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Effect of Sunlight and Fecal Source on Decay of Fecal Indicator Bacteria in Freshwater

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Abstract

Fecal indicator bacteria (FIB) such as Enterococcus, Escherichia coli, and total coliforms are routinely monitored for recreational water quality. Although not generally pathogenic, FIB are monitored as surrogates for human pathogens and are the basis for public health protection. However, FIB are known to originate from various fecal sources and differential decay of FIB and human pathogens in environmental waters may render FIB inadequate as pathogen surrogates. It is therefore important to understand the fate of FIB after fecal material enters natural waters. This study examined decay of FIB from three fecal sources under sunlit and shaded conditions in urban freshwater. Sets of dialysis bags (6-8 kDa) containing sewage (5% w/v), cow (1% w/v) or gull (0.1% w/v) feces mixed with ambient freshwater were suspended from PVC frames and placed in ambient freshwater in San Joaquin Marsh (Irvine, CA) for 10 days. Half of the frames were in direct sunlight, the balance were covered with shade cloth. Duplicate bags from each source and treatment were retrieved daily and the contents analyzed for FIB by Enterolert and Colilert. A simple log linear model was used to fit the FIB time series data, and the decay rates ranged from 0.05 to 1.1 log unit per day. Among the three factors (sunlight, fecal source, and FIB organism) examined, the largest difference was observed for organism. Enterococcus decayed about twice as fast compared to E.coli or total coliform, regardless of sun exposure and fecal source. Sunlight had a significant effect on decay rates for E.coli and total coliform, but made little difference on Enterococcus decay (except for when the fecal source was cow). The fecal origin of FIB also did not significantly affect decay, although marginal difference was observed for E. coli decay between cow and sewage only. Contrary to similar studies in other environments, our results suggest that sunlight exposure and fecal origin only played a minor role in FIB degradation. This may be due to the high turbidity of urban freshwater.