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Environ Microbiol. 2007 Aug;9(8):2038-49.

Frequent occurrence of the human-specific Bacteroides fecal marker at an open coast marine beach: relationship to waves, tides and traditional indicators.

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Molecular genetic markers, such as those from fecal Bacteroides microorganisms, can link microbial pollution with its source, and have been used successfully in studies of sheltered aquatic environments. Their applicability to wave-driven, open coast environments has not been tested. We assessed the contribution of a tidal outlet to surf zone water quality in coastal Orange County, California, USA by measuring three traditional culture-based fecal indicator bacteria (FIB) as well as the human-specific Bacteroides molecular marker (HF marker) at four shoreline locations. We found that total and fecal coliform levels were higher during low tides than high tides at two of the four stations, and that this effect was strongest at the mouth of the tidal lagoon and decayed with distance from the outlet. The HF marker was detected in 23% and 47% of samples from the tidal outlet and 26% and 41% of samples from an adjacent recreational beach in 2005 and 2006 respectively. Surprisingly, the station farthest from the tidal outlet had the highest occurrence of the HF marker. We found no relationship between FIB abundance and occurrence of the HF marker for individual samples, but that when the data were considered together by year, higher FIB abundance was correlated with a higher incidence of the HF marker. DNA sequences of the HF marker recovered from this site were > 99% similar to those recovered from states and countries, suggesting low global diversity of this marker. These data provide strong support for the idea that multiple time points and physical conditions should be considered when assessing coastal water quality.

PMID: 17635548 [PubMed - indexed for MEDLINE]

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