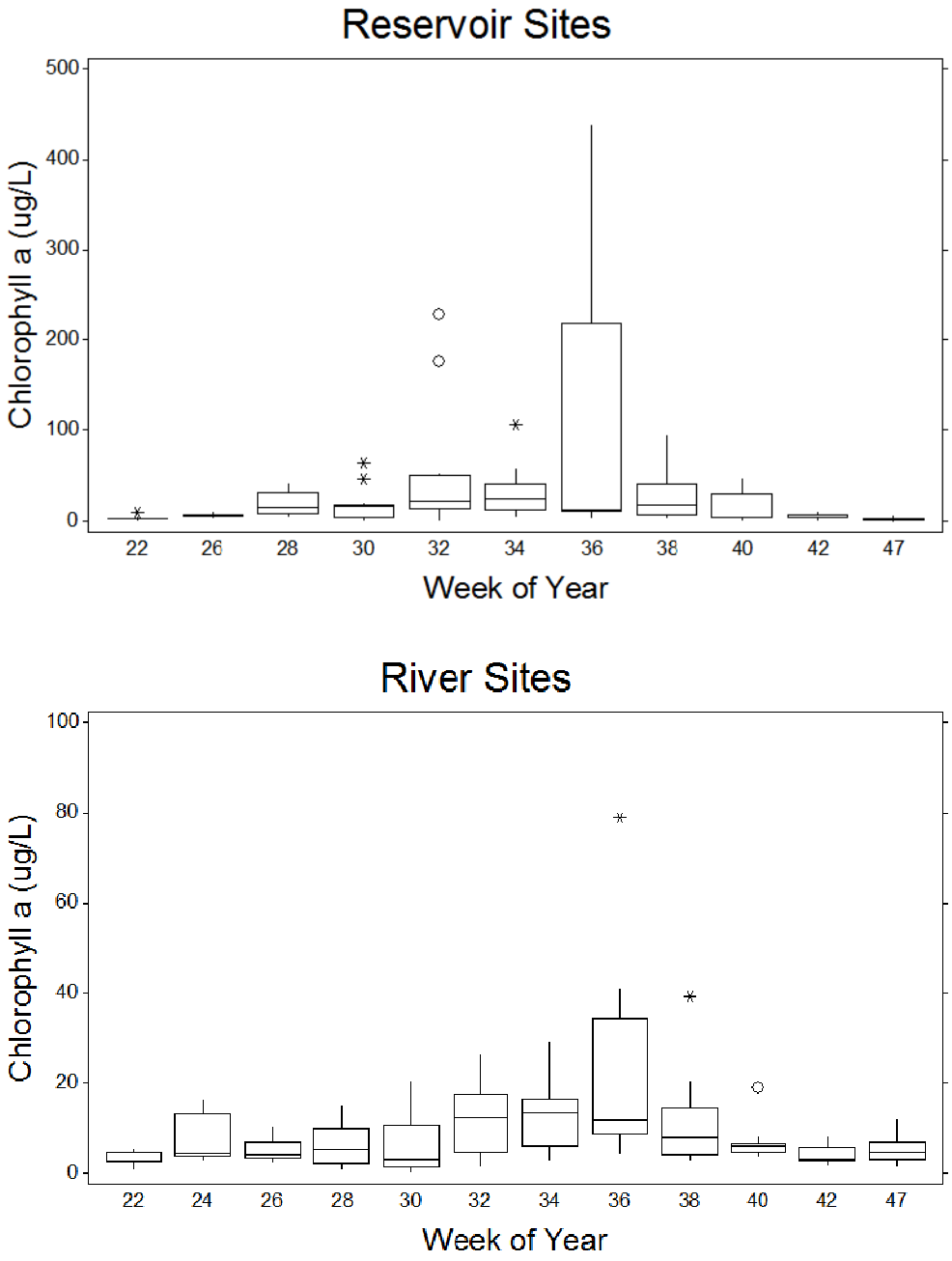

Figure 7. Box plots showing the seasonal distribution of chlorophyll *a* values measured in 2007 at reservoir sites (top panel) and river sites (bottom panel) in the Klamath River. High outlier values mentioned in the text have been excluded from the graph in order to improve legibility.

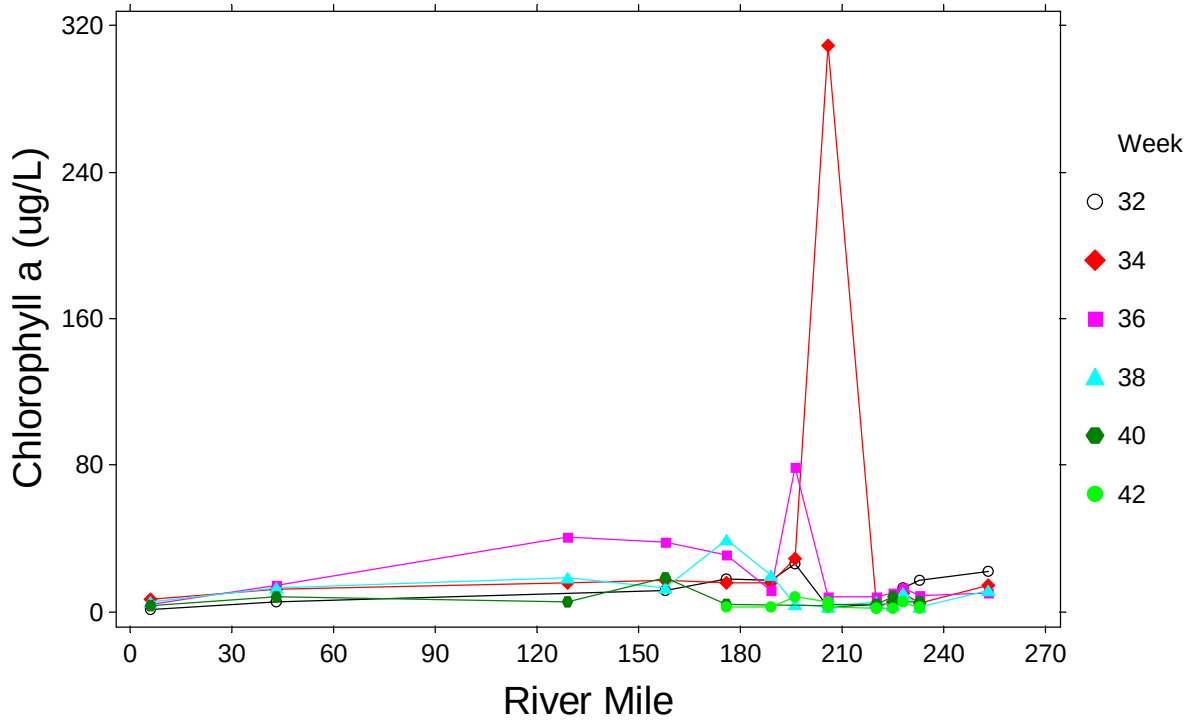

Figure 8. Chlorophyll *a* concentrations measured in 2007 between August 15th (Week 32) and October 29th (week 42) at various locations in the Klamath River.

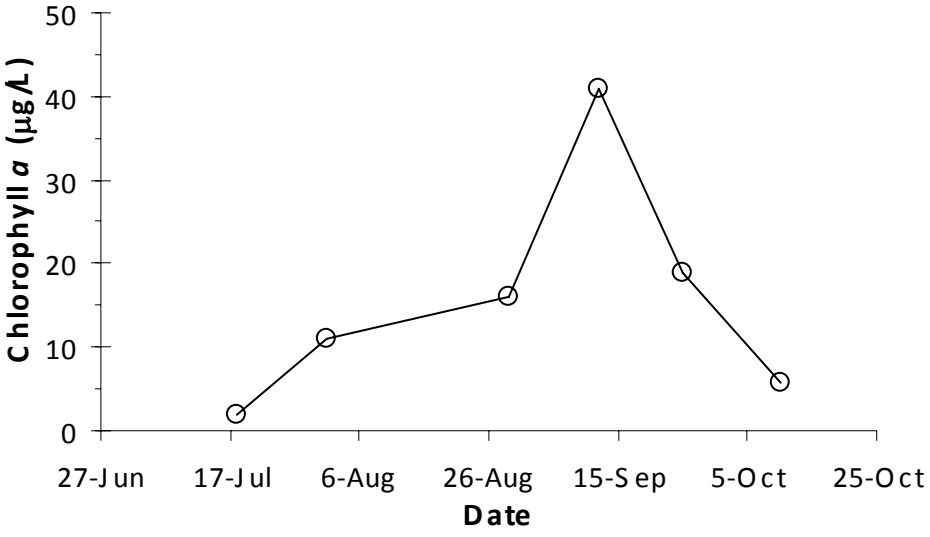

Figure 9. Chlorophyll *a* values measured at site KR12850, Seiad Valley (RM 129) in 2007.

Species Composition

A total of 164 phytoplankton species was observed in the 226 samples that were analyzed for this report. Of those species, 138 occurred in more than 2 samples, and 68 comprised more than 5 percent of any one sample. There were 43 "common" species that occurred in more than 10 percent of the samples. The most common species are listed in Table 6. A complete list of species observed in 2007 is included as Appendix 1.

Aphanizomenon flos-aquae accounted for 38.6 percent of the total biovolume measured in the phytoplankton in 2007, *Epithemia sorex* (a diatom) accounted for 24.0 percent. Only two other species, *Rhopalodia gibba* and *Cocconeis placentula* (both diatoms) accounted for more than 4 percent of the total biovolume measured in 2007. Thirty-nine species accounted for 99 percent of the total biovolume measured. The 15 most abundant species, by biovolume, accounted for more than 90 percent of the total biovolume measured in 2007. *Microcystis aeruginosa* accounted for 2.5 percent of the total biovolume measured in 2007.

Various algal species typically prefer conditions under which they grow best, and while some species are quite tolerant of a wide range of conditions and are widespread, others are less tolerant and are limited to a more narrow range of conditions. It is thus possible to describe the probable water quality conditions of a body of water or to group locations into categories of similar water quality based on the algae present. Through the use of the agglomerative hierarchical clustering technique (Everitt, Landau, and Leese 2001), sites in the Klamath River were separated into groups of potentially similar water quality based on the frequency of occurence of the phytoplankton species found at each location. The cluster dendrogram is presented in Figure 10. The relationships reflected in this dendrogram are associated with such factors as nutrient concentration, water temperature, sunlight penetration, and flow rate.

The sites sampled in the Klamath River and Klamath Hydroelectric project cluster into roughly four groups:

- A "reservoir" group consisting of Copco Reservoir (KR19874), Iron Gate Reservoir (KR19019), and J. C. Boyle Reservoir (KR22478) is dominated by species that are planktonic and most commonly found in highly enriched, eutrophic waters;
- An "Upper Klamath Lake" group consisting of Upper Klamath Lake (KR25479), Link River (KR25312), Keno Reservoir (KR23360), and the Klamath River below Keno dam (KR23334), characterized the abundant presence of *Aphanizomenon flos-aquae*. The J. C. Boyle bypass reach and Walker bridge form a subset of this group, but that may be the result of the anomalous nature of these two sites – Walker Bridge had only a few samples, and the J. C. Boyle bypass is heavily influenced by ground water;
- a "river" group including sites on the Klamath River at I-5 freeway (KR17600), below Iron Gate dam (KR18973), below Copco 2 powerhouse (KR19645), above Shovel Creek (KR20642), below J. C. Boyle powerhouse (KR22000), below J. C. Boyle dam (KR22460), and above J. C. Boyle reservoir (KR22822) characterized the frequent occurrence of *Rhoicosphenia curvata*, *Cocconeis placentula*, *Achnanthes lanceolata*, *Ankistrodesmis falcatus*, and *Aphanizomenon flos-aquae* – algae that are found in a wide variety of conditions, primarily flowing water, and nutrient conditions rangine from oligotrophic to eutrophic;
- A "lower river" group of Turwar, Weitchpec, Orleans, and Seiad Valley characterized by the frequency of occurrence of *Epithemia sorex*, *Aphanizomenon flos-aquae*, and *Achnanthes minutissima*. *Epithemia* and *Achnanthes* are usually epiphytic (attached), while *Epithemia* and *Aphanizomenon* favor eutrophic, and possibly low nitrogen, conditions. *Epithemia* and *Aphanizomenon* are both able to fix nitrogen.

The six most common species for each site, grouped according to the hierarchical analysis, are listed in Table 4.

Table 6. Common phytoplankton observed in the Klamath River in 2007.

Most abundant based on frequency of occurrence			Most abundant based on total biovolume		
Taxa	Count	% of Total	Taxa	% Total Biovolume	Cum % Biovolume
Rhodomonas minuta	447	88.69	*Aphanizomenon flos-aquae*	30.58	30.58
Cryptomonas erosa	444	88.10	*Epithemia sorex*	23.97	54.55
Cocconeis placentula	423	83.93	*Rhopalodia gibba*	7.61	62.16
Aphanizomenon flos-aquae	345	68.45	*Cocconeis placentula*	6.92	69.08
Nitzschia frustulum	332	65.87	*Synedra ulna*	3.98	73.06
Rhoicosphenia curvata	320	63.49	*Nitzschia frustulum*	2.63	75.69
Ankistrodesmus falcatus	312	61.90	*Microcystis aeruginosa*	2.46	78.15
Nitzschia palea	291	57.74	*Diatoma vulgare*	2.03	80.17
Nitzschia amphibia	289	57.34	*Gomphonema subclavatum*	1.84	82.01
Navicula cryptocephala veneta	282	55.95	*Navicula cryptocephala veneta*	1.84	83.85
Gomphonema angustatum	280	55.56	*Gomphoneis herculeana*	1.60	85.45
Chlamydomonas sp.	244	48.41	*Gomphonema angustatum*	1.56	87.01
Microcystis aeruginosa	221	43.85	*Nitzschia paleacea*	1.41	88.42
Nitzschia paleacea	189	37.50	*Fragilaria crotonensis*	1.23	89.65
Gomphonema subclavatum	172	34.13	*Stephanodiscus niagarae*	1.15	90.80
Melosira granulata	170	33.73	*Cryptomonas erosa*	0.91	91.71
Glenodinium sp.	169	33.53	*Nitzschia palea*	0.88	92.59
Unidentified flagellate	168	33.33	*Navicula tripunctata*	0.69	93.28
Scenedesmus quadricauda	165	32.74	*Rhoicosphenia curvata*	0.67	93.96
Cyclotella meneghiniana	157	31.15	*Scenedesmus quadricauda*	0.44	94.39
Stephanodiscus hantzschii	153	30.36	*Melosira granulata*	0.43	94.82
Nitzschia dissipata	150	29.76	*Gomphonema ventricosum*	0.42	95.25
Fragilaria construens venter	149	29.56	*Achnanthes lanceolata*	0.41	95.65
Achnanthes lanceolata	146	28.97	*Nitzschia amphibia*	0.39	96.04
Fragilaria construens	146	28.97	*Chlamydomonas* sp.	0.35	96.39
Synedra ulna	125	24.80	*Eudorina elegans*	0.34	96.73
Chromulina sp.	116	23.02	*Synedra mazamaensis*	0.31	97.04
Selenastrum minutum	114	22.62	*Fragilaria construens*	0.31	97.35
Diatoma vulgare	103	20.44	*Gloeotrichia echinulata*	0.23	97.58
Navicula tripunctata	101	20.04	*Navicula cryptocephala*	0.22	97.80
Achnanthes minutissima	90	17.86	*Nitzschia dissipata*	0.21	98.00
Sphaerocystis schroeteri	88	17.46	*Cymbella tumida*	0.19	98.19
Navicula cryptocephala	86	17.06	*Diatoma tenue*	0.16	98.35
Fragilaria capucina mesolepta	73	14.48	*Cyclotella meneghiniana*	0.15	98.50
Stephanodiscus astraea minutula	73	14.48	*Fragilaria vaucheriae*	0.12	98.63
Fragilaria crotonensis	70	13.89	*Melosira varians*	0.12	98.75
Navicula sp.	68	13.49	*Glenodinium* sp.	0.11	98.86
Fragilaria vaucheriae	61	12.10	*Cymbella affinis*	0.09	98.96
Melosira varians	60	11.90	*Fragilaria capucina mesolepta*	0.08	99.04
Fragilaria vaucheria	59	11.71			
Navicula pupula	54	10.71			
Amphora perpusilla	52	10.32			
Gomphonema olivaceum	51	10.12			

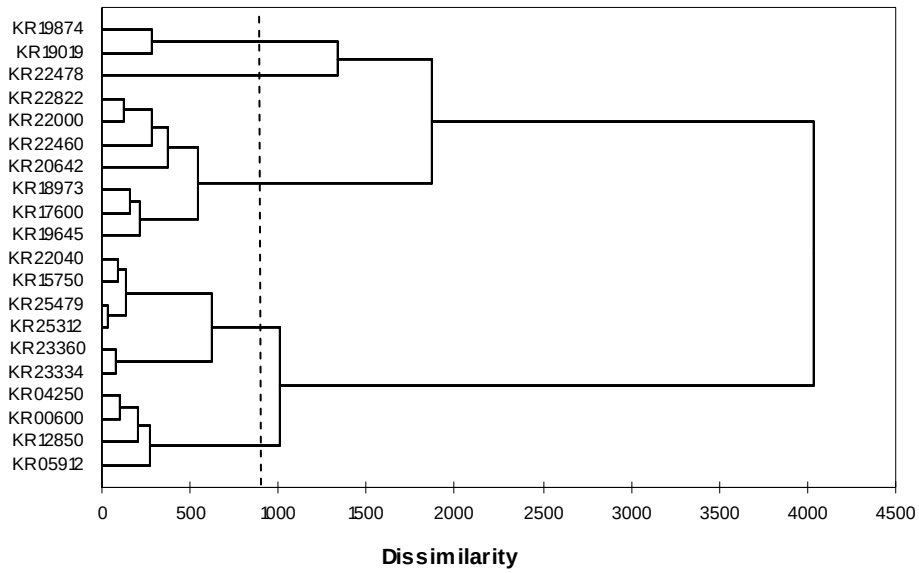

Figure 10. Dendrogram of Klamath River sample sites clustered based on frequency of occurrence of phytoplankton species.

Seasonal Succession

Succession of Algal Phyla

The seasonal change in total biovolume observed in the Klamath River in 2007 was the result not only of changes in the number of algal cells, but also in the composition of the phytoplankton community. Figure 11 shows the seasonal changes in relative abundance of the major algal divisions observed in the Klamath River in 2007: Bacillariophyta (diatoms), Chlorophyta (green algae), Ochrophyta, (golden algae), Cryptophyta (cryptomonads, Cyanobacteria (blue-green bacteria/algae), and Dinophyta (dinoflagellates).

There is typically a large early spring bloom of diatoms and chrysophytes in the Klamath River that reaches a peak in March. In June, when sampling started in 2007, diatoms have typically been reduced by zooplankton grazing, and biovolume is relatively low. In 2007 the large peak diatom biovolume in mid-August (week 33) was influenced by very high abundance of *Epithemia sorex* and *Rhopalodia gibba* observed in the sample collected from the Klamath River near Orleans (RM 59). The late August peak in cyanobacteria is largely the result of high numbers of *Aphanizomenon flos-aquae* at the sites upstream of Keno dam.

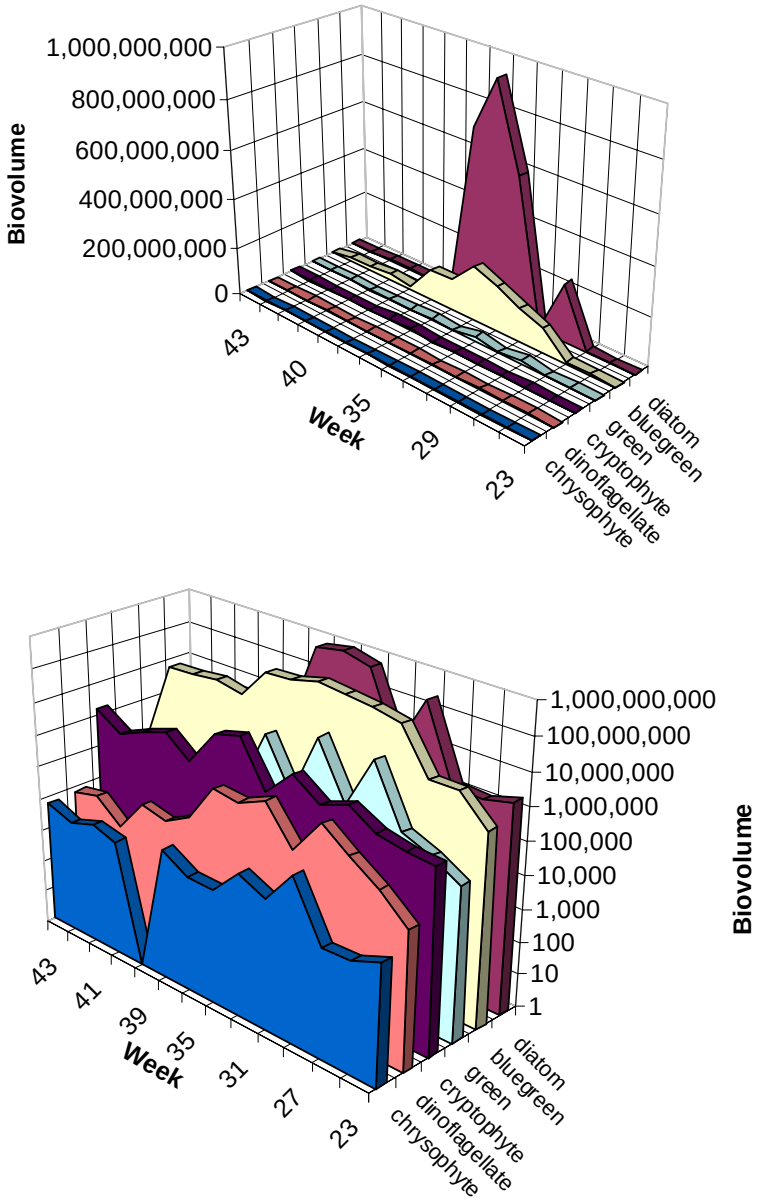

Figure 11. Seasonal succession of algal groups, as represented by biovolume at all sites sampled, in the Klamath River in 2007. The panels show the same information in varying detail. In the bottom panel the z-axis has been plotted on a logarithmic scale to show more detail in the less abundant groups.

Succession of Cyanobacteria

The maximum cyanobacteria biovolume attained was similar in both reservoirs, but the peak in Iron Gate reservoir came about four weeks later than the peak in Copco reservoir, the week of August 11th vs. the week of July 14th (Figure 12). Copco reservoir also exhibited several sharp peaks of cyanobacterial biovolume separated by periods of relatively low values in contrast to the single broad peak observed in Iron Gate reservoir.

The phytoplankton community in Copco and Iron Gate reservoirs was characterized by blooms of cyanobacteria in 2007. The composition of the cyanobacteria bloom differed between the reservoirs, but *Microcystis aeruginosa* and *Aphanizomenon flos-aquae* were the dominant species in both reservoirs. In Copco reservoir *Aphanizomenon flos-aquae* and *Microcystis aeruginosa* were present in similar abundance, while in Iron Gate reservoir *Aphanizomenon flos-aquae* was clearly dominant, as shown in Figure 13.

The pattern of relative abundance of *Microcystis aeruginosa* and *Aphanizomenon flos-aquae* differed between the two reservoirs (Figure 14). In Copco reservoir the relative abundance of the two species was similar, but *Microcystis aeruginosa* was variable through the summer while *Aphanizomenon flos-aquae* abundance was more stable. *Microcystis aeruginosa* abundance remained high until quite late in the fall. In Iron Gate reservoir both species reached maximum abundance at about the same time in early September, but *Aphanizomenon* was almost two orders of magnitude more abundant. Iron Gate reservoir did not exhibit the large fluctuation in *Microcystis* abundance that occurred in Copco reservoir. *Microcystis* did not persist into the fall in Iron Gate reservoir at the high abundance seen in Copco reservoir.

Potential Toxin-Producing Cyanobacteria

Abundance

Nine species of cyanobacteria were observed in samples from the Klamath River in 2007. All but one of the nine are recognized as capable of producing toxins at times that can potentially affect humans and other species (Falconer 2005). They are listed in Table 7.

Table 7. Potential toxin-producing Cyanobacteria species observed in samples from the Klamath River in 2007.

Species	Reported Toxicity
Anabaena circinalis	Yes
Anabaena flos-aquae	Yes
Anabaena planctonica	Yes
Anabaena sp.	Yes
Aphanizomenon flos-aquae	Yes[3]
Chroococcus minimus	No
Microcystis aeruginosa	Yes
Oscillatoria limosa	Yes
*Oscillatori*a sp.	Yes

Only two of the cyanobacteria species observed in 2007 were present in significant abundance, *Microcystis aeruginosa* and *Aphanizomenon flos-aquae*. Even though *Aphanizomenon flos-aquae* has been recognized as a potential toxin producer in some locations, it apparently has not done so in the Klamath River or Upper Klamath Lake. The only confirmed toxin-producing cyanobacterium of importance in Upper Klamath Lake or the Klamath River is *Microcystis aeruginosa*.

Microcystis aeruginosa was observed in 88 samples, 39 percent of the samples collected, and was present at every site sampled. Figure 15 shows the distribution of abundance of *Microcystis aeruginosa* by river mile in 2007. The highest median abundance of *Microcystis aeruginosa* occurred in Copco reservoir (RM 199), and in the Klamath River at Walker Bridge (RM 158) and Seiad Valley (RM 129). Large standard

[3] Although it has been shown to produce toxins in some locations, *Aphanizomenon flos-aquae* has not been reported as toxic in the Klamath River.

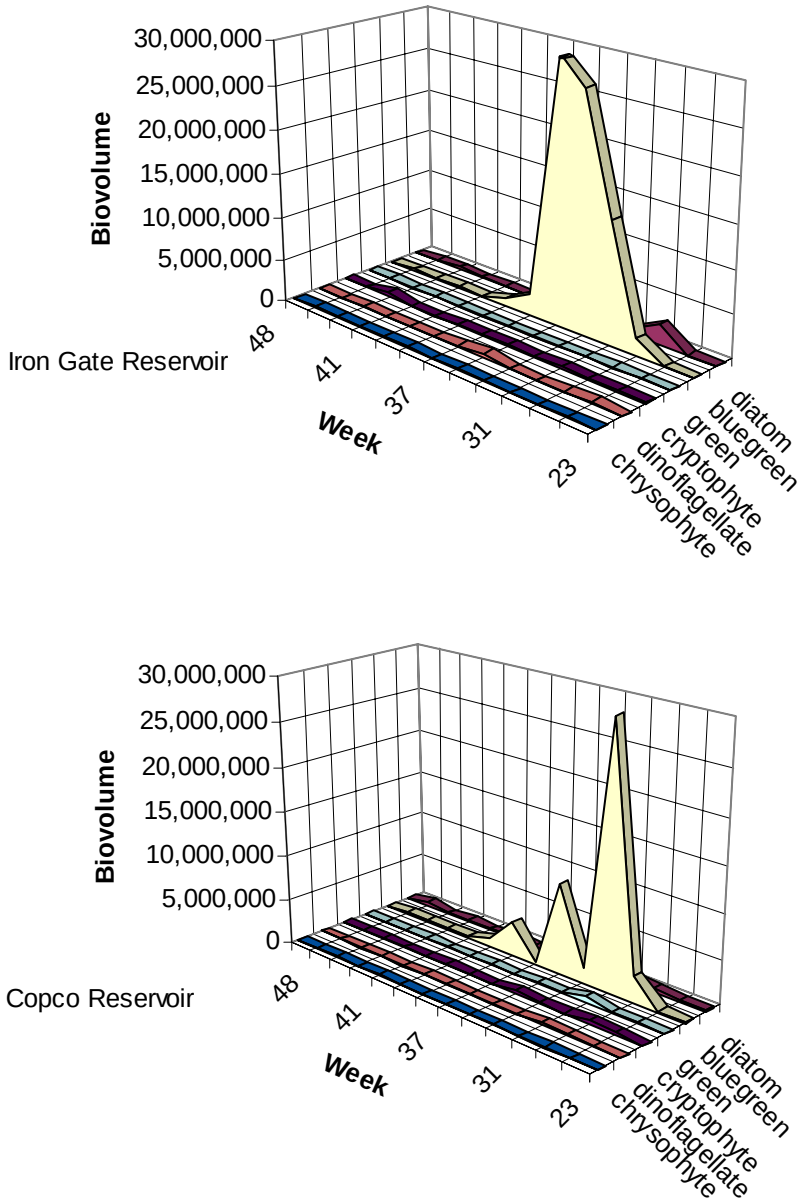

Figure 12. Seasonal succession of algal groups, as represented by biovolume (μm^3/mL), in Iron Gate (top panel) and Copco (bottom panel) reservoirs in 2007.

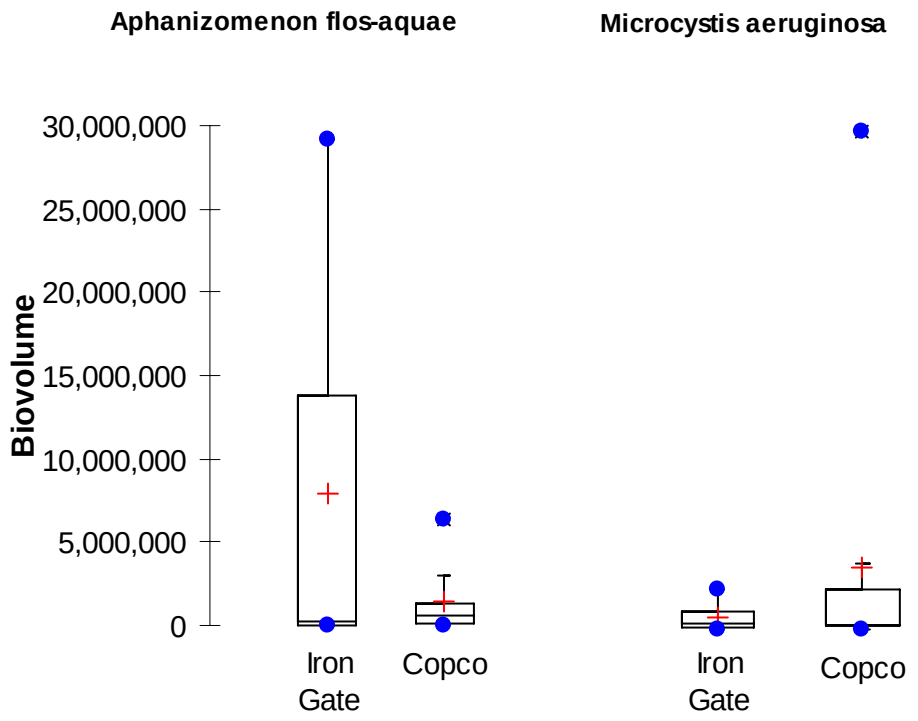

Figure 13. Box plot showing the difference in relative abundance, as biovolume (μm^3/mL), in 2007 of *Aphanizomenon flos-aquae* and *Microcystis aeruginosa* in Copco and Iron Gate reservoirs.

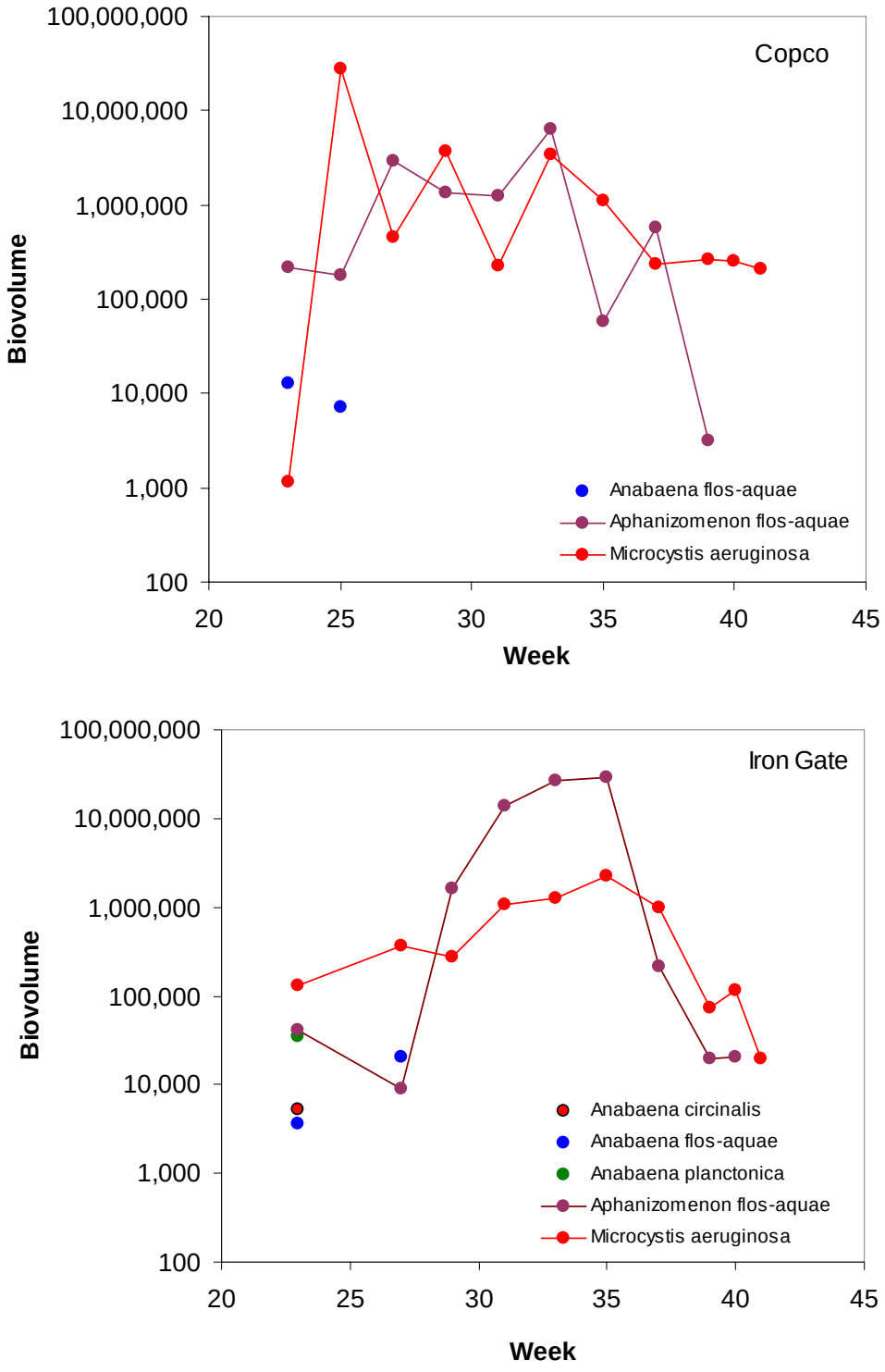

Figure 14. The seasonal abundance of cyanobacteria species, measured as biovolume ($\mu m^3/mL$) in Copco (top) and Iron Gate (bottom) reservoirs in 2007. Note that the vertical scale is logarithmic.

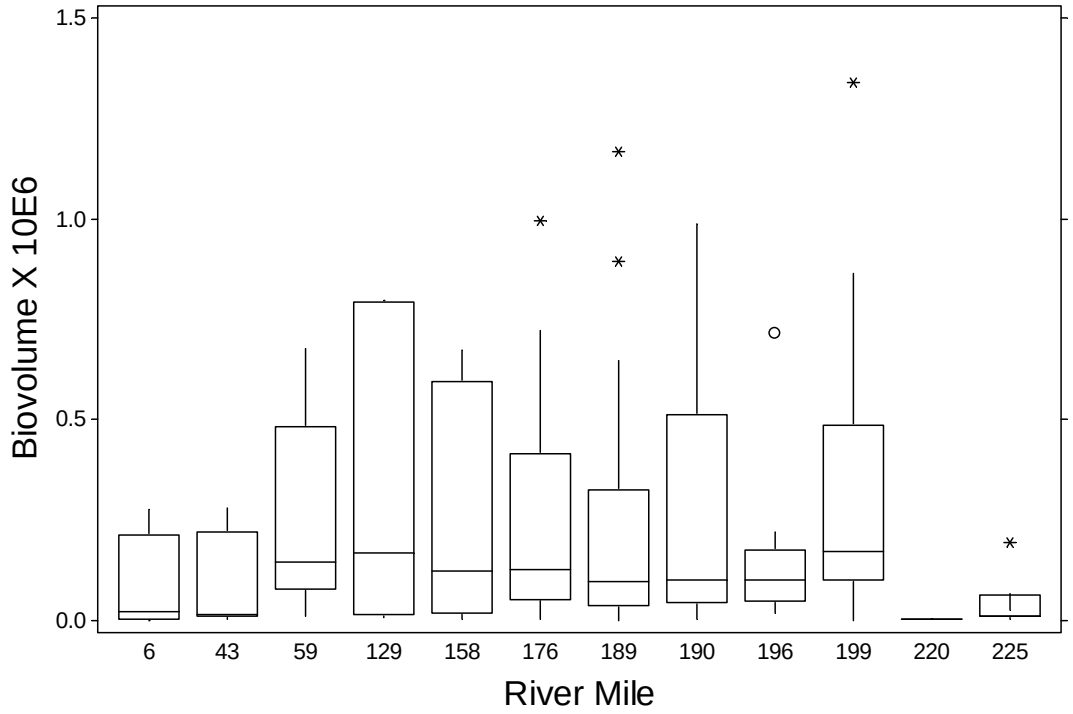

Figure 15. A box plot showing the variation in abundance of *Microcystis aeruginosa* in 2007, as measured by total biovolume (μm^3/mL), at various sites sampled in the Klamath River and reservoirs

errors at these sites suggest that the average values may have been influenced by one or a few large values.

Copco and Iron Gate reservoir sites (RM 199 and 190) tended to have higher abundance of *Microcystis aeruginosa* than the upstream river sites (Figure 15). Also, the river sites below the reservoirs tended to have higher abundance than the river sites above the reservoirs. *Microcystis aeruginosa* abundance tended to decline in the river below Iron Gate dam, but the decrease was not monotonic, and in some weeks several of the river sites below Iron Gate dam had higher *Microcystis aeruginosa* abundance than the site below Iron Gate dam. This is particularly evident during the apparent peak of the *Microcystis aeruginosa* bloom in mid September (week 37) as shown in Figure 16. *Microcystis* abundance was high in Copco and Iron Gate reservoirs, but relatively low in the river just below Iron Gate dam (RM 189). Further downstream *Microcystis aeruginosa* abundance reached its highest values for that week at Walker Bridge (RM 158) and Seiad Valley (RM 129).

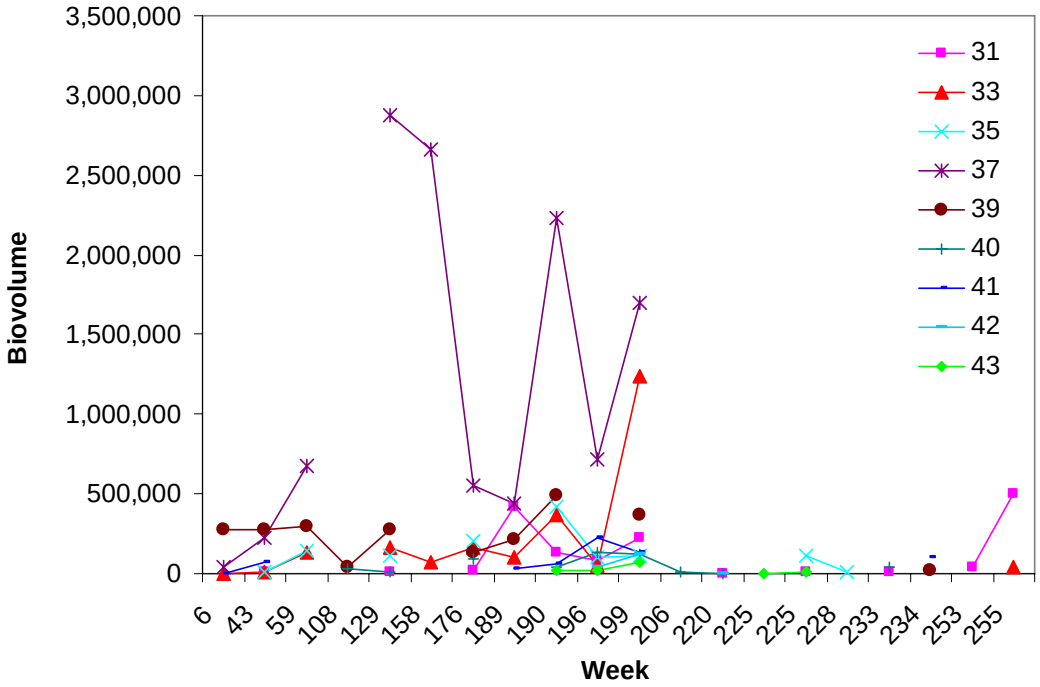

Figure 16. Total biovolume (µm3/mL) measured at various sites in the Klamath River and reservoirs in 2007 between July 31st (week 31) and October 29th (week 42).

Microcystin

Microcystin toxin was measured by other parties at a number of sites in the Klamath River in 2007 (Fetcho 2007, Kann 2007). Microcystin data from 2005 through 2007 collected by other parties was compiled by CH2M HILL (2008), and is provided in Appendix 2. The sites sampled included river sites, open water reservoir sites, and reservoir shoreline sites[4]. Microcystin concentrations observed in 2007 at the river sites and open water reservoir sites are presented in Figure 17 (top).

No sample from any of the river sites in 2007 exceeded the 20 µg/L guideline value from the World Health Organization (WHO) for moderate risk through recreational exposure. Of the river sites, only one sample had a microcystin concentration above the California (SWRCB 2007) and Oregon (ODHS 2005) guideline value of 8 µg/L[5] for posting advisories in recreation waters. This sample had a microcystin

[4] Measures of abundance of cyanobacteria are highly sensitive to sampling method (Ahn 2008). The purpose of PacifiCorp's sampling was to characterize the phytoplankton community and thus avoided sampling concentrated scums in order not to bias the sample. Sampling by others was directed toward public health concerns and therefore tended to focus on areas with highly concentrated scums. The samples are therefore not comparable. However, for the purposes of this analysis comparison of PacifiCorp samples to the river and open water reservoir samples of other parties is reasonable.

[5] The California State Water Resources Control Board (SWRCB 2007) and Oregon Department of Health Services (ODHS 2005) provide guidelines for posting advisories in recreation waters. These guidelines were developed using information provided in WHO (2003). Both SWRCB (2007) and ODHS (2005) recommend posting advisories in recreation waters under three circumstances: (1) if "scum is present associated with toxigenic species"; (2) if scum is not present, but the density of *Microcystis* or *Planktothrix* is 40,000 cells/ml or greater; and (3) if scum is not present, but the density of all potentially toxigenic BGA is 100,000 cells/ml or greater. Based on WHO (2003) information, SWRCB (2007) and ODHS (2005) indicate that cell counts of 40,000 and 100,000 cells/ml equate to microcystin toxin concentrations of 8 µg/L and 20 µg/L, respectively.

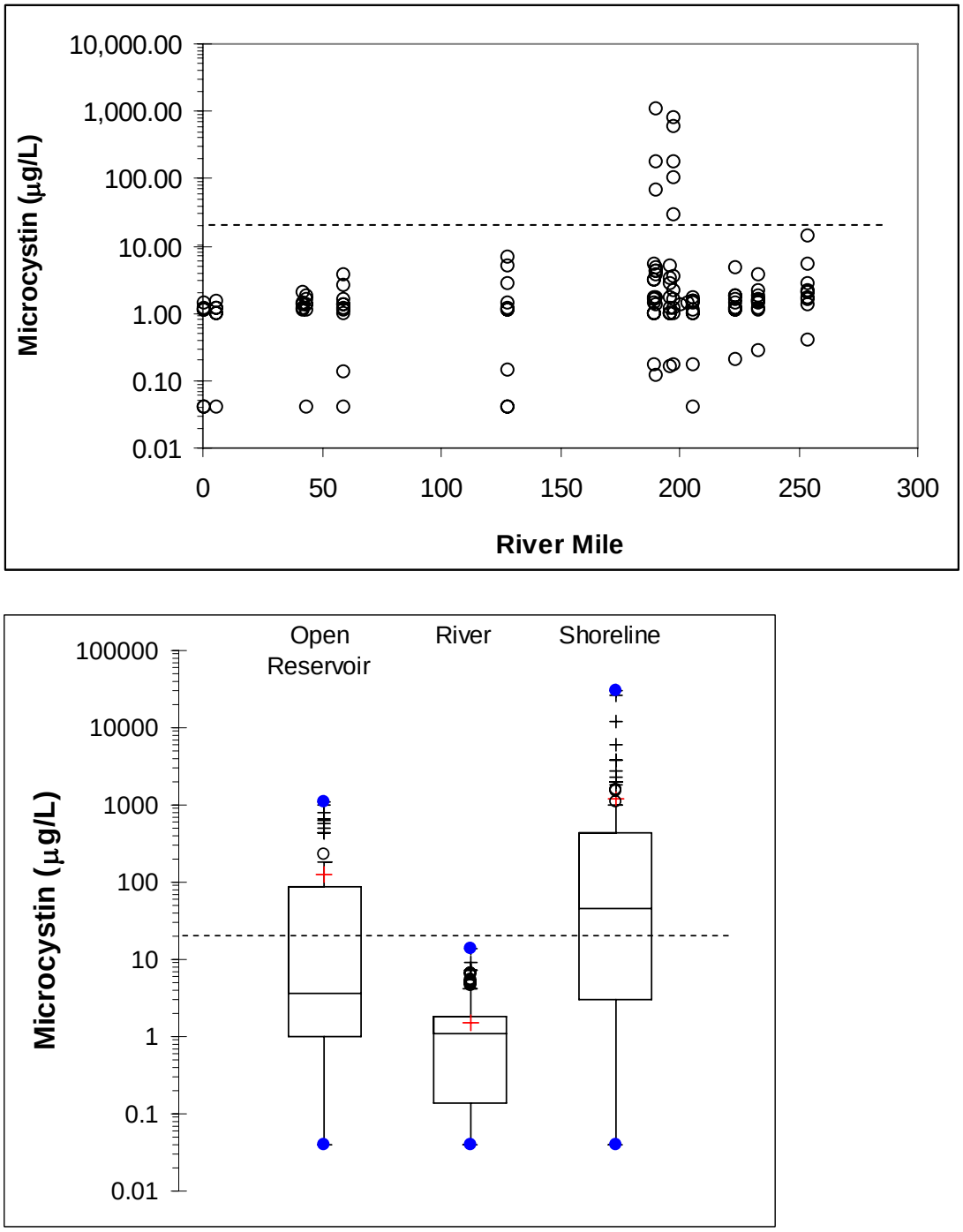

Figure 17. Microcystin data collected in 2007 at river sites and open water reservoir sites in the Klamath River. The horizontal dashed line shows the WHO guideline value for moderate risk of recreational microcystin exposure (20 µg/L).

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concentration of 14 µg/L and was obtained at Link River near the outlet of Upper Klamath Lake on August 22, 2007. This is the highest value for microcystin recorded at any river site for all data collected from 2005 through 2007 (CH2M 2008). Samples from the open water and shoreline reservoir sites exhibited higher values that would indicate some risk of harmful exposure. This is a result of both the higher abundance of MSAE in the reservoirs and of sampling techniques used by other parties that were intended to identify worst-case conditions.

For all microcystin data measured in river samples collected in 2005 through 2007, only two samples (1.1 percent) had concentrations greater than the 8 µg/L California guideline value. No river sample exceeded the 20 µg/L WHO guideline value for moderate health risk from recreational exposure (Figure 17 bottom).

Although the public health risk from the presence of *Microcystis aeruginosa* arises because of microcystin, the toxin it can produce, most of the decisions regarding actions to protect the public health have been based on the cell count of *Microcystis aeruginosa*. The relationship between microcystin and *Microcystis aeruginosa* cell count in samples from the Klamath River is highly variable as illustrated in Figure 18 (top). In addition to being highly variable, the relationship between *Microcystis aeruginosa* cell count and microcystin concentration appears to vary seasonally. The concentration of microcystin per cell appears to decrease substantially from early summer through the fall as shown in Figure 18 (bottom), although there is considerable variability in the relationship.

A non-linear regression model calculated for all samples with non-zero cell counts suggests that the relationship is best described by a power function

MCYN = 10^(0.8216*MSAE – 3.2828) where

MCYN = microcystin concentration in µg/L, and
MSAE = *Microcystis aeruginosa* abundance in cells/mL.

The relationship is illustrated in Figure 19.

Quality Assurance

Phytoplankton and chlorophyll measurements are inherently variable. PacifiCorp has maintained a quality control program for phytoplankton data collection since 2001 to evaluate the variability and repeatability of the data collected. That program includes collection and analysis of field replicate samples for phytoplankton, and replicate and blank samples for chlorophyll *a*. Approximately one field replicate and one blank is collected and analyzed for every 10 samples, but at least one for every sample batch.

For chlorophyll *a* field replicate samples obtained during 2007, the relative percent difference[6] (RPD) was 8 percent to 134 percent, with a mean value of 66 percent. These values for field replicates compare favorably with the precision, of 14.6 to 33.2 percent relative standard deviation obtained by EPA (1997) using samples of cultured pure strains of algae. A paired t-test on samples and replicates indicated no statistically significant difference between the means (P = 0.47). Results for analysis of chlorophyll *a* field replicates are presented in Figure 20.

[6] Relative percent difference is calculated as the absolute value of the difference between two replicates divided by the average of the two replicates expressed as a percent.

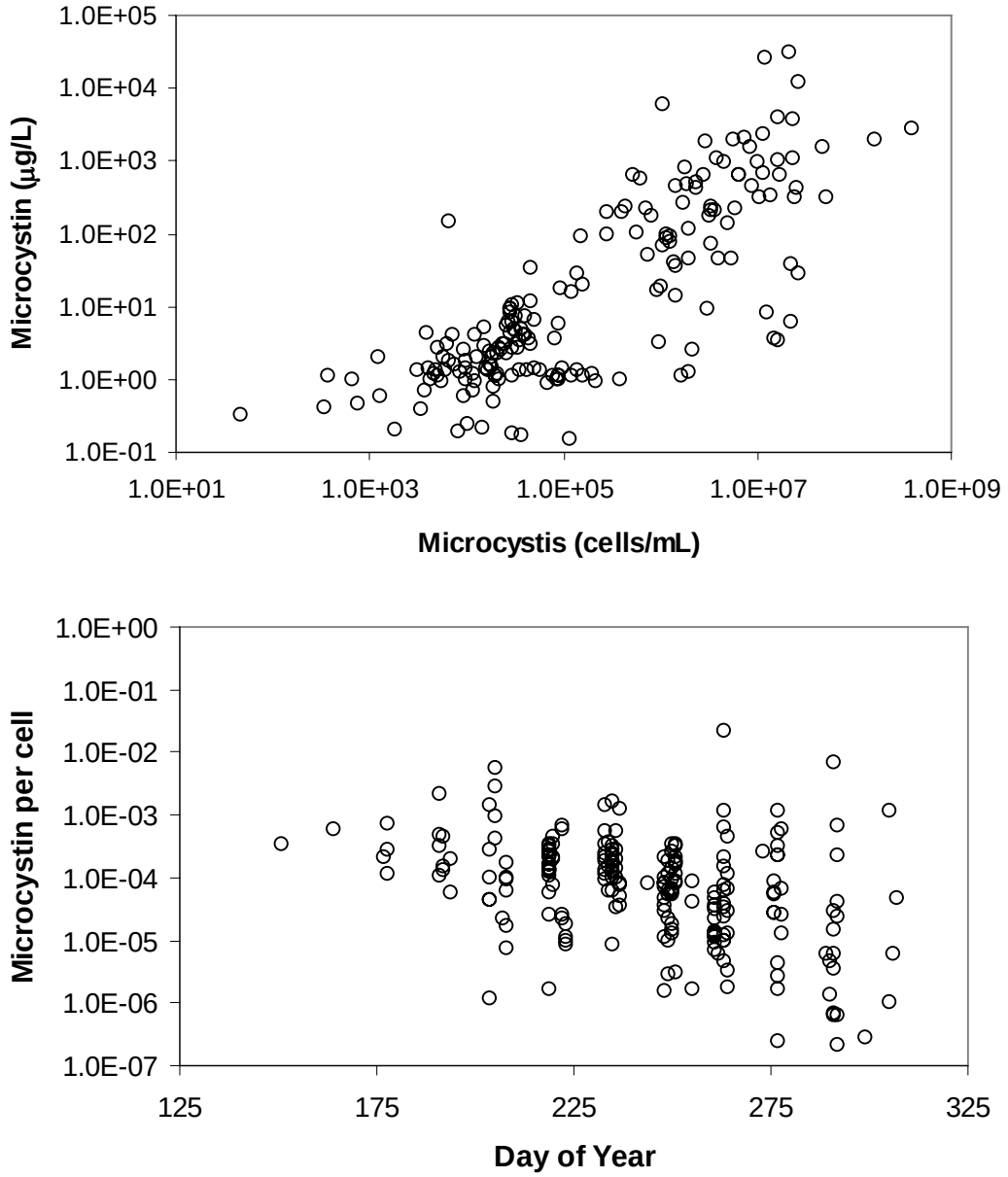

Figure 18. Relationship between microcystin concentration and Microcystis abundance. The top panel shows the relationship between cell count and toxin concentration. The bottom panel shows the seasonal change in toxin concentration per cell.

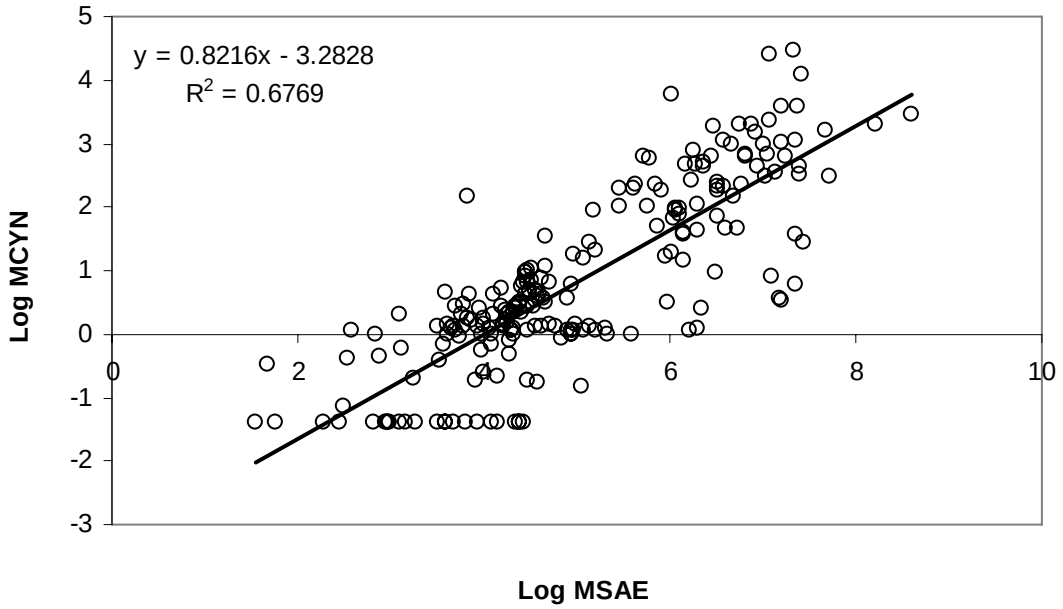

Figure 19 The correlation between microcystin concentration (µg/L) and *Microcystis aeruginosa* cell count (cells/mL).

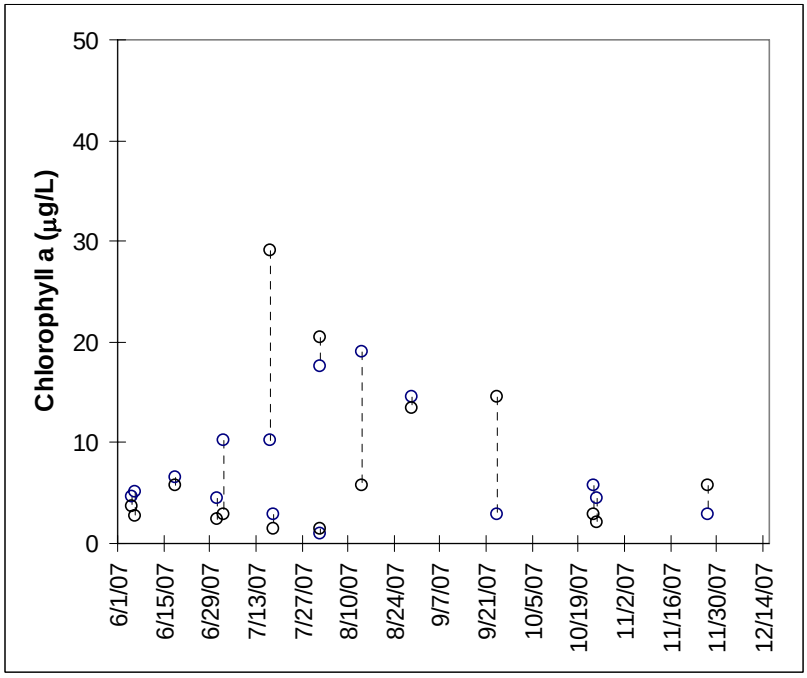

Figure 20. Results of analysis for chlorophyll *a* of paired field replicates from the Klamath River in 2007.

Measured values for chlorophyll *a* field blanks ranged from 0.0 µg/L to 4.4 µg/L with a median of 0.5 µg/L and a mean of 1.8 µg/L. In comparison, the measured values for regular samples ranged from 0.2 to 1156 µg/L with a median of 8.8 µg/L and a mean of 18.4 µg/L.

Quality control for phytoplankton samples is assessed through comparison of total abundance, measured as algal units/mL, and similarity index (SI) for replicate field samples. Blank samples are not processed for phytoplankton. Similarity index is a unit free number calculated based on the number of species common between two samples and their relative ranks with each sample. The SI ranges in value from 0, for two samples with no species in common, to 100 for two samples with identical species in the same rank order.

The SI for field replicates for samples obtained during 2007 averaged approximately 75. The SI for non-replicate samples collected on the same day averaged around 34 (Table 8). A two-sample t-test shows that these averages are significantly different ($P < 0.0001$), indicating that the SI for replicate samples is significantly higher than for unrelated samples. Although not a regular part of the 2007 QA plan, experience has shown that the SI for recounts of the same sample are in the range to 65-85[7].

RPDs for measurements of total density for phytoplankton samples, in algal units/mL, ranged from approximately 0.5 percent to 77 percent with an average of 21 percent and a median of 19 percent. Summary statistics for phytoplankton abundance replicate RPDs are presented in Table 9. Quality assurance values for phytoplankton samples are illustrated in Figure 21.

Table 8. Summary statistics for Similarity Indices calculated for phytoplankton samples collected in the Klamath River and reservoirs.

Statistic	Unrelated Samples	Field Replicates
Count	97	30
Mean	33.8	74.5
Standard Error	1.5	2.6
Median	31.6	71
Standard Deviation	14.3	14.5
Range	63.4	53
Minimum	2.4	46
Maximum	65.8	99
t-Test: Two-Sample Assuming Equal Variances		
Mean	33.8	74.5
Variance	205.2	210.3
Observations	97	30
Pooled Variance	206.4	
Hypothesized Mean Difference	0	
Degrees of freedom	125	
t Stat	-13.5705	
P(T<=t) one-tail	1.21E-26	
t Critical one-tail	1.657135	
P(T<=t) two-tail	2.42E-26	
t Critical two-tail	1.979124	

[7] J. W. Sweet, personal communication

Table 9. Summary statistics for Relative Percent Difference (RPD) calculated for phytoplankton samples collected in the Klamath River and reservoirs.

Statistic	RPD
Mean	21.3
Standard Error	3.8
Median	19.2
Standard Deviation	19.0
Range	76.0
Minimum	0.5
Maximum	76.5
Count	25
95% C.I. of mean	7.8

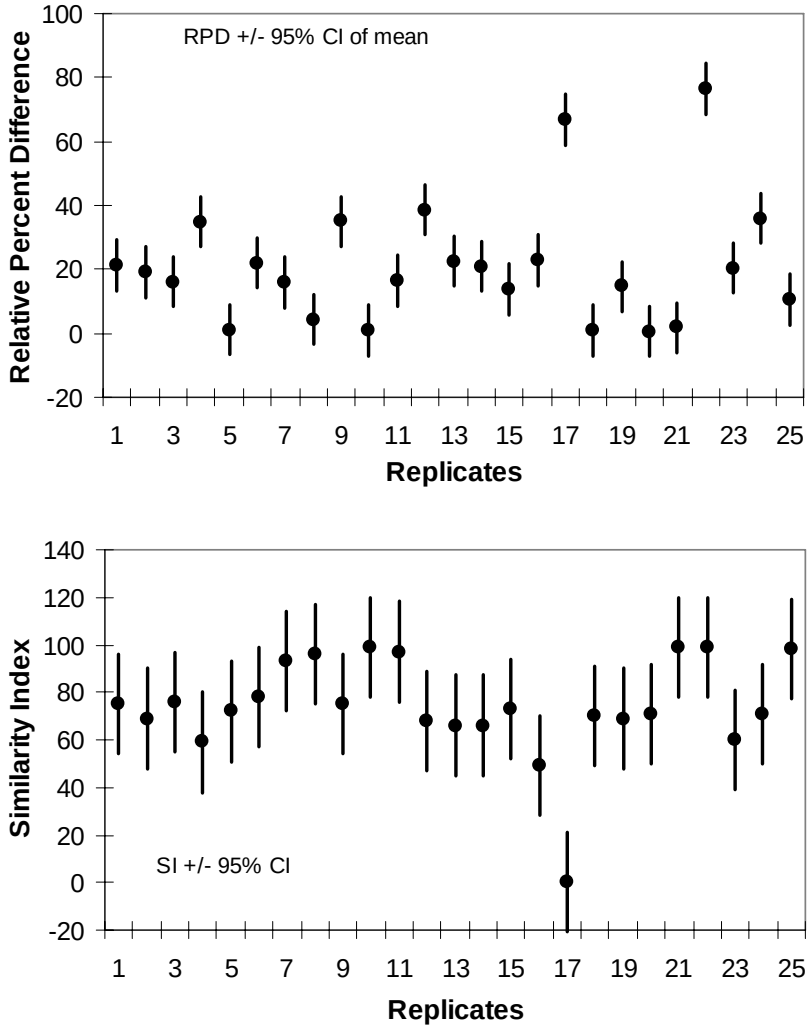

Figure 21. Results of analysis for phytoplankton abundance of paired field replicates from the Klamath River in 2007.

Conclusions

A number of conclusions can be drawn based on the phytoplankton and chlorophyll data analyzed for this report:

- The algal community of the Klamath River and the reservoirs in the vicinity of the Project was dominated by diatoms and cyanobacteria in 2007

- The abundance of algae in June through November in the Klamath River and the reservoirs in the vicinity of the Project was highly seasonal, with peak biovolume in mid August to early September, the result of growth of cyanobacteria.

- A large number of species (168) were present in the Klamath River and the reservoirs in the vicinity of the Project, but relatively few species (33) accounted for 99 percent of the biovolume.

- Algal biovolume was greatest in Upper Klamath Lake, but lower in the river reaches between Upper Klamath Lake and Copco reservoir. Biovolume increased in Copco and Iron Gate reservoirs, but was relatively low in the Klamath River immediately below Iron Gate dam.

- There was a distinct difference in the composition of the algal community in the river compared to the reservoirs. Reservoir samples were dominated by planktonic species typically found in highly enriched waters. River samples were dominated by species that are found in a wide variety of conditions, primarily flowing water, and nutrient conditions ranging from oligotrophic to eutrophic.

- The algal community exhibited a seasonal succession in composition as different species increased and decreased in abundance throughout the growing season. The community was dominated by cyanobacteria in late summer.

- *Aphanizomenon flos-aquae* and *Microcystis aeruginosa* were the predominant cyanobacteria in the Project reservoirs. The biovolume of the two species was comparable in Copco reservoir, but *Aphanizomenon* was clearly dominant in Iron Gate reservoir. *Microcystis* persisted at quite high biovolume in Copco reservoir until late into the fall.

- *Microcystis aeruginosa* can produce microcystin, a potential liver toxin. The concentration of toxin in the water appeared to be correlated with the number of *Microcystis* cells present, but the relationship may not be constant. Microcystin concentration per cell of *Microcytsis* present in the sample appeared to decrease through the growing season.

- Although samples taken from highly concentrated shoreline accumulations of cyanobacteria ("scums") occasionally had very high concentration of microcystin, samples collected from the Klamath River were uniformly low in microcystin concentration. Only two samples collected from the Klamath River in 2005 – 2007 (1.1 percent of samples) had microcystin concentrations that exceeded the recommended guideline value of 8 μg/L for the protection of human health.

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Appendix 1

Phytoplankton species observed in the Klamath River and reservoirs in 2007.

Species	Frequency	Highest Rank	Species	Frequency	Highest Rank
Rhodomonas minuta	340	1	*Achnanthes exigua*	6	11
Cryptomonas erosa	308	1	*Amphora coffeiformes*	6	7
Cocconeis placentula	300	1	*Gyrosigma spencerii*	6	13
Aphanizomenon flos-aquae	247	1	*Melosira ambigua*	6	2
Nitzschia frustulum	246	1	*Navicula anglica*	6	6
Nitzschia palea	229	1	*Synedra radians*	6	2
Rhoicosphenia curvata	225	1	*Synedra socia*	6	12
Nitzschia amphibia	215	2	*Caloneis ventricosa*	5	9
Navicula cryptocephala veneta	210	1	*Coelastrum microporum*	5	12
Gomphonema angustatum	205	1	*Fragilaria leptostauron*	5	13
Ankistrodesmus falcatus	204	1	*Gomphonema parvulum*	5	7
Microcystis aeruginosa	183	1	*Hemidinium sp.*	5	5
Chlamydomonas sp.	163	1	*Navicula menisculus upsaliensis*	5	11
Nitzschia paleacea	145	1	*Navicula rhynchocephala*	5	14
Unidentified flagellate	142	2	*Nitzschia innominata*	5	9
Gomphonema subclavatum	131	4	*Nitzschia linearis*	5	12
Scenedesmus quadricauda	128	1	*Pediastrum boryanum*	5	12
Cyclotella meneghiniana	118	2	*Pediastrum duplex*	5	6
Glenodinium sp.	109	3	*Closteriopsis longissima*	4	7
Nitzschia dissipata	105	1	*Diploneis elliptica*	4	16
Melosira granulata	100	1	*Eudorina elegans*	4	14
Synedra ulna	98	2	*Pandorina morum*	4	10
Fragilaria construens	96	4	*Rhopalodia gibba*	4	10
Stephanodiscus hantzschii	96	1	*Scenedesmus abundans*	4	11
Fragilaria construens venter	95	2	*Synedra rumpens*	4	12
Achnanthes lanceolata	94	3	*Ulothrix sp.*	4	8
Chromulina sp.	85	1	*Cyclotella ocellata*	3	4
Selenastrum minutum	84	1	*Dinobryon sp.*	3	11
Diatoma vulgare	70	3	*Epithemia turgida*	3	12
Navicula tripunctata	69	4	*Gomphonema acuminatum*	3	8
Navicula cryptocephala	67	2	*Navicula decussis*	3	16
Fragilaria crotonensis	65	1	*Nitzschia constricta*	3	13
Achnanthes minutissima	64	3	*Oocystis sp.*	3	3
Sphaerocystis schroeteri	63	5	*Synedra ulna contracta*	3	9
Fragilaria vaucheriae	55	5	*Tetraedron regulare*	3	11
Navicula sp.	55	6	*Anabaena circinalis*	2	8
Stephanodiscus astraea minutula	51	3	*Anomoeoneis vitrea*	2	20
Navicula pupula	45	4	*Chroococcus minimus*	2	13
Epithemia sorex	41	1	*Cocconeis pediculus*	2	13
Melosira varians	41	5	*Cymbella mexicana*	2	23
Amphora perpusilla	40	3	*Dinobryon sertularia*	2	16
Gomphonema ventricosum	39	6	*Euglena sp.*	2	13
Cymbella minuta	36	4	*Gomphonema gracile*	2	10
Fragilaria capucina mesolepta	36	4	*Gymnodinium sp.*	2	7
Nitzschia sp.	34	5	*Hantzschia amphioxys*	2	10
Nitzschia communis	32	6	*Melosira distans alpigena*	2	10

Cymbella affinis	29	1	*Mougeotia sp.*	2	9
Fragilaria vaucheria	29	5	*Navicula gregaria*	2	14
Gomphoneis herculeana	29	5	*Neidium affine*	2	18
Nitzschia acicularis	29	4	*Oscillatoria sp.*	2	11
Nitzschia microcephala	29	6	*Stauroneis sp.*	2	20
Anabaena flos-aquae	28	3	*Stephanodiscus binderanus*	2	10
Cryptomonas ovata	28	4	*Stephanodiscus niagarae*	2	2
Achnanthes linearis	26	5	*Achnanthes clevei*	1	19
Gomphonema olivaceum	25	6	*Anabaena planctonica*	1	6
Diatoma tenue	24	2	*Anabaena sp.*	1	11
Gomphonema clevei	23	3	*Caloneis sp.*	1	12
Scenedesmus acuminatus	23	8	*Chrysochromulina sp.*	1	15
Nitzschia volcanica	22	4	*Closterium sp.*	1	18
Nitzschia capitellata	20	6	*Cocconeis disculus*	1	21
Nitzschia fonticola	19	9	*Crucigenia crucifera*	1	14
Synedra parasitica	19	7	*Crucigenia tetrapedia*	1	11
Navicula minima	17	10	*Cymatopleura solea*	1	13
Achnanthes hauckiana	16	4	*Cymbella angustata*	1	23
Actinastrum hantzschii	15	9	*Cymbella microcephala*	1	13
Cymbella sinuata	15	7	*Cymbella muelleri*	1	15
Kephyrion sp.	15	7	*Cymbellonitzschia diluviana*	1	22
Asterionella formosa	14	6	*Denticula elegans*	1	19
Oocystis pusilla	14	9	*Elakatothrix gelatinosa*	1	18
Schroderia sp.	14	9	*Gyrosigma sp.*	1	16
Cocconeis klamathensis	13	11	*Hannaea arcus*	1	5
Synedra cyclopum	13	4	*Lagynion sp.*	1	18
Amphora ovalis	12	8	*Mallomonas-like*	1	8
Gloeocystis ampla	12	7	*Melosira italica*	1	24
Navicula minuscula	12	7	*Navicula cascadensis*	1	10
Navicula mutica	12	11	*Navicula graciloides*	1	22
Synedra mazamaensis	12	4	*Navicula viridula*	1	13
Dictyosphaerium ehrenbergianum	11	9	*Nitzschia clausii*	1	15
Mallomonas sp.	11	5	*Nitzschia fruticosa*	1	16
Pinnularia sp.	11	4	*Nitzschia tryblionella*	1	28
Cymbella tumida	10	11	*Ochromonas sp.*	1	13
Fragilaria pinnata	10	7	*Oocystis parva*	1	12
Fragilaria virescens	10	3	*Oscillatoria limosa*	1	14
Tetraedron minimum	10	7	*Pediastrum tetras*	1	20
Gomphonema tenellum	9	14	*Peridinium cinctum*	1	20
Gomphonema truncatum	9	11	*Scenedesmus bijuga*	1	24
Ceratium hirundinella	8	4	*Scenedesmus denticulatus*	1	18
Cyclotella stelligera	8	9	*Staurastrum gracile*	1	19
Cyclotella pseudostelligera	7	10	*Synedra tenera*	1	20
Gomphonema sp.	7	14	*Tetraedron sp.*	1	22
Navicula capitata	7	11			

Appendix 2

Microcystin data collected in the Klamath River and reservoirs in 2005 through 2007. (Data compiled by CH2M Hill, 2008).

Table A1. Microcystis and microcystin data obtained at all sites sampled in the Klamath River and reservoirs, 2005-2007 (source: various Tribe report and memos).

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
9/29/04	CRJS	198.7	Copco Res. Mallard Cove	SL	1,908,732	0	482.00	Kann & Corum 2006
6/28/05	IR03-1m	193.0	Iron Gate Res. Upper ½	OW	0	541		Kann & Corum 2006
6/28/05	IR01-1m	190.2	Iron Gate Res. Near Dam	OW	793	2,213		Kann & Corum 2006
6/29/05	CR02-1m	201.0	Copco Res. - Upper half	OW	0	0		Kann & Corum 2006
6/29/05	CR01	198.0	Copco Res. Near Dam	OW	0	181		Kann & Corum 2006
7/13/05	CR02-1m	201.0	Copco Res. - Upper half	OW	0	0		Kann & Corum 2006
7/13/05	CRSH	200.6	Copco Res. North Shoreline	SL	11,402,943	38,383	667.00	Kann & Corum 2006
7/13/05	CR01	198.0	Copco Res. Near Dam	OW	15,527	488		Kann & Corum 2006
7/13/05	CR01-1m	198.0	Copco Res. Near Dam	OW	0	0		Kann & Corum 2006
7/13/05	CR01-D	198.0	Copco Res. Near Dam	OW	15,987	0		Kann & Corum 2006
7/14/05	IR03-1m	193.0	Iron Gate Res. Upper ½	OW	0	203		Kann & Corum 2006
7/14/05	IR01-1m	190.2	Iron Gate Res. Near Dam	OW	0	0		Kann & Corum 2006
7/26/05	CR02-1m	201.0	Copco Res. - Upper half	OW	0	145		Kann & Corum 2006
7/26/05	CRCC	198.5	Copco Res. Copco Cove	SL	3,316,176	0	72.16	Kann & Corum 2006
7/26/05	CR01	198.0	Copco Res. Near Dam	OW	0	0		Kann & Corum 2006
7/26/05	CR01-1m	198.0	Copco Res. Near Dam	OW	278	0		Kann & Corum 2006
7/27/05	IRUS	195.0	Iron Gate Res. Upper Shoreline	SL	NA	NA	98.38	Kann & Corum 2006
7/27/05	IR03	193.0	Iron Gate Res. Upper ½	OW	5,534	1,217	0.92	Kann & Corum 2006
7/27/05	IR03-1m	193.0	Iron Gate Res. Upper ½	OW	223	0		Kann & Corum 2006
7/27/05	IR01-1m	190.2	Iron Gate Res. Near Dam	OW	0	0		Kann & Corum 2006
8/10/05	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann & Corum 2006
8/10/05	CRSS	203.0	Copco Res. South Shoreline	SL	1,985,035	0	44.22	Kann & Corum 2006
8/10/05	CRMC	200.8	Copco Res. Mallard Cove	SL	1,427,215	0	36.58	Kann & Corum 2006
8/10/05	CRCC	198.5	Copco Res. Copco Cove	SL	283,963	0	196.36	Kann & Corum 2006
8/10/05	CR01	198.0	Copco Res. Near Dam	OW	151,004	0	90.35	Kann & Corum 2006
8/11/05	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	1,423,430	0	14.23	Kann & Corum 2006
8/11/05	IRNC	192.5	Iron Gate Res. Near Camp Creek	SL	5,350,847	0	46.02	Kann & Corum 2006
8/11/05	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	4,059,000	0	46.55	Kann & Corum 2006
8/11/05	IR01	190.2	Iron Gate Res. Near Dam	OW	916,548	0	16.23	Kann & Corum 2006
8/11/05	KRBI	189.5	Klamath River below Iron Gate	RIV	989	0		Kann & Corum 2006
8/24/05	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann & Corum 2006
8/24/05	CRSS	203.0	Copco Res. South Shoreline	SL	46,834,615	0	1571.70	Kann & Corum 2006
8/24/05	CRMC	200.8	Copco Res. Mallard Cove	SL	9,826	0	1.40	Kann & Corum 2006
8/24/05	CRCC	198.5	Copco Res. Copco Cove	SL	6,413,303	0	640.20	Kann & Corum 2006
8/24/05	CR01	198.0	Copco Res. Near Dam	OW	28,188	0	8.00	Kann & Corum 2006
8/24/05	WE	43.5	Klamath River at Weitchpec	RIV	1,628			Fetcho 2006
8/24/05	KBW	42.5	Klamath River below Weitchpec	RIV	391			Fetcho 2006
8/24/05	TG.1	6.0	Klamath at Turwar-Right Bank	RIV	0			Fetcho 2006
8/24/05	LES	0.5	Lower Estuary Surface	RIV	DNS			Fetcho 2006
8/25/05	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	1,251,525	0	93.60	Kann & Corum 2006
8/25/05	IRCC-D	192.8	Iron Gate Res. Camp Creek Area	SL	1,164,467	0	94.60	Kann & Corum 2006
8/25/05	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	17,458,065	0	632.20	Kann & Corum 2006
8/25/05	IROW	190.5	Iron Gate Res. Open Water Station	OW	8,944,366	0	436.90	Kann & Corum 2006
8/25/05	IR01	190.2	Iron Gate Res. Near Dam	OW	528,759	0	645.40	Kann & Corum 2006

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
8/25/05	KRBI	189.5	Klamath River below Iron Gate	RIV	24,429	0		Kann & Corum 2006
9/1/05	WE	43.5	Klamath River at Weitchpec	RIV	44,543		3.53	Fetcho 2006
9/1/05	KBW	42.5	Klamath River below Weitchpec	RIV	DNS			Fetcho 2006
9/1/05	TG.1	6.0	Klamath at Turwar-Right Bank	RIV	11,745			Fetcho 2006
9/1/05	LES	0.5	Lower Estuary Surface	RIV	4,393			Fetcho 2006
9/7/05	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann & Corum 2006
9/7/05	CRSS	203.0	Copco Res. South Shoreline	SL	24,415,038	0	321.48	Kann & Corum 2006
9/7/05	CRMC	200.8	Copco Res. Mallard Cove	SL	737,617	0	50.00	Kann & Corum 2006
9/7/05	CRCC	198.5	Copco Res. Copco Cove	SL	10,022,222	0	946.00	Kann & Corum 2006
9/7/05	CR01	198.0	Copco Res. Near Dam	OW	1,252,778	0	75.05	Kann & Corum 2006
9/8/05	UKLOUT	254.0	Upper Klamath Lake outlet	OW			0.32	Kann & Corum 2006
9/8/05	IR03	193.0	Iron Gate Res. Upper ½	OW	2,307,442	0	431.14	Kann & Corum 2006
9/8/05	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	33,407	0	10.78	Kann & Corum 2006
9/8/05	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	584,473	0	100.86	Kann & Corum 2006
9/8/05	IR01	190.2	Iron Gate Res. Near Dam	OW	3,095,098	0	9.41	Kann & Corum 2006
9/8/05	KRBI	189.5	Klamath River below Iron Gate	RIV	42,577	0		Kann & Corum 2006
9/8/05	WE	43.5	Klamath River at Weitchpec	RIV	29,413		6.25	Fetcho 2006
9/8/05	KBW	42.5	Klamath River below Weitchpec	RIV	DNS			Fetcho 2006
9/8/05	EWB	16.5	Klamath River nr Blue Creek	RIV	5,704		1.99	Fetcho 2006
9/8/05	TG.1	6.0	Klamath at Turwar-Right Bank	RIV	12,819		2.00	Fetcho 2006
9/8/05	TG.2	6.0	Klamath at Turwar-Center	RIV	22,390		2.53	Fetcho 2006
9/8/05	TG.3	6.0	Klamath at Turwar-Left Bank	RIV	29,807		2.62	Fetcho 2006
9/8/05	LES	0.5	Lower Estuary Surface	RIV	12,297		0.96	Fetcho 2006
9/12/05	WE	43.5	Klamath River at Weitchpec	RIV	24,285		0.00	Fetcho 2006
9/12/05	KBW	42.5	Klamath River below Weitchpec	RIV	DNS			Fetcho 2006
9/12/05	TG.1	6.0	Klamath at Turwar-Right Bank	RIV	18,989		0.79	Fetcho 2006
9/12/05	LES	0.5	Lower Estuary Surface	RIV	26,058		2.24	Fetcho 2006
9/20/05	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann & Corum 2006
9/20/05	CRSS	203.0	Copco Res. South Shoreline	SL	5,965,608	0	227.39	Kann & Corum 2006
9/20/05	CRMC	200.8	Copco Res. Mallard Cove	SL	2,931,500	0	1856.54	Kann & Corum 2006
9/20/05	CRCC	198.5	Copco Res. Copco Cove	SL	163,004,286	0	1994.83	Kann & Corum 2006
9/20/05	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	33,995	0	2.64	Kann & Corum 2006
9/20/05	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	6,657	0	142.31	Kann & Corum 2006
9/20/05	KRBI	189.5	Klamath River below Iron Gate	RIV	8,509	0	1.27	Kann & Corum 2006
9/21/05	CR01	198.0	Copco Res. Near Dam	OW	46,256	0	3.08	Kann & Corum 2006
9/21/05	IR01	190.2	Iron Gate Res. Near Dam	OW	4,920,000	0	141.23	Kann & Corum 2006
9/21/05	WE	43.5	Klamath River at Weitchpec	RIV	3,235		0.00	Fetcho 2006
9/21/05	KBW	42.5	Klamath River below Weitchpec	RIV	1,296		0.58	Fetcho 2006
9/21/05	TG.1	6.0	Klamath at Turwar-Right Bank	RIV	1,804		0.20	Fetcho 2006
9/21/05	LES	0.5	Lower Estuary Surface	RIV	DNS			Fetcho 2006
9/28/05	KBW	42.5	Klamath River below Weitchpec	RIV	DNS			Fetcho 2006
9/28/05	TG.1	6.0	Klamath at Turwar-Right Bank	RIV	0		0.00	Fetcho 2006
9/28/05	LES	0.5	Lower Estuary Surface	RIV	DNS			Fetcho 2006
10/4/05	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.00	Kann & Corum 2006
10/4/05	CRCC	198.5	Copco Res. Copco Cove	SL	28,544	0	9.29	Kann & Corum 2006
10/4/05	CR01	198.0	Copco Res. Near Dam	OW	22,284,026	0	37.65	Kann & Corum 2006
10/4/05	KRAI	196.0	Klamath River above Iron Gate	RIV			0.85	Kann & Corum 2006
10/5/05	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	88,617	0	5.92	Kann & Corum 2006
10/5/05	IR01	190.2	Iron Gate Res. Near Dam	OW	68,480	0	0.87	Kann & Corum 2006
10/5/05	IR01-D	190.2	Iron Gate Res. Near Dam	OW	18,982	0	0.49	Kann & Corum 2006
10/5/05	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0	0.24	Kann & Corum 2006
10/18/05	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.00	Kann & Corum 2006

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
10/18/05	CRCC	198.5	Copco Res. Copco Cove	SL	953,620	0	3.23	Kann & Corum 2006
10/18/05	CR01	198.0	Copco Res. Near Dam	OW	1,986,548	0	1.25	Kann & Corum 2006
10/18/05	CR01-D	198.0	Copco Res. Near Dam	OW	1,621,162	0	1.12	Kann & Corum 2006
10/18/05	KRAI	196.0	Klamath River above Iron Gate	RIV			0.00	Kann & Corum 2006
10/19/05	IRUS	195.0	Iron Gate Res. Upper Shoreline	SL	8,768,503	0		Kann & Corum 2006
10/19/05	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	980	0	0.00	Kann & Corum 2006
10/19/05	IR01	190.2	Iron Gate Res. Near Dam	OW	16,155,224	0	3.44	Kann & Corum 2006
10/19/05	IR01-D	190.2	Iron Gate Res. Near Dam	OW	12,712,563	0	8.18	Kann & Corum 2006
10/19/05	KRBI	189.5	Klamath River below Iron Gate	RIV	58	0	0.00	Kann & Corum 2006
10/26/05	IRUS	195.0	Iron Gate Res. Upper Shoreline	SL	22,241,096	0	5.99	Kann & Corum 2006
10/26/05	IRUS-D	195.0	Iron Gate Res. Upper Shoreline	SL	12,596,111	0		Kann & Corum 2006
11/2/05	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.00	Kann & Corum 2006
11/2/05	CRCC	198.5	Copco Res. Copco Cove	SL	6,505	0	0.00	Kann & Corum 2006
11/2/05	CR01	198.0	Copco Res. Near Dam	OW	0	0	0.00	Kann & Corum 2006
11/2/05	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0	0.00	Kann & Corum 2006
11/3/05	IR01	190.2	Iron Gate Res. Near Dam	OW	867	0	0.00	Kann & Corum 2006
11/3/05	IR01-D	190.2	Iron Gate Res. Near Dam	OW	0	0		Kann & Corum 2006
5/23/06	IG	189.5	Klamath R. below IG Dam	RIV	0			Fetcho 2007
5/23/06	SH	176.0	Shasta R. nr mouth	Trib	0			Fetcho 2007
5/23/06	SC	143.0	Scott R. nr mouth	Trib	0			Fetcho 2007
5/23/06	SV	128.5	Klamath R. at Seiad Valley	RIV	0			Fetcho 2007
5/23/06	SA	66.0	Salmon R. nr mouth	Trib	0			Fetcho 2007
5/23/06	OR	59.0	Klamath R. at Orleans	RIV	0			Fetcho 2007
5/23/06	WE	43.5	Klamath R. at Weitchpec	RIV	0			Fetcho 2007
5/23/06	TR	42.6	Trinity R. nr mouth	Trib	0			Fetcho 2007
5/23/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0			Fetcho 2007
5/23/06	TG	6.0	Klamath R. at Turwar	RIV	0			Fetcho 2007
6/20/06	IG	189.5	Klamath R. below IG Dam	RIV	0			Fetcho 2007
6/20/06	SH	176.0	Shasta R. nr mouth	Trib	0			Fetcho 2007
6/20/06	SC	143.0	Scott R. nr mouth	Trib	0			Fetcho 2007
6/20/06	SV	128.5	Klamath R. at Seiad Valley	RIV	0			Fetcho 2007
6/20/06	SA	66.0	Salmon R. nr mouth	Trib	0			Fetcho 2007
6/20/06	OR	59.0	Klamath R. at Orleans	RIV	0			Fetcho 2007
6/20/06	WE	43.5	Klamath R. at Weitchpec	RIV	0			Fetcho 2007
6/20/06	TR	42.6	Trinity R. nr mouth	Trib	0			Fetcho 2007
6/20/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0			Fetcho 2007
6/20/06	TG	6.0	Klamath R. at Turwar	RIV	0			Fetcho 2007
7/12/06	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann 2006
7/13/06	CRCC	198.5	Copco Res. Copco Cove	SL	11,783,212	6,086	2286.00	Kann 2006
7/13/06	CR01	198.0	Copco Res. Near Dam	OW	2,492	0		Kann 2006
7/13/06	IR01	190.2	Iron Gate Res. Near Dam	OW	13,377	0		Kann 2006
7/13/06	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0		Kann 2006
7/18/06	IG	189.5	Klamath R. below IG Dam	RIV	7,063			Fetcho 2007
7/18/06	SH	176.0	Shasta R. nr mouth	Trib	0			Fetcho 2007
7/18/06	SC	143.0	Scott R. nr mouth	Trib	0			Fetcho 2007
7/18/06	SV	128.5	Klamath R. at Seiad Valley	RIV	0			Fetcho 2007
7/18/06	SA	66.0	Salmon R. nr mouth	Trib	0			Fetcho 2007
7/18/06	OR	59.0	Klamath R. at Orleans	RIV	0			Fetcho 2007
7/18/06	WE	43.5	Klamath R. at Weitchpec	RIV	0			Fetcho 2007
7/18/06	TR	42.6	Trinity R. nr mouth	Trib	0			Fetcho 2007
7/18/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0			Fetcho 2007
7/18/06	TG	6.0	Klamath R. at Turwar	RIV	0			Fetcho 2007

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
7/18/06	LES	0.5	Lower Estuary - surface	RIV	0			Fetcho 2007
7/26/06	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann 2006
7/26/06	SV	128.5	Klamath River at Seiad Valley	RIV	0	0		Kann 2006
7/26/06	OR	59.0	Klamath River at Orleans	RIV	0	0	0.97	Kann 2006
7/26/06	WE	43.5	Klamath R. at Weitchpec	RIV	0		0.00	Fetcho 2007
7/26/06	BC	16.5	Klamath R. above Blue Cr.	RIV	0		0.00	Fetcho 2007
7/26/06	TG	6.0	Klamath R. at Turwar	RIV	0		0.00	Fetcho 2007
7/26/06	LES	0.5	Lower Estuary - surface	RIV	0		0.00	Fetcho 2007
7/27/06	CRCC	198.5	Copco Res. Copco Cove	SL	393,395,000	0	2813.00	Kann 2006
7/27/06	CR01	198.0	Copco Res. Near Dam	OW	16,340,580	0	1003.00	Kann 2006
7/27/06	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	25,043,386	32,214	430.00	Kann 2006
7/27/06	IR01	190.2	Iron Gate Res. Near Dam	OW	6,504,808	0	650.00	Kann 2006
7/27/06	KRBI	189.5	Klamath River below Iron Gate	RIV	35,985	0	3.40	Kann 2006
8/7/06	KBL	254.0	Klamath R. below Link Dam	RIV	0		3.30	Fetcho 2007
8/7/06	KBK	233.0	Klamath R. below Keno Dam	RIV	21,107		2.20	Fetcho 2007
8/7/06	KBB	224.0	Klamath R. below JC Boyle Dam	RIV	24,247		0.00	Fetcho 2007
8/7/06	KRAC	206.0	Klamath River above Copco	RIV	0	0	2.00	Kann 2006
8/7/06	CRMC	200.8	Copco Res. Mallard Cove	SL	23,575,000	0	3779.00	Kann 2006
8/7/06	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	1,999,113	0	113.00	Kann 2006
8/7/06	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	13,717,917	0	341.00	Kann 2006
8/7/06	KRBI	189.5	Klamath River below Iron Gate	RIV	24,929	0	3.00	Kann 2006
8/7/06	SV	128.5	Klamath River at Seiad Valley	RIV		0	6.70	Kann 2006
8/7/06	OR	59.0	Klamath River at Orleans	RIV		0	4.10	Kann 2006
8/7/06	WE	43.5	Klamath R. at Weitchpec	RIV	30,576		4.80	Fetcho 2007
8/7/06	TG	6.0	Klamath R. at Turwar	RIV	4,802		1.30	Fetcho 2007
8/7/06	LES	0.5	Lower Estuary - surface	RIV	289		0.00	Fetcho 2007
8/8/06	CRCC	198.5	Copco Res. Copco Cove	SL	26,487,302	0	12176.00	Kann 2006
8/8/06	CR01	198.0	Copco Res. Near Dam	OW	2,371,806	0	507.00	Kann 2006
8/8/06	IR03	193.0	Iron Gate Res. Upper ½	OW	379,668	0		Kann 2006
8/8/06	IR01	190.2	Iron Gate Res. Near Dam	OW	1,170,405	0	87.00	Kann 2006
8/23/06	KBL	254.0	Klamath R. below Link Dam	RIV	41,000		4.10	Fetcho 2007
8/23/06	KBK	233.0	Klamath R. below Keno Dam	RIV	665		0.00	Fetcho 2007
8/23/06	KBB	224.0	Klamath R. below JC Boyle Dam	RIV	4,856		0.00	Fetcho 2007
8/23/06	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.45	Kann 2006
8/23/06	CRMC	200.8	Copco Res. Mallard Cove	SL	8,388,600	0	1543.00	Kann 2006
8/23/06	CRCC	198.5	Copco Res. Copco Cove	SL	16,093,579	0	3839.00	Kann 2006
8/23/06	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	7,492,880	0	2032.00	Kann 2006
8/23/06	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	121,401	0	15.90	Kann 2006
8/23/06	KRBI	189.5	Klamath River below Iron Gate	RIV	28,423	0	9.20	Kann 2006
8/23/06	SH	176.0	Shasta R. nr mouth	Trib	0		0.00	Fetcho 2007
8/23/06	SC	143.0	Scott R. nr mouth	Trib	0		0.00	Fetcho 2007
8/23/06	SV	128.5	Klamath River at Seiad Valley	RIV	41,299	0	7.30	Kann 2006
8/23/06	SA	66.0	Salmon R. nr mouth	Trib	0		0.00	Fetcho 2007
8/23/06	OR	59.0	Klamath River at Orleans	RIV	31,801	0	4.60	Kann 2006
8/23/06	WE	43.5	Klamath R. at Weitchpec	RIV	32,069		7.10	Fetcho 2007
8/23/06	TR	42.6	Trinity R. nr mouth	Trib	0		0.00	Fetcho 2007
8/23/06	KBW	42.5	Klamath R. below Weitchpec	RIV	15,455		2.80	Fetcho 2007
8/23/06	TG	6.0	Klamath R. at Turwar	RIV	21,759		2.70	Fetcho 2007
8/23/06	LES	0.5	Lower Estuary - surface	RIV	1,246		2.00	Fetcho 2007
8/24/06	CR01	198.0	Copco Res. Near Dam	OW	92,250	0	17.60	Kann 2006
8/24/06	IR01	190.2	Iron Gate Res. Near Dam	OW	434,893	0	231.00	Kann 2006
9/6/06	KBL	254.0	Klamath R. below Link Dam	RIV	0		2.70	Fetcho 2007

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
9/6/06	KBK	233.0	Klamath R. below Keno Dam	RIV	0		0.00	Fetcho 2007
9/6/06	KBB	224.0	Klamath R. below JC Boyle Dam	RIV	0		0.00	Fetcho 2007
9/6/06	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.00	Kann 2006
9/6/06	KRBI	189.5	Klamath River below Iron Gate	RIV	3,735	0	0.69	Kann 2006
9/6/06	SV	128.5	Klamath River at Seiad Valley	RIV	9,555	0	0.57	Kann 2006
9/6/06	OR	59.0	Klamath River at Orleans	RIV	3,356	0	0.39	Kann 2006
9/6/06	WE	43.5	Klamath R. at Weitchpec	RIV	1,845		0.00	Fetcho 2007
9/6/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0		0.00	Fetcho 2007
9/6/06	TG	6.0	Klamath R. at Turwar	RIV	0		0.00	Fetcho 2007
9/6/06	LES	0.5	Lower Estuary - surface	RIV	0		0.00	Fetcho 2007
9/7/06	CRMC	200.8	Copco Res. Mallard Cove	SL	1,028,844	0	19.00	Kann 2006
9/7/06	CRCC	198.5	Copco Res. Copco Cove	SL	3,728,535	0	206.10	Kann 2006
9/7/06	CR01	198.0	Copco Res. Near Dam	OW	95,838	0	1.40	Kann 2006
9/7/06	IR03	193.0	Iron Gate Res. Upper ½	OW	45,585		11.90	Kann 2006
9/7/06	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	29,530	0	10.10	Kann 2006
9/7/06	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	11,897	0	0.68	Kann 2006
9/7/06	IR01	190.2	Iron Gate Res. Near Dam	OW	17,524	0	2.40	Kann 2006
9/20/06	KBL	254.0	Klamath R. below Link Dam	RIV	0		0.00	Fetcho 2007
9/20/06	KBK	233.0	Klamath R. below Keno Dam	RIV	1,230		0.00	Fetcho 2007
9/20/06	KBB	224.0	Klamath R. below JC Boyle Dam	RIV	0		0.00	Fetcho 2007
9/20/06	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.00	Kann 2006
9/20/06	CRMC	200.8	Copco Res. Mallard Cove	SL	3,312,031	0	209.00	Kann 2006
9/20/06	CRCC	198.5	Copco Res. Copco Cove	SL	2,628,528	0		Kann 2006
9/20/06	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	8,301	0	0.19	Kann 2006
9/20/06	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	8,786	0	0.00	Kann 2006
9/20/06	IG	189.5	Klamath R. below IG Dam	RIV	3,982		0.00	Fetcho 2007
9/20/06	KRBI	189.5	Klamath River below Iron Gate	RIV	3,982	0	0.00	Kann 2006
9/20/06	SH	176.0	Shasta R. nr mouth	Trib	0			Fetcho 2007
9/20/06	SC	143.0	Scott R. nr mouth	Trib	0			Fetcho 2007
9/20/06	SV	128.5	Klamath River at Seiad Valley	RIV	190	0	0.00	Kann 2006
9/20/06	SA	66.0	Salmon R. nr mouth	Trib	0			Fetcho 2007
9/20/06	OR	59.0	Klamath River at Orleans	RIV	0	0	0.00	Kann 2006
9/20/06	WE	43.5	Klamath R. at Weitchpec	RIV	0		0.00	Fetcho 2007
9/20/06	TR	42.6	Trinity R. nr mouth	Trib	0			Fetcho 2007
9/20/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0		0.00	Fetcho 2007
9/20/06	TG	6.0	Klamath R. at Turwar	RIV	0		0.00	Fetcho 2007
9/20/06	LES	0.5	Lower Estuary - surface	RIV	35		0.00	Fetcho 2007
9/21/06	CR01	198.0	Copco Res. Near Dam	OW	22,259	0	0.00	Kann 2006
9/21/06	IR01	190.2	Iron Gate Res. Near Dam	OW	12,177	0	0.00	Kann 2006
10/4/06	KBL	254.0	Klamath R. below Link Dam	RIV	0			Fetcho 2007
10/4/06	KBK	233.0	Klamath R. below Keno Dam	RIV	0			Fetcho 2007
10/4/06	KBB	224.0	Klamath R. below JC Boyle Dam	RIV	0			Fetcho 2007
10/4/06	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann 2006
10/4/06	CRMC	200.8	Copco Res. Mallard Cove	SL	403,718	0	200.00	Kann 2006
10/4/06	CRCC	198.5	Copco Res. Copco Cove	SL	2,774,943	0	630.00	Kann 2006
10/4/06	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	346	0	0.40	Kann 2006
10/4/06	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0	0.17	Kann 2006
10/4/06	SV	128.5	Klamath River at Seiad Valley	RIV	0	0	0.26	Kann 2006
10/4/06	OR	59.0	Klamath River at Orleans	RIV	0	0	0.27	Kann 2006
10/4/06	WE	43.5	Klamath R. at Weitchpec	RIV	0			Fetcho 2007
10/4/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0			Fetcho 2007
10/4/06	TG	6.0	Klamath R. at Turwar	RIV	0			Fetcho 2007

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
10/4/06	LES	0.5	Lower Estuary - surface	RIV	0			Fetcho 2007
10/5/06	CR01	198.0	Copco Res. Near Dam	OW	756	0	0.45	Kann 2006
10/5/06	IR03	193.0	Iron Gate Res. Upper ½	OW	604	0		Kann 2006
10/5/06	IR01	190.2	Iron Gate Res. Near Dam	OW	0	0	0.27	Kann 2006
10/18/06	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.14	Kann 2006
10/18/06	CRMC	200.8	Copco Res. Mallard Cove	SL	10,570,313	0	310.00	Kann 2006
10/18/06	CRCC	198.5	Copco Res. Copco Cove	SL	51,250,000	0	310.00	Kann 2006
10/18/06	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	14,455	0	0.21	Kann 2006
10/18/06	KRBI	189.5	Klamath River below Iron Gate	RIV	47	0	0.33	Kann 2006
10/18/06	SH	176.0	Shasta R. nr mouth	Trib	0			Fetcho 2007
10/18/06	SC	143.0	Scott R. nr mouth	Trib	0			Fetcho 2007
10/18/06	SV	128.5	Klamath River at Seiad Valley	RIV	0	0	0.32	Kann 2006
10/18/06	SA	66.0	Salmon R. nr mouth	Trib	0			Fetcho 2007
10/18/06	OR	59.0	Klamath River at Orleans	RIV	0	0	0.27	Kann 2006
10/18/06	WE	43.5	Klamath R. at Weitchpec	RIV	0			Fetcho 2007
10/18/06	KBW	42.5	Klamath R. below Weitchpec	RIV	0			Fetcho 2007
10/18/06	TG	6.0	Klamath R. at Turwar	RIV	0			Fetcho 2007
10/18/06	LES	0.5	Lower Estuary - surface	RIV	0			Fetcho 2007
10/19/06	KBL	254.0	Klamath R. below Link Dam	RIV	0			Fetcho 2007
10/19/06	KBK	233.0	Klamath R. below Keno Dam	RIV	0			Fetcho 2007
10/19/06	KBB	224.0	Klamath R. below JC Boyle Dam	RIV	9,204			Fetcho 2007
10/19/06	CR01	198.0	Copco Res. Near Dam	OW	313	0	0.07	Kann 2006
10/19/06	IR03	193.0	Iron Gate Res. Upper ½	OW	0	0	0.13	Kann 2006
10/19/06	IR01	190.2	Iron Gate Res. Near Dam	OW	10,208	0	0.24	Kann 2006
11/1/06	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann 2007 memos
11/1/06	CRMC	200.8	Copco Res. Mallard Cove	SL	27,234,581	0	28.00	Kann 2007 memos
11/1/06	CRCC	198.5	Copco Res. Copco Cove	SL	3,855	0	4.40	Kann 2007 memos
11/1/06	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0		Kann 2007 memos
11/2/06	CR01	198.0	Copco Res. Near Dam	OW	313	0		Kann 2007 memos
5/31/07	IR01	190.2	Iron Gate Res. Near Dam	OW	12,528	863	4.10	Kann 2007 memos
6/12/07	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0		Kann 2007 memos
6/13/07	KBL	254.0	Klamath R. below Link Dam	RIV			1.60	EPA lab report
6/13/07	KBK	233.0	Klamath R. below Keno Dam	RIV			3.60	EPA lab report
6/13/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			4.70	EPA lab report
6/13/07	KRAC	206.0	Klamath River above Copco	RIV	0	0		Kann 2007 memos
6/13/07	CRCC	198.5	Copco Res. Copco Cove	SL	360,800	65,996		Kann 2007 memos
6/13/07	CR01	198.0	Copco Res. Near Dam	OW	0	2,747	3.50	Kann 2007 memos
6/13/07	IR01	190.2	Iron Gate Res. Near Dam	OW	7,091	1,968	4.10	Kann 2007 memos
6/26/07	CRCC	198.5	Copco Res. Copco Cove	SL	4,578,497	30,283	990.00	Kann 2007 memos
6/26/07	KRAI	196.0	Klamath River above Iron Gate	RIV			1.00	EPA lab report
6/26/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	0	168	1.80	Kann 2007 memos
6/26/07	KRBI	189.5	Klamath River below Iron Gate	RIV	0	0	1.60	Kann 2007 memos
6/26/07	SH	176.0	Shasta R. nr mouth	Trib			1.30	EPA lab report
6/26/07	SC	143.0	Scott R. nr mouth	Trib			0.97	EPA lab report
6/26/07	SV	128.5	Klamath River at Seiad Valley	RIV	0	0	1.40	Kann 2007 memos
6/26/07	OR	59.0	Klamath River at Orleans	RIV	0	0		Kann 2007 memos
6/27/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.00	Kann 2007 memos
6/27/07	CRMC	200.8	Copco Res. Mallard Cove	SL	46,979	542	34.00	Kann 2007 memos
6/27/07	CR01	198.0	Copco Res. Near Dam	OW	18,910	0	2.20	Kann 2007 memos
6/27/07	IR01	190.2	Iron Gate Res. Near Dam	OW	3,856,736	11,808	1100.00	Kann 2007 memos
6/28/07	KBL	254.0	Klamath R. below Link Dam	RIV			2.20	EPA lab report
6/28/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.60	EPA lab report

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
6/28/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.80	EPA lab report
7/10/07	CRCC	198.5	Copco Res. Copco Cove	SL	12,036,824	0	26000.00	Kann 2007 memos
7/10/07	KRAI	196.0	Klamath River above Iron Gate	RIV			5.00	EPA lab report
7/10/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	1,474,969	4,888	460.00	Kann 2007 memos
7/10/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	38,828	1,882	4.00	Kann 2007 memos
7/10/07	KRBI	189.5	Klamath River below Iron Gate	RIV	6,231	119	3.00	Kann 2007 memos
7/10/07	SV	128.5	Klamath River at Seiad Valley	RIV	0	0	6.60	Kann 2007 memos
7/10/07	OR	59.0	Klamath River at Orleans	RIV	0	0	3.70	Kann 2007 memos
7/10/07	WE	43.5	Klamath R. at Weitchpec	RIV	0	0		Mackie 2007 memo
7/10/07	KBW	42.5	Klamath R. below Weitchpec	RIV	0	0		Mackie 2007 memo
7/10/07	TG	6.0	Klamath River at Turwar	RIV	0	0		Mackie 2007 memo
7/10/07	LES	0.5	Lower Estuary - surface	RIV	0	0		Mackie 2007 memo
7/11/07	KBL	254.0	Klamath R. below Link Dam	RIV			2.00	EPA lab report
7/11/07	KBK	233.0	Klamath R. below Keno Dam	RIV			2.20	EPA lab report
7/11/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.80	EPA lab report
7/11/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	1.70	Kann 2007 memos
7/11/07	CRMC	200.8	Copco Res. Mallard Cove	SL	1,726,049	0	260.00	Kann 2007 memos
7/11/07	CR01	198.0	Copco Res. Near Dam	OW	1,804,000	8,509	790.00	Kann 2007 memos
7/11/07	IR01	190.2	Iron Gate Res. Near Dam	OW	36,315	3,338	4.80	Kann 2007 memos
7/23/07	CRCC	198.5	Copco Res. Copco Cove	SL	2,183,809	0	2.60	Kann 2007 memos
7/23/07	KRAI	196.0	Klamath River above Iron Gate	RIV			0.96	EPA lab report
7/23/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	6,594	3,627	1.80	Kann 2007 memos
7/23/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	80,776	0	3.60	Kann 2007 memos
7/23/07	KRBI	189.5	Klamath River below Iron Gate	RIV	9,636	155	0.98	Kann 2007 memos
7/23/07	SV	128.5	Klamath River at Seiad Valley	RIV	932	0	0.00	Kann 2007 memos
7/23/07	OR	59.0	Klamath River at Orleans	RIV	677	0	0.99	Kann 2007 memos
7/24/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	1.40	Kann 2007 memos
7/24/07	CRMC	200.8	Copco Res. Mallard Cove	SL	1,074,834	0	6000.00	Kann 2007 memos
7/24/07	CR01	198.0	Copco Res. Near Dam	OW	617,508	0	570.00	Kann 2007 memos
7/24/07	IR01	190.2	Iron Gate Res. Near Dam	OW	0	0	1.70	Kann 2007 memos
7/24/07	WE	43.5	Klamath R. at Weitchpec	RIV	3,124	0	1.30	Fetcho 2007 memos
7/24/07	TR	42.6	Trinity R. nr mouth	Trib			0.00	EPA lab report
7/24/07	KBW	42.5	Klamath R. below Weitchpec	RIV	0	0		Fetcho 2007 memos
7/24/07	TG	6.0	Klamath River at Turwar	RIV	0	0	1.20	Fetcho 2007 memos
7/24/07	LES	0.5	Lower Estuary - surface	RIV	380	0	1.10	Fetcho 2007 memos
7/25/07	KBL	254.0	Klamath R. below Link Dam	RIV			2.80	EPA lab report
7/25/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.20	EPA lab report
7/25/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.20	EPA lab report
8/7/07	CRCC	198.5	Copco Res. Copco Cove	SL	711,309	0	220.00	Kann 2007 memos
8/7/07	KRAI	196.0	Klamath River above Iron Gate	RIV			3.20	EPA lab report
8/7/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	50,509	0	6.50	Kann 2007 memos
8/7/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	27,333	0	6.30	Kann 2007 memos
8/7/07	IR01	190.2	Iron Gate Res. Near Dam	OW	812,740	0	180.00	Kann 2007 memos
8/7/07	KRBI	189.5	Klamath River below Iron Gate	RIV	24,247	0	3.10	Kann 2007 memos
8/7/07	SV	128.5	Klamath River at Seiad Valley	RIV	15,475	0	5.10	Kann 2007 memos
8/7/07	OR	59.0	Klamath River at Orleans	RIV	9,251	0	2.60	Kann 2007 memos
8/7/07	WE	43.5	Klamath R. at Weitchpec	RIV	6,013	0	1.30	Fetcho 2007 memos
8/7/07	KBW	42.5	Klamath R. below Weitchpec	RIV	4,567	0	1.20	Fetcho 2007 memos
8/7/07	TG	6.0	Klamath River at Turwar	RIV	0	0	0.00	Fetcho 2007 memos
8/7/07	LES	0.5	Lower Estuary - surface	RIV	0	34	0.00	Fetcho 2007 memos
8/8/07	KBL	254.0	Klamath R. below Link Dam	RIV			5.20	EPA lab report
8/8/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.50	EPA lab report

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
8/8/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.40	EPA lab report
8/8/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	1.50	Kann 2007 memos
8/8/07	CRMC	200.8	Copco Res. Mallard Cove	SL	5,709,515	0	2000.00	Kann 2007 memos
8/8/07	CR01	198.0	Copco Res. Near Dam	OW	139,733	0	28.00	Kann 2007 memos
8/21/07	CRCC	198.5	Copco Res. Copco Cove	SL	21,297,222	0	30000.00	Kann 2007 memos
8/21/07	KRAI	196.0	Klamath River above Iron Gate	RIV			2.70	EPA lab report
8/21/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	159,017	1,646	20.00	Kann 2007 memos
8/21/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	1,608,856	0		Kann 2007 memos
8/21/07	KRBI	189.5	Klamath River below Iron Gate	RIV	25,441	0	5.40	Kann 2007 memos
8/21/07	SH	176.0	Shasta R. nr mouth	Trib			1.00	EPA lab report
8/21/07	SC	143.0	Scott R. nr mouth	Trib			1.10	EPA lab report
8/21/07	SV	128.5	Klamath River at Seiad Valley	RIV	5,092	0	2.70	Kann 2007 memos
8/21/07	SA	66.0	Salmon R. nr mouth	Trib			0.91	EPA lab report
8/21/07	OR	59.0	Klamath River at Orleans	RIV	17,458	0	1.60	Kann 2007 memos
8/21/07	WE	43.5	Klamath R. at Weitchpec	RIV	9,890	0	1.80	Fetcho 2007 memos
8/21/07	TR	42.6	Trinity R. nr mouth	Trib			0.00	EPA lab report
8/21/07	KBW	42.5	Klamath R. below Weitchpec	RIV	18,040	0	2.00	Fetcho 2007 memos
8/21/07	TG	6.0	Klamath River at Turwar	RIV	4,195	210	1.00	Fetcho 2007 memos
8/21/07	LES	0.5	Lower Estuary - surface	RIV	4,003	0	1.40	Fetcho 2007 memos
8/22/07	KBL	254.0	Klamath R. below Link Dam	RIV			14.00	EPA lab report
8/22/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.10	EPA lab report
8/22/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.20	EPA lab report
8/22/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	1.00	Kann 2007 memos
8/22/07	CRMC	200.8	Copco Res. Mallard Cove	SL	28,188	0	4.20	Kann 2007 memos
8/22/07	CR01	198.0	Copco Res. Near Dam	OW	283,502	0	100.00	Kann 2007 memos
8/22/07	IR01	190.2	Iron Gate Res. Near Dam	OW	1,085,036	0	68.00	Kann 2007 memos
9/5/07	KBL	254.0	Klamath R. below Link Dam	RIV			1.70	EPA lab report
9/5/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.50	EPA lab report
9/5/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.10	EPA lab report
9/5/07	KRAC	206.0	Klamath River above Copco	RIV			1.50	EPA lab report
9/5/07	CRCC	198.5	Copco Res. Copco Cove	SL	22,898,635	0	1100.00	Kann 2007 memos
9/5/07	KRAI	196.0	Klamath River above Iron Gate	RIV			1.70	EPA lab report
9/5/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	1,383,565	0	41.00	Kann 2007 memos
9/5/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	3,350,406	0	240.00	Kann 2007 memos
9/5/07	KRBI	189.5	Klamath River below Iron Gate	RIV	87,255	0	1.00	Kann 2007 memos
9/5/07	SV	128.5	Klamath River at Seiad Valley	RIV	26,747	0	0.00	Kann 2007 memos
9/5/07	OR	59.0	Klamath River at Orleans	RIV	29,959	0	1.10	Kann 2007 memos
9/5/07	WE	43.5	Klamath R. at Weitchpec	RIV	7,517	0	1.60	Fetcho 2007 memos
9/5/07	KBW	42.5	Klamath R. below Weitchpec	RIV	16,443	0	1.30	Fetcho 2007 memos
9/5/07	TG	6.0	Klamath River at Turwar	RIV	18,405	0	1.50	Fetcho 2007 memos
9/5/07	LES	0.5	Lower Estuary - surface	RIV	11,791	0	1.20	Fetcho 2007 memos
9/6/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	1.50	Kann 2007 memos
9/6/07	CRMC	200.8	Copco Res. Mallard Cove	SL	14,289	0	0.00	Kann 2007 memos
9/6/07	CR01	198.0	Copco Res. Near Dam	OW	3,253,859	0	180.00	Kann 2007 memos
9/6/07	IR01	190.2	Iron Gate Res. Near Dam	OW	136,665	0	1.30	Kann 2007 memos
9/12/07	SV	128.5	Klamath River at Seiad Valley	RIV			1.20	EPA lab report
9/12/07	OR	59.0	Klamath River at Orleans	RIV			1.20	EPA lab report
9/18/07	CRMC	200.8	Copco Res. Mallard Cove	SL	58,718	0	1.30	Kann 2007 memos
9/18/07	CRCC	198.5	Copco Res. Copco Cove	SL	121,021	0	1.10	Kann 2007 memos
9/18/07	KRAI	196.0	Klamath River above Iron Gate	RIV			1.00	EPA lab report
9/18/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	128,449	0		Kann 2007 memos
9/18/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	157,994	0	1.10	Kann 2007 memos

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
9/18/07	IR01	190.2	Iron Gate Res. Near Dam	OW	NS	0		Kann 2007 memos
9/18/07	KRBI	189.5	Klamath River below Iron Gate	RIV	90,057	0	1.00	Kann 2007 memos
9/18/07	SH	176.0	Shasta R. nr mouth	Trib			0.00	EPA lab report
9/18/07	SC	143.0	Scott R. nr mouth	Trib			0.00	EPA lab report
9/18/07	SV	128.5	Klamath River at Seiad Valley	RIV	88,316	0	1.10	Kann 2007 memos
9/18/07	SA	66.0	Salmon R. nr mouth	Trib			0.00	EPA lab report
9/18/07	OR	59.0	Klamath River at Orleans	RIV	35,704	0	1.30	Kann 2007 memos
9/18/07	OR	59.0	Klamath River at Orleans	RIV	42,281	0	1.30	Kann 2007 memos
9/18/07	WE	43.5	Klamath R. at Weitchpec	RIV	80,016	0	1.10	Fetcho 2007 memos
9/18/07	TR	42.6	Trinity R. nr mouth	Trib	0	0	0.98	Fetcho 2007 memos
9/18/07	TC	42.5	Klamath R. abv Tully Cr.	RIV	19,773	0	1.10	Fetcho 2007 memos
9/18/07	TG	6.0	Klamath River at Turwar	RIV	21,498	0	0.98	Fetcho 2007 memos
9/18/07	LES	0.5	Lower Estuary - surface	RIV	90,764	0	1.10	Fetcho 2007 memos
9/19/07	KBL	254.0	Klamath R. below Link Dam	RIV			1.30	EPA lab report
9/19/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.40	EPA lab report
9/19/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.10	EPA lab report
9/19/07	KRAC	206.0	Klamath River above Copco	RIV	0	0	0.99	Kann 2007 memos
9/19/07	CR01	198.0	Copco Res. Near Dam	OW	201,624	0	1.20	Kann 2007 memos
9/24/07	CRUB	204.0	Copco Res. UR Bridge	OW			1.40	EPA lab report
9/24/07	CRUR	201.0	Copco Res. - Upper half	OW			1.30	EPA lab report
9/24/07	CRMC-I	200.8	Copco Res. Mallard (Inlet)	SL			180.00	EPA lab report
9/24/07	CRMC-R	200.8	Copco Res. Mallard (Ramp)	SL			18.00	EPA lab report
9/24/07	CR01	198.0	Copco Res. Near Dam	OW			1.60	EPA lab report
9/24/07	KRBI	189.5	Klamath River below Iron Gate	RIV			1.70	EPA lab report
10/2/07	KBL	254.0	Klamath R. below Link Dam	RIV			2.00	EPA lab report
10/2/07	KBK	233.0	Klamath R. below Keno Dam	RIV			1.80	EPA lab report
10/2/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			1.60	EPA lab report
10/2/07	WE	43.5	Klamath R. at Weitchpec	RIV			0.00	EPA lab report
10/2/07	TC	42.5	Klamath R. abv Tully Cr.	RIV			1.40	EPA lab report
10/2/07	TG	6.0	Klamath River at Turwar	RIV			1.20	EPA lab report
10/2/07	LES	0.5	Lower Estuary - surface	RIV			0.00	EPA lab report
10/3/07	CRCC	198.5	Copco Res. Copco Cove	SL	18,675			Kann 2007 memos
10/3/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	20,723		1.20	Kann 2007 memos
10/3/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	50,783		1.40	Kann 2007 memos
10/3/07	KRBI	189.5	Klamath River below Iron Gate	RIV	16,223		1.40	Kann 2007 memos
10/3/07	SV	128.5	Klamath River at Seiad Valley	RIV	20,237		1.10	Kann 2007 memos
10/3/07	OR	59.0	Klamath River at Orleans	RIV	1,455		0.00	Kann 2007 memos
10/4/07	KRAC	206.0	Klamath River above Copco	RIV	5,056		1.10	Kann 2007 memos
10/4/07	CRMC	200.8	Copco Res. Mallard Cove	SL	220,643		0.95	Kann 2007 memos
10/4/07	CR01	198.0	Copco Res. Near Dam	OW	387,603		1.00	Kann 2007 memos
10/4/07	KRAI	196.0	Klamath River above Iron Gate	RIV			1.20	EPA lab report
10/4/07	IR01	190.2	Iron Gate Res. Near Dam	OW	15,285,884		3.60	Kann 2007 memos
10/16/07	CRCC	198.5	Copco Res. Copco Cove	SL	29,893		0.18	Kann 2007 memos
10/16/07	KRAI	196.0	Klamath River above Iron Gate	RIV			0.16	EPA lab report
10/16/07	IRCC	192.8	Iron Gate Res. Camp Creek Area	SL	0		0.16	Kann 2007 memos
10/16/07	IRJW	192.4	Iron Gate Res. Williams Boat Ramp	SL	0		0.17	Kann 2007 memos
10/16/07	KRBI	189.5	Klamath River below Iron Gate	RIV	0		0.17	Kann 2007 memos
10/16/07	SV	128.5	Klamath River at Seiad Valley	RIV	0		0.14	Kann 2007 memos
10/16/07	OR	59.0	Klamath River at Orleans	RIV	0		0.13	Kann 2007 memos
10/17/07	KBL	254.0	Klamath R. below Link Dam	RIV			0.40	EPA lab report
10/17/07	KBK	233.0	Klamath R. below Keno Dam	RIV			0.27	EPA lab report
10/17/07	KBB	224.0	Klamath R. below JC Boyle Dam	RIV			0.21	EPA lab report

Date	Station	Approx RM	Name	Location	MSAE (cells/ml)	ANAB (cells/ml)	Microcystin (µg/L)	Source
10/17/07	KRAC	206.0	Klamath River above Copco	RIV	0		0.17	Kann 2007 memos
10/17/07	CRMC	200.8	Copco Res. Mallard Cove	SL	115,583		0.15	Kann 2007 memos
10/17/07	CR01	198.0	Copco Res. Near Dam	OW	37,192		0.17	Kann 2007 memos
10/17/07	IR01	190.2	Iron Gate Res. Near Dam	OW	0		0.12	Kann 2007 memos