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Bayesian Analysis of Fecal Indicator Bacteria Criteria for Water Quality

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Fecal indicator bacteria (FIB) measurements are commonly used to assist in quantifying the threat of pathogen contamination in U.S. coastal and inland waters. Unlike most measures of pollutant levels however, FIB concentration metrics, such as "Most Probable Number" (MPN) and "Colony-Forming Units" (CFU), are not direct measures of the true *in situ* concentration distribution. Thus there is the potential for inconsistencies among model and sample-based water quality assessments, such as those used in the U.S. EPA's "Total Maximum Daily Load" (TMDL) program. To address this problem, we propose an innovative approach of basing standards on predicted pathogen contaminations from a Bayesian model, rather than on MPN or CFU values. Such concentration-based standards link more explicitly to human health considerations, are independent of the analytical procedures employed, and are consistent with the outcomes of most predictive water quality models. This methodology, applicable to a wide range of FIB-based water quality assessments, is illustrated here using fecal coliform data from shellfish harvesting waters in the Newport River Estuary, North Carolina, USA. Our results isuggest that areas determined to be 'compliant' under current methods-based standards may actually have an unacceptably high probability of violating concentration-based standards, while areas designated 'non-compliant' may in fact be safe.