Full and new moons could inform monitoring programs

Managers of marine recreational beaches routinely monitor for fecal indicator bacteria (FIB) such as enterococci. These bacteria cause an increased risk for bathers in acquiring gastrointestinal illness and other ailments. Water quality is typically monitored in early morning once a week without respect to tidal conditions (Boehm and Weisberg 2005). When samples exceed regulatory limits, managers temporarily close beaches. One problem with the present monitoring protocol is that FIB concentrations change at frequencies that surpass those at which posting decisions can be made. In other words, managers may be too late in detecting a pollution event; the health hazard may be gone by the time they post health advisories.

To assess the effect of tides on water quality, which informs the public health warning system, researchers analyzed data from monitoring programs in three regions of southern California, including Huntington Beach, Whites Point, and Santa Monica Bay. Researchers assembled years of data from 60 beaches spanning 75 miles (120 km).

At most sites (50 beaches), enterococci concentrations were significantly higher during spring tides (associated with full and new moons), especially during ebbing, than during neap tides (associated with the moon's first and third quarters). Moreover, enterococci concentrations that exceeded standards were typically more than twice as likely to occur during spring tides as compared to neap tides. Researchers also considered a beach's geomorphology, orientation, and the proximity to terrestrial runoff sources. However, according to Boehm and Weisberg, these factors had minimal influence on the tidal modulation of enterococci concentrations.

Spring tides have the maximum tidal range in an area and, thereby, provide the greatest exchange between terrestrial (surface and ground) waters and coastal waters. Neap tides have the minimum tidal range for an area. Hence, it may not be surprising that higher concentrations of enterococci occur during spring tides because these tides affect a greater terrestrial area. Possible terrestrial sources of enterococci include enterococci-laden groundwater (saline and fresh) from the beach aquifer, enterococci-enriched sands, decaying wrack, and bird feces near the high water line. This study suggests that enterococci delivered by tidally forced sources other than terrestrial surficial runoff are widespread, showing the importance of including tides in the design and interpretation of beach-water monitoring programs.

Reference

Boehm, A. B., and S. B. Weisberg. 2005. Tidal forcing of enterococci at marine recreational beaches at fortnightly and semidiurnal frequencies. Environmental Science & Technology 39(15):5575–5583.