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USE OF BIOMARKERS AND WASTEWATER COMPOUNDS AS INDICATORS OF HUMAN FECAL CONTAMINATION IN THE LOWER RUSSIAN RIVER BASIN, SONOMA COUNTY, CALIFORNIA

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ABSTRACT: Chemical, microbiological, and isotopic data were collected from 7 mainstem sites, 8 tributary sites and a sewage treatment plant along the lower Russian River in northern California during 2006 to determine whether tributary discharges are a potential source of human fecal contamination in the Russian River during summer flows. Standard bacterial indicators (total coliforms, E. coli, and enterococci) were detected in all water samples, with E. coli concentrations approaching the 235 cfu/100 mL single-sample maximum allowable density for recreational use at some tributary sites. Enrichment of enterococci was performed on all water samples for detection of the human-associated enterococcal surface protein (esp) in Enterococcus faecium. The human-associated esp marker was detected in 3 tributary samples and in the sewage treatment plant effluent. These results indicate that human fecal contamination was not present in the lower Russian River during the study period; however, tributary discharges are a potential source of human fecal contamination if flow in the Russian River is reduced.In addition to the human-associated esp marker, water samples were analyzed for a suite of organic wastewater compounds (OWCs) to assess the influence of sewage effluent in the lower Russian River. Although 22 OWCs were detected in the sewage effluent sample at concentrations equal to or slightly greater then their published method detection limit, only the herbicide 3, 4-dichloroaniline, the fragrance benzophenone, the pharmaceutical compound cabamazepine, the insecticides DEET and fipronil (along with their corresponding desulfinyl derivatives), the disinfectant triclosan, and the plasticizer triphenyl phosphate were detected in both the sewage effluent and at least one river sample. In contrast, combustion byproducts, the flavorant camphor, and the herbicide simazine were detected in several Russian River and tributary samples but not detected in the sewage effluent. Combustion byproducts also were found in the bed sediment at three Russian River sites and one tributary site at concentrations ranging from 10 to 450 μm/kg of soil. These results suggest that human activities in and adjacent to the lower Russian River, other than sewage effluent, are the predominant source of OWCs within this reach of the river.

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