

SCCWRP #0980

Death from below: Investigation of inhibitory factors in bloom development during a wastewater effluent diversion

Raphael M. Kudela¹, Andrew J. Lucas², Kendra Hayashi¹, Meredith Howard³, Karen McLaughlin³

¹*Ocean Sciences and Institute for Marine Sciences, University of California, Santa Cruz, CA*

²*Scripps Institute of Oceanography, University of California, San Diego, La Jolla, CA*

³*Southern California Coastal Water Research Project, Costa Mesa, CA*

ABSTRACT

Eutrophication of coastal waters is an urgent and globally increasing problem. A significant source of nutrients to Southern California coastal waters is direct discharge of secondarily treated wastewater effluent from regional Publicly Owned Treatment Works. The planned diversion of treated wastewater from the Orange County Sanitation District's main (5-mile) pipe to a shallow 1-mile pipe off Huntington Beach, CA in autumn 2012 provided an unprecedented opportunity to monitor the response of the coastal phytoplankton community to a major anthropogenic loading event. Despite the continuous release of approximately $11.07 \times 10^6 \text{ m}^3$ of effluent containing 1743 μM ammonium, there was virtually no detectable change in phytoplankton biomass, in striking contrast to the harmful algal bloom dominated community that quickly developed in response to a comparable diversion in Santa Monica Bay in 2006. Field and laboratory studies demonstrate that disinfection byproducts associated with enhanced dichlorination were present in the discharged water, and that these compounds had a strong inhibitory impact on phytoplankton photophysiology and growth, lasting 24 h for photosynthetic performance and at least 3 d for growth, assessed as change in chlorophyll. Thus, the perhaps fortuitous unintended consequence of enhanced chlorination was the production of inhibitory compounds that suppressed the potential phytoplankton response over a large swath of the continental shelf during the diversion.

Due to distribution restrictions, the full-text version of this article is available by request only.

Please contact pubrequest@sccwrp.org to request a copy.