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Memo: Copco/Irongate Reservoir Toxic Cyanobacteria Results: Follow-up

To: Karuk Tribe/SWRCB/NCRWQCB

To all concerned:

Immediately after I sent the previous 8/17 memo I received another batch of more recent phytoplankton data from Aquatic Analysts. These data are from a variety of shoreline and open-water sites, including the standard open-water locations: IR01 and CR01 (Figure 1). Stations IR01, IR03, CR01, and CR02 are open-water locations and are sampled biweekly as part of an EPA funded nutrient loading study. Other stations are shoreline locations and are sampled specifically to assess the extent of toxic cyanobacteria. Shoreline samples consist of grab samples of surface algal material, and open-water samples consist of a surface or 1 m grab taken with a Van-Dorn water collection bottle. Samples for phytoplankton density and biovolume are preserved in Lugol's Iodine and are sent to Aquatic Analysts in White Salmon, WA. Samples for determination of microcystin toxin are placed in a cooler with gel-ice and shipped overnight air to Wright State University in Dayton, OH.

Previous data (e.g., from 9-29-04 and 7-13-05) have shown that blooms of *Microcystis aeruginosa* in Copco Reservoir produce the potent hepatotoxin (liver toxin) microcystin. Although no toxin data are yet available (these results are pending) for samples collected after 7/13/05, it is clear from the phytoplankton density data that cyanobacterial blooms have continued to increase in intensity and extent since late June, now extending to Irongate Reservoir and to open-water locations (Table 1). Given cyanobacterial scums shown in pictures included in the 8/17 memo, the high *Microcystis* cell densities at Copco and Irongate locations (as shown in the August 10th and 11th pictures) as well as other locations are not unexpected (Table 1; Figure 2).

Again, for recreational bathing waters a moderate risk level is given as 50 µg/L chlorophyll a, 100,000 cells/ml or 20 µg/L microcystin in the top 4 meters of surface waters by documents published for the World Health Organization (WHO) and EPA (Falconer el al. 1999; Chorus and Cavalieri 2000). Cell density of *Microcystis aeruginosa* exceeded this moderate risk level **at all sampled stations on 8/10 and 8/11** (Figure 3), including at the open-water stations IR01 (916,548 cells/ml) and CR01 (151,004 cells/ml). Several of the shoreline stations exceeded the moderate risk cell count level by more than 20 times (e.g., CRSS by 20x, IRJW by 41x, and IRNC by 54x; Table 1). Moreover, the WHO (Falconer et al. 1999) further lists cyanobacterial scums in swimming areas as having the potential to cause acute poisoning and recommends immediate action to prevent contact with scums. Stations IRJW, IRCC, CRCC, and CRMC are in the immediate vicinity of designated recreational areas. Station CRSS is located along the shoreline of a private residence.

These samples represent both shoreline areas where human and pet access are likely to occur and lake-wide conditions likely to be experienced by boaters and water skiers. As stated previously, given the lag in obtaining toxin results, and the known toxicity of *Microcystis* blooms in the system, public health actions should be based on the presence of cyanobacterial scums or cell count results of toxigenic species.

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

Please let me know if you have any questions. Thank you.

Sincerely,

Jacob Kann, Ph.D.
Aquatic Ecologist

References

Chorus, I, and M. Cavalieri. 2000. Cyanobacteria and algae. Pages 219-271 *in*: J. Bartram and G Rees, editors. *Monitoring Bathing Waters: a practical guide to the design and implementation of assessments and monitoring programmes.* World Health Organization Report. E & FN Spon, London and New York.

Falconer et al. 1999. Safe levels and safe practices. Pages 155-177 *in*: I. Chorus and J. Bartram, editors. *Toxic Cyanobacteria in water: a guide to their public health consequences*. World Health Organization Report. E & FN Spon, London and New York.

WHO 1998. Guidelines for Drinking-water Quality. Second Ed. Addendum to Vol. 2, Health Criteria and Other Supporting Information. World Health Organization, Geneva.

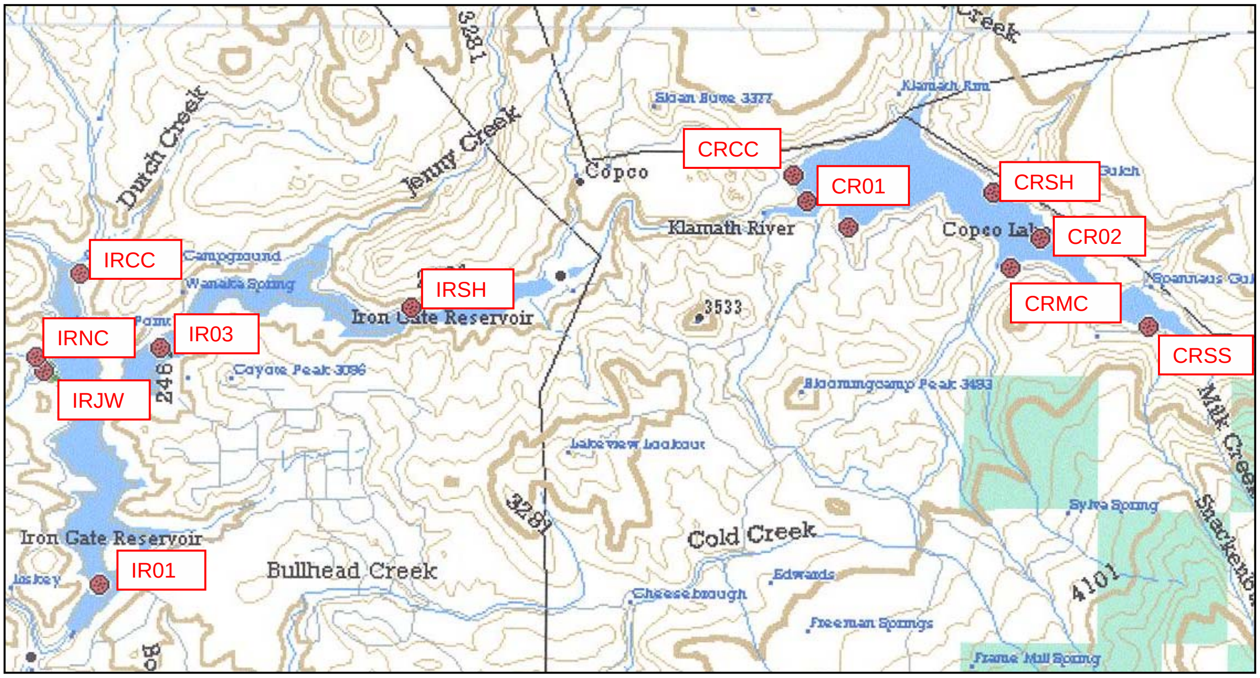

Figure 1. Location of Copco and Irongate Reservoir toxic cyanobacteria sampling stations, 2005.

Table 1. Cell density and risk exceedance for toxigenic cyanobacteria in Copco and Irongate Reservoirs, 2005.

DATE	STATION LAT/LON	STATION NAME	DEPTH	*Microcystis aeruginosa* (cells/ml)	*Anabaena flos-aquae* (cells/ml)	Microcystin (µg/L)	Exceedance of moderate risk level of 100,000 cells/ml *Microcystis* (x greater than 10^5 cells/ml)	Exceedance of moderate risk level of 20 µg/L microcystin (x greater than 20 µg/L)	Exceedance of TDI of 0.04 µg/kg/day for a 40 lb (18kg) child ingesting 100 mls (x greater than TDI)
6/28/05	N41 56.330 W122 25.930	IR01	1	793	2,213		0		
6/28/05	N41 57.876 W122 25.389	IR03	1	0	541		0		
6/29/05	N41 58.932 W122 19.694	CR01	1	0	181		0		
6/29/05	N41 58.796 W122 17.796	CR02	1	0	0		0		
7/13/05	N41 58.932 W122 19.694	CR01	0	15,527	488		0		
7/13/05	N41 58.932 W122 19.694	CR01	1	0	0		0		
7/13/05	N41 58.932 W122 19.694	CR01-D	0	15,987	0		0		
7/13/05	N41 58.796 W122 17.796	CR02	1	0	0		0		
7/13/05	N41 58.939 W122 18.032	CRSH	0	11,402,943	38,383	667	114	33	92
7/14/05	N41 56.330 W122 25.930	IR01	1	0	0		0		
7/14/05	N41 57.876 W122 25.389	IR03	1	0	203		0		
7/26/05	N41 58.932 W122 19.694	CR01	0	0	0		0		
7/26/05	N41 58.932 W122 19.694	CR01	1	278	0		0		
7/26/05	N41 58.796 W122 17.796	CR02	1	0	145		0		
7/26/05	N41 59.035 W122 19.802	CRCC	0	3,316,176	0		33		
7/27/05	N41 56.330 W122 25.930	IR01	1	0	0		0		
7/27/05	N41 57.876 W122 25.389	IR03	0	5,534	1,217		0		
7/27/05	N41 57.876 W122 25.389	IR03	1	223	0		0		
7/27/05	N41 58.161 W122 23.176	IRSH	0	1,807	16,587		0		
8/10/05	N41 58.932 W122 19.694	CR01	0	151,004	0		2		
8/10/05	N41 59.035 W122 19.802	CRCC	0	283,963	0		3		
8/10/05	N41 58.441 W122 17.869	CRMC	0	1,427,215	0		14		
8/10/05	N41 58.067 W122 16.648	CRSS	0	1,985,035	0		20		
8/11/05	N41 56.330 W122 25.930	IR01	0	916,548	0		9		
8/11/05	N41 58.368 W122 26.114	IRCC	0	1,423,430	0		14		
8/11/05	N41 57.721 W122 26.425	IRJW	0	4,059,000	0		41		
8/11/05	N41 57.810 W122 26.493	IRNC	0	5,350,847	0		54		

CRMC; 8-10-05
1,427,215 cells/ml
Microcystis

CRCC; 8-10-05
283,963 cells/ml
Microcystis

IRNC; 8-11-05
5,350,847 cells/ml
Microcystis

Figure 2. Cyanobacterial algal blooms shown with *Microcystis* density in Copco and Irongate Reservoirs; August 10-11, 2005.

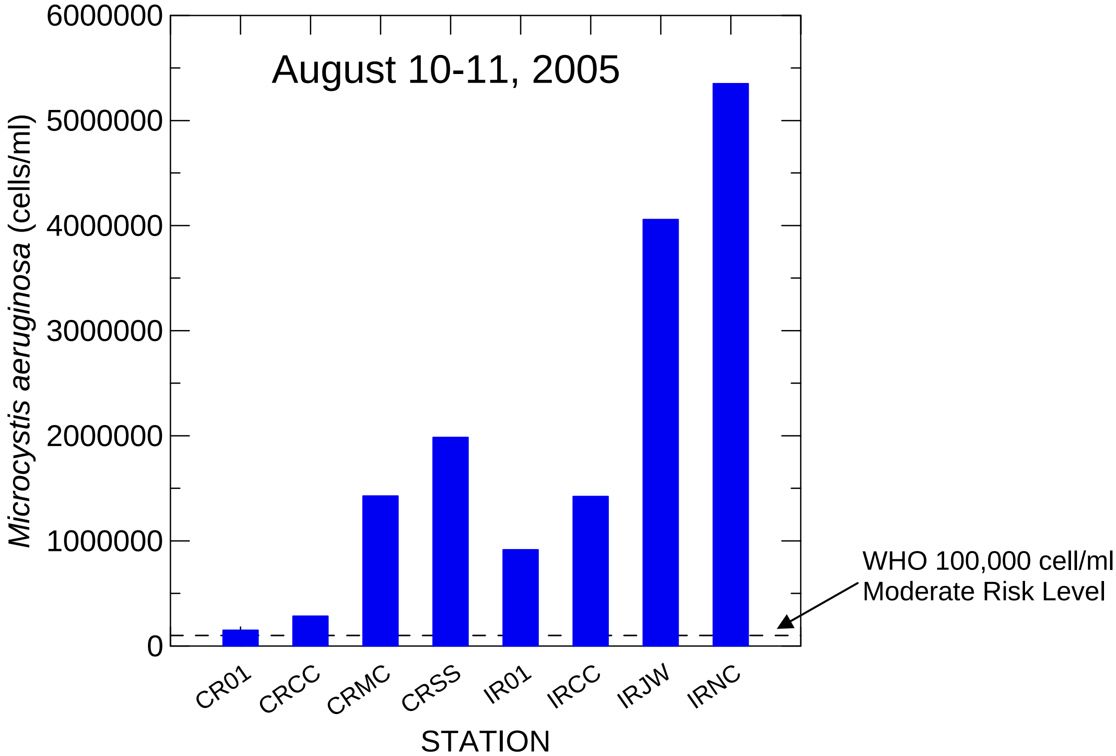

Figure 3. *Microcystis aeruginosa* cell density in Copco and Irongate Reservoirs, August 10-11, 2005.