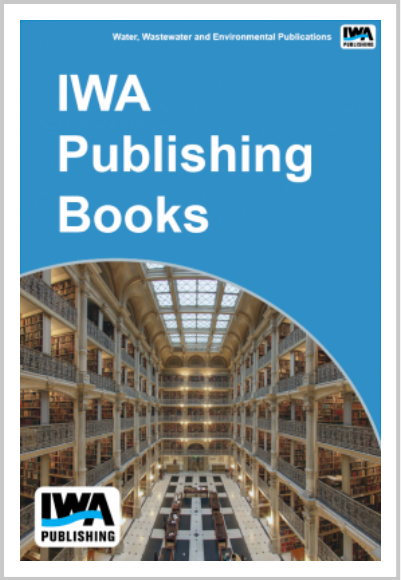
Comparative Evaluation of Molecular and Culture Methods for Fecal Indicator Bacteria for Use in Inland Recreational Waters



Rapid analytical methods are likely to be incorporated into revised recreational water quality criteria by the US EPA (2012). While epidemiological studies have demonstrated a correlation of health effects to fecal indicator bacteria (FIB) as quantified by QPCR, there is a need to examine the relationship between EPA-approved culture-based methods and their QPCR-based equivalents prior to implementation. In particular, inland waters, including lakes, streams/rivers, and wastewater through the treatment process (as a source of environmental DNA) need to be assessed to determine whether they can be accurately managed using rapid QPCR based techniques. The goal of this research was to determine how EPA-approved culture-based and QPCR-based methods compared when a) inhibition caused underestimation, b) target bacteria were viable and/or non-viable, c) using a variety of different QPCR quantification approaches, d) related to pathogen densities, and e) analyses were performed in multiple laboratories (precision, accuracy, and other sources of variability).

Results indicate that all sites are not equal. While QPCR appeared to have satisfactory correlation to culture-based methods for FIB at some sites, including in process wastewater, it does not appear that the methods can be unilaterally applied across all inland water bodies. The lack of consistent correlation observed for some geographic locations and water body types could be attributed to different types of contamination sources (age and growth state of FIB), unresolved inhibition, method variability (between lab, development of calibration curves, extraction efficiency, method of result calculation, and limit of detection), and the relative contribution of DNA from viable vs. non-viable cells.

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