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Response of phytoplankton and bacterial biomass during a wastewater effluent diversion into nearshore coastal waters

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ABSTRACT

A 3-week diversion of the Orange County Sanitation District effluent discharge into nearshore waters off Newport Beach, CA constituted a considerable injection of secondarily-treated effluent into the coastal ecosystem. The location ≈1.6 km from shore, shallow water depth (≈16 m), volume and nutrient content of the discharge (≈5.3 x 10^8 L day^{-1} of effluent with inorganic nitrogen concentration >2 mM) during the diversion raised concerns regarding the potential for stimulating phytoplankton blooms and, in particular, blooms of toxic species. Remarkably, phytoplankton standing stocks during the event and shortly thereafter did not reach values associated even with minor blooms historically observed in the region (generally <5 μg 1^{-1}), although shifts in community composition were observed. Diatom abundances increased early during the diversion, dinoflagellates, phototrophic picoplanktonic eukaryotes and other algae increased mid-diversion, and cyanobacteria (*Synechococcus*, *Prochlorococcus*) increased near the end of the diversion. Concentrations of domoic acid (a phycotoxin commonly present in the area) remained near or below detection throughout the diversion, and abundances of potentially-harmful algal species were unresponsive. Bacterial biomass increased during the diversion, and equaled or exceeded total phytoplankton biomass in most samples. Abundances of microbial grazers were also elevated during the diversion. We speculate that nutrient uptake by the bacterial biomass, acting in concert with or a response to a negative effect of disinfection byproducts associated with chlorination on phytoplankton physiology, played a significant role in muting the response of the phytoplankton to nutrients released in the effluent.