SCCWRP Annual Report 2013

Towards establishing a human fecal contamination index in microbial source tracking

Yiping Cao[1], Charles Hagedorn[1], Orin C. Shanks[3], Dan Wang[4], Jared Ervin[5], John F. Griffith[1], Blythe A. Layton[1], Charles D. McGee[6], Timothy E. Riedel[7] and Stephen B. Weisberg[1]

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

[2]Virginia Polytechnic Institute and State University, Department of Crop & Soil Environmental Sciences, Blacksburg, VA

[3]US Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH

[4]Stanford University, Environmental and Water Studies, Department of Civil and Environmental Engineering, Stanford, CA

[5]University of California, Earth Research Institute and Bren School of Environmental Science & Management, Santa Barbara, CA

[6]Orange County Sanitation District, Fountain Valley, CA

[7]University of California, Department of Civil and Environmental Engineering, Los Angeles, CA

ABSTRACT

The fecal indicator bacteria (FIB), such as *Enterococcus*, used to monitor recreational water quality do not differentiate fecal pollution originating from human or animal sources, even though human fecal material represents a greater public-health risk. Host-associated genetic markers that allow for source identification have been developed, but there is no agreed upon approach for integrating multiple samples exhibiting different marker signal strengths and varying levels of agreement among markers into an index that managers can use for prioritizing beaches with the greatest presence of human fecal contamination. As a first step towards developing such an index, 10 experts were provided a simulated dataset for 26 beaches where we systematically varied 4 factors: *Enterococcus* concentrations, frequency of detection for two human-associated MST markers, magnitude of the marker signal, and agreement between the markers. The Delphi technique was then used to establish consensus principles for prioritizing how these factors should be used in ranking beaches with respect to human fecal contamination. The experts' initial ranking varied widely, but after three iterations of ranking and discussion, the experts converged on a consensus that: 1) frequency of samples that are positive for human-associated MST markers is of primary importance in ranking beaches with respect to the extent of human fecal contamination, 2) magnitude of and consistency between the markers should be used to weigh marker frequency for assessing a beach, and 3) general FIB data should receive the least weight. Using the experts' consensus, a conceptual mathematical algorithm is proposed to establish an index that consistently and transparently quantifies the relative probability of human fecal contamination at a beach.

Full Text

http://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2013AnnualReport/ar13_567_579.pdf