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## **R-Beale: an automated stratified Beale's ratio estimator to calculate pollutant loading from measurements with missing observations.**

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The Beale's ratio estimator (Beale, 1962) had been proven to be an unbiased pollutant loading calculator. However, Dolan et al (1981) cited that the estimator may have poor performance due to inadequate stratification. This study evaluated the error in phosphorus annual load calculation using an automated stratified sampling Beale's ratio estimator of weekly, bi-weekly, and baseflow + storm event sampling schedules. The uniform random sampling and genetic algorithm approaches to search the optimal stratification and the number of strata were implemented in R programming language. The data from the National Center for Water Quality Research's (NCWQR) tributary loading program in Ohio, USA and the Norwegian Institute for Bioeconomy's (NIBIO) JOVA monitoring program in Norway were used in this study. The minimum number of strata required in uniform random sampling and the number of sample size and iterations for the genetic algorithm were identified to obtain the stratification that has the lowest load mean square error calculation. The results of this study can be used to find the optimal pollution sampling strategy with minimal loading calculation error depending on monitoring infrastructure and constraints.