Title: Examining trends in general fecal indicator bacteria and microbial source tracking genetic markers at non-point source impacted Chicago beaches

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Abstract: In the Chicago area, treated wastewater and storm water flow through the engineered Chicago River system to the Mississippi River, with the goal to protect Lake Michigan from urban discharges. Therefore, under dry weather conditions, nearby Lake Michigan recreational beaches should only be impacted by non-point sources of fecal contamination. Nevertheless, many Chicago beaches often exceed United States Environmental Protection Agency (EPA) recommended Beach Action Values (BAV). The goal of this study was to compare paired measurements of general fecal indicator bacteria (FIB) with host-associated genetic markers targeting human, bird, and dog in water samples collected from nine Chicago area recreational beaches to identify trends in non-point source fecal pollution. Surface water samples were collected five days a week over the 2016 beach season (nine beaches tested on 70 days = 630 total samples). Enterococci (EPA Method 1609.1) and *E. coli* (Colilert®) FIB concentrations were measured for local beach monitoring and public notification. Enterococci analyses resulted in 4.8% advisories (30 of 624 total days sampled) of the EPA recommended BAV of 1000 CCE/100mL, while 21.2% (88 of 416 total days sampled) resulted in exceedance of *E. coli* BAV recommendations (235 MPN/100mL). A total of 195 samples were selected for microbial source tracking analysis for human (HF183/BacR287, HumM2), canine (DG3, DG37), and avian (GFD) based on enterococci and *E. coli* BAV advisories. Qualitative analysis indicates that out of the 195 samples tested, 20% (n=39) yield amplification products for HF183/BacR287, 8.2% (n=16) for HumM2, 21.5% (n=42) for DG3, 6.7% (n=13) for DG37 and 55.4% (n=108) for GFD. Initial findings suggest that non-human fecal pollution sources including canine and avian may influence recreational water quality at these Chicago area Great Lakes beaches. Further data analysis will explore potential links between fecal pollution trends and precipitation.

Keywords: Microbial source tracking, qPCR, water quality, fecal indicator bacteria

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