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Use of dye tracers and qPCR to identify human fecal contamination at Doheny State Beach, Dana Point, CA

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EXECUTIVE SUMMARY

Doheny State Beach (Dana Point, CA) has a history of chronically poor microbial water quality, increased swimmer illness and the presence of human-associated bacterial and viral markers. Here we conduct a phased, tiered microbial source tracking approach to investigate three potential fecal contamination sources during dry weather: urban runoff discharges to adjacent San Juan Creek, potential leaks in sanitary infrastructure, and avian wildlife. The contribution of urban runoff was evaluated by measuring weekly fluxes of fecal indicator bacteria and human-associated DNA markers at various inputs to lower San Juan Creek and the beach. Sanitary infrastructure was evaluated with an intensive, 30-hour study of bacterial water quality and a simultaneous rhodamine dye test of the local collection system. The contribution of avian wildlife was evaluated by comparing weekly bird counts to FIB levels in the lagoon, characterizing the fecal bacteria of this population, and estimating fluxes of FIB from birds to the lagoon. While upstream storm drain outlets consistently contained high levels of FIB and human markers (4.42 ± 2.20 log HF183 copies/second/drain), this source was unlikely to make significant contributions to the problems at the beach because creek flow was intermittent and did not reach the beach during most of the study period. In contrast, leaking sanitary lines were clearly a contributor as fluorometric measurement of beach and lagoon water samples after rhodamine introduction to the nearby sanitary collection system revealed pervasive diffuse leaks. Birds in the lagoon were found to be a primary source of FIB to the lagoon, and possibly to the surf zone via through-berm transport and beach deposits washed into the ocean by waves. Several observations suggest that through-berm transport of FIB is occurring: (1) berm pore water samples were high in FIB, (2) the berm substrate is cobble and coarse sands, which provide for good transport of bacteria, and (3) there was a correlation between *Enterococcus* concentrations in the lagoon and the nearby ocean sampling site.

Full text: [860_DyeTracersPCRForContamWCov.pdf](#)