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Association of fecal indicator bacteria with human viruses and microbial source tracking markers at coastal beaches impacted by nonpoint source pollution

Shannon McQuaig[1], John Griffith[2] and Valerie J. Harwood[1]

[1]*Department of Biology, University of South Florida, Tampa, FL*

[2]*Southern California Coastal Water Research Project, Costa Mesa, CA*

ABSTRACT

Water quality was assessed at two marine beaches in California by measuring the concentrations of culturable fecal indicator bacteria (FIB) and by library-independent microbial source tracking (MST) methods targeting markers of human-associated microbes (human polyomavirus [HPyV] PCR and quantitative PCR, Methanobrevibacter smithii PCR, and Bacteroides sp. strain HF183 PCR) and a human pathogen (adenovirus by nested PCR). FIB levels periodically exceeded regulatory thresholds at Doheny and Avalon Beaches for enterococci (28.5% and 31.7% of samples, respectively) and fecal coliforms (20% and 5.8%, respectively). Adenoviruses were detected at four of five sites at Doheny Beach and were correlated with detection of HPyVs and human Bacteroides HF183; however, adenoviruses were not detected at Avalon Beach. The most frequently detected human source marker at both beaches was Bacteroides HF183, which was detected in 27% of samples. Correlations between FIBs and human markers were much more frequent at Doheny Beach than at Avalon Beach; e.g., adenovirus was correlated with HPyVs and HF183. Human sewage markers and adenoviruses were routinely detected in samples meeting FIB regulatory standards. The toolbox approach of FIB measurement coupled with analysis of several MST markers targeting human pathogens used here demonstrated that human sewage is at least partly responsible for the degradation of water quality, particularly at Doheny Beach, and resulted in a more definitive assessment of recreational water quality and human health risk than reliance on FIB concentrations alone could have provided.