
The Eel River Recovery Project (ERRP) is grassroots group that works with volunteers throughout the watershed to collect scientific data to improve community understanding of the status and trends of river health and fish populations. The group is publishing a report entitled *Eel River Cooperative Cyanotoxin Analysis Summary 2013-2017* that discusses the sources of algal toxins, the geographic extent of the problem, and factors that may be stimulating noxious blooms. This study is one of the first in the Western United States to look at cyanotoxin development in a river system, while blooms in lakes and reservoirs are better studied.

Cooperators in the study include the University of California Berkeley (UCB), UC Santa Cruz, and the North Coast Regional Water Quality Control Board (NCRWQCB). Studies were initiated in 2013 under the direction of UCB doctoral candidate Keith Bouma-Gregson who worked with volunteers and set up the study design for assessing toxic cyanobacteria on a basinwide scale. Data were collected weekly in 2013 and 2014 as a basis for Keith’s doctoral dissertation. In 2015-2017, data were collected monthly during summer months. A total of 332 cyanotoxin sampling devices were deployed at 20 locations throughout the Eel River watershed from 2013 to 2017.

Results indicated widespread occurrence of two types of toxins produced by cyanobacteria: anatoxin-a and microcystin. Dog deaths documented since 2001 were as a result of exposure to anatoxin-a, which is a fast-acting neurotoxin. Microcystin attacks the liver and is a significant problem in the nearby Klamath River, but it occurs at only very low levels in the Eel River basin and has little potential impact on public health presently.

Anabaena on South Fork at Phillipsville. Notes oxygen bubbles trapped in colonies that cause segments to float and drift.

The cyanobacteria *Anabaena*, the greatest source of anatoxin-a, thrives in warm water, particularly in stagnant water at channel margins. This colonial organism forms on dead and dying *Cladophora*, the beneficial green algae that fuels the aquatic food chain. *Anabaena* creates dark green spires that have embedded oxygen bubbles created during photosynthesis. Segments tend to become buoyant in the afternoon and can be loosened by wind and float downstream to form scums and floating mats. When dogs roll in patches of *Anabaena* or frolic through scums and then lick their fur, they are exposed to a lethal dose of neurotoxins.

The South Fork Eel River had the highest levels of anatoxin-a in most years. In 2013, the highest levels were in the lower reach at Phillipsville; in 2014, the highest levels were measured farther upstream, near Piercy. The pattern changed in 2015, when the highest anatoxin-a levels were measured in the lower Middle Fork, upper Eel, the lower Eel River, and the Van Duzen River near Carlotta, as well as in the South Fork.
Very low flows and high air temperatures in spring of 2015 gave blooms an early start and there were no flushing flows until November. Extremely low late summer flows may also have allowed Anabaena colonization across the entire river bed, as opposed to just in the edges of the stream. The high flow years of 2016 and 2017 had much lower levels of cyanotoxins basinwide.

Although Middle Fork and upper main Eel River locations had higher water temperatures than the South Fork, they rarely had high levels of cyanotoxins. This suggests factors other than water temperature are driving blooms and nutrient pollution is suspected. Summer base flow of the South Fork Eel River has declined from historic levels based on U.S. Geologic Survey data, and this promotes warming and nutrient concentration. This pushes the river past a tipping point from a cold-water/green algae dominated ecosystem to a warm water/cyanobacteria dominated one.

The report acknowledges that direct water diversion plays a role in diminished base flows, but points out that perturbed watershed hydrology may be of equal or greater import. Forests in the Eel River watershed were profoundly altered by post WWII logging. Stands of old growth trees spaced far apart were replaced with dense forests of mixed conifers and hardwoods that use much more water due to increased evapotranspiration. High road densities, another legacy of logging, increase winter peak flows and diminish percolation into the landscape. These two factors effects are likely contributing to decreased summer flows.

In 2016 a dog died along the upper Eel River within the Potter Valley Project at Trout Creek of apparent exposure to cyanotoxins. Lush growth of another anatoxin-a producing species, Phormidium, was found nearby and was the likely source of the toxins. This species prefers fast-moving riffles and can tolerate cold water. It is well studied in New Zealand, where it causes widespread livestock mortality. Further study is needed to understand more about what is causing Phormidium blooms and what level of public health risk they pose in the upper Eel River.

Phormidium mats near Trout Creek on upper Eel River within the Potter Valley Project. Photo courtesy of Rich Fadness, NCRWQCB. 9/15/16.
ERRP is once again conducting basin wide cyanotoxin and water temperature monitoring in 2018. Low flows are causing significant late summer algae blooms, similar to 2015. Aquatic recreation is not recommended at present on the lower South Fork or lower main Eel River.

Because there is no dedicated funding for cyanotoxin research, ERRP is conducting a fundraising drive to get public support for this important work. Donations can be mailed to ERRP, P.O. Box 214, Loleta, CA 95551 or made on-line at www.eelriverrecovery.org.

In addition to the new report, the website has links to Keith Bouma-Gregson’s doctoral dissertation and three related peer reviewed publications. His work and UCB involvement were made possible by an Environmental Protection Agency STAR Fellowship and the National Science Foundation Eel River Critical Zone Observatory grant. Call 707 223-7200 if you want to volunteer or to request monitoring of the river reach or creek near you.