

Spatial and temporal variability of fecal indicator bacteria in an urban stream under different meteorological regimes

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ABSTRACT

As a representative urban stream in Korea, the Gwangju (GJ) stream suffers from chronic fecal contamination. In this study, to characterize levels of fecal pollution in the GJ stream, the monthly monitoring data for seven years (from 2001 to 2007) and the hourly monitoring data from two field experiments were examined with respect to seasonal/daily variations and spatial distribution under wet and dry weather conditions. This research revealed that concentrations of fecal indicator bacteria strongly varied depending on the prevalent meteorological conditions. That is, during the dry daytime, fecal indicator bacteria concentrations decreased due to inactivation from solar irradiation, but rapidly increased in the absence of sunlight, suggesting external source inputs. In addition, bacterial concentrations substantially increased during rainfall events, due probably to a major contribution from combined sewer overflow. The observations in this study can be useful for implementing fecal pollution management strategies and for predicting fecal contamination as a function of meteorological conditions.

Key words | external forces, fecal indicator bacteria, meteorological conditions, spatial and temporal variation, urban stream

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INTRODUCTION

Urban streams are highly polluted/impacted by multiple sources such as sewage discharges and combined sewer overflows (CSOs) that carry a wide variety of microbial pathogens (Pourcher *et al.* 1991; Petersen *et al.* 2005; Aryal *et al.* 2009). As a typical urban stream in Korea, the Gwangju (GJ) stream, the most contaminated tributary among the 13 tributaries of the Yeongsan (YS) River (Ki *et al.* 2007), is chronically exposed to severe fecal pollution along its length and as such shows significantly high concentrations of fecal indicator bacteria (FIB; e.g., enterococci (ENT), *Escherichia coli* (EC), and total coliform (TC)). Regulations pertaining to fresh water from the Ministry of Environment (ME), Korea require that concentrations of FIB in stream water should be monitored as an

indicator of fecal pollution. In the GJ stream, the average concentration of EC has exceeded 780 CFU/100 mL along the stream for the last 7 years. This concentration exceeds both the US EPA's recommended water quality criteria (EC: 576 CFU/100 mL) allowable for full body contact in recreational fresh water use as well as the ME's criteria for EC (1,000 CFU/100 mL). In its national water quality monitoring program, the ME has routinely monitored concentrations of TC and EC in the GJ stream, which has revealed severe levels of fecal contamination. However, under its current monitoring practice, fecal pollution levels in the GJ stream cannot be fully investigated because samplings under the influence of factors affecting the FIB concentration such as storm/urban runoff, CSOs,