A risk-based probabilistic approach for implementing the 'discounting' mechanism in the new EU Bathing Water Directive

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Under the new Bathing Water Directive, more stringent bathing water quality standards, defined in terms of E.coli and Intestinal Enterococci (IE), will apply. An integrated approach to coastal zone management essential for sustaining tourism and shellfish harvesting in European coastal waters is required in the context of the new legislation. The directive recognises that elevated levels of faecal coliform bacteria in bathing areas can derive from the overland transport of waste from livestock in the rural fraction of river catchments. On days therefore, that follow significant storm events in coastal agricultural catchments, exceedences of threshold bacteria levels may occur. Given that these exceedences result from 'natural' rather than anthropogenic influences, a 'discounting' mechanism is included in the Directive where high levels of faecal bacteria contamination can be excluded from the water quality record if they are predicted in advance and mitigation actions to maintain public health protection are taken. However, this discounting, which can apply to a maximum of 15% of water quality samples in a 4-year monitoring period, is required on a continuous basis rather than at the end of the monitoring period.

This presents practical problem for responsible authorities charged with enforcing the legislation. In the event of a poor quality water sample associated with a naturally occurring short-term pollution incident being recorded early in the monitoring period, authorities must decide whether or not this is likely to be included in the 15% of discounted samples in a 4 year period. This study develops a risk based probabilistic approach to 'discounting' for advising responsible Authorities whether the water quality of a particular sample should be discounted. The study uses E.coli and IE records in three bathing water areas (Dollymount, Merrion and Sandymount Strands) on the east coast of Ireland collected from 2003 – 2012. The records were initially analysed to identify any seasonal or other patterns in the data. Following this, synthetic records of E.coli and IE were generated from a Monte-Carlo simulation over the monitoring period. The non-exceedence probabilities of E.coli and IE were determined from the generated samples. The directive requires that threshold values of both E.coli and IE should be within specified limits to maintain beach quality and therefore, a joint probability analysis was undertaken to identify allowable E.coli and IE levels to facilitate the discounting of 15% of samples.