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# Benthic cyanotoxin production in California streams

Betty Fetscher

*Southern California Coastal Water Research Project*

## Abstract

Lentic water bodies and large rivers have long been recognized as prone to toxigenic planktonic cyanobacterial blooms. Although benthic cyanobacteria are known to commonly inhabit streams, little has been published on the potential for cyanotoxin production in this water body type. Recent research in Monterey Bay has linked inland-derived microcystins to catastrophic levels of sea otter mortality in the marine environment, illustrating the far-reaching effects cyanotoxins can have downstream from their origin. Thus, to the extent that it occurs, cyanotoxin production in streams may result in toxin loading to receiving waters, potentially affecting multiple beneficial uses (both locally to the stream environment and remotely). A survey of >1,000 shallow stream reaches conducted throughout California between 2007 and 2013 revealed a high occurrence of potentially toxin-producing cyanobacteria. In addition, cyanotoxin production (especially microcystins) was detected in the benthos of one-third of stream reaches, where tested (N=368), based on one-time sampling from 2011 to 2013. Lyngbyatoxin, saxitoxin, and anatoxin-*a* were also measured, at subsets of sites (N=14 to 101), and were also detected, albeit at lower rates than microcystins. Our results provide strong evidence that streams could be significant loading sources for cyanotoxins to receiving waters, a finding that has implications for the management of drinking water, wildlife, and aquatic recreational resources. Next steps in this research include examining drivers of toxin production in stream benthic cyanobacteria and effects on aquatic life.