



## **Probabilistic assessment of compliance with the numerical criteria for fecal coliforms in rivers**

YoonKyung Cha

Department of Environmental Engineering, University of Seoul, Seoul, Republic of Korea (ykcha@uos.ac.kr)

Most guidelines for assessing fecal contamination in surface waters suggest that a waterbody is impaired if a certain percent or the geometric mean of samples exceeds the numerical criteria for fecal indicator organisms. However, this raw score approach is not able to account for the uncertainty and variability in the sample statistics. In a Bayesian hierarchical modeling approach, the uncertainty in the mean parameter is expressed as a posterior distribution, and the probability of not violating the criterion is referred to as the confidence of compliance (COC). Further, the spatiotemporal variability in the mean parameter can be quantified by imposing the hierarchical structure on the model. The monitoring data spanning 91 sites across the four major rivers (the Han, Geum, Yeongsan, and Nakdong) of South Korea for the years 2007-2016 were used. The Bayesian hierarchical model was developed for each river to predict the COC with the criteria for fecal coliforms. The established criteria for fecal coliforms are less than 10, 100, 200, and 1,000 CFU/100mL in the river whose water quality goal corresponds to Class Ia, Ib, II, and III, respectively. The model results suggested that the COC varied significantly by site, ranging from 0.0 to 98.9 percent across the four rivers. In the Geum, Yeongsan, and Nakdong Rivers, COC values in the upper river sections were substantially lower than those in the upper river sections. The model suggested that for all four rivers the spatial component, compared with annual and seasonal components, made the largest contribution to the variability in mean fecal coliforms. In all four rivers, mean levels for fecal coliform during the summer (July to September) were distinctly higher than those during other seasons. A decreasing pattern was clearly shown in the Yeongsan River over the recent decade, while monotonic increases or decreases were not shown in other three rivers.