Title: Effects of Spatial Allocation and Parameter Variability on Lakewide Estimates from Surveys of Lake Superior, North America's Largest Lake

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Lake Superior was sampled in 2011 using a Generalized Random Tessellation Stratified design (n=54 sites) to characterize biological and chemical properties of this huge aquatic resource, with statistical confidence. The lake was divided into two strata (inshore <100m and offshore >100m), each with 2 sub-zones. Approximately 75% of lake area is offshore. A series of systematic, computational experiments were conducted using the 2011 data and constructed sets based on its properties: 1) means and variability were held constant while within- and between-strata allocation of sites were varied, 2) allocations were held constant while means and variability were varied, and 3) allocations were varied and means and variability were based on observed depth patterns. Results showed that allocation of sites between the two strata and the distribution of variability across depth affect confidence intervals. Under-allocation to the larger offshore strata and extremely unbalanced spatial allocation should be avoided; they lead to undesired expansion of confidence intervals. Furthermore, optimizing for specific parameters occurs at the expense of other parameters with opposing spatial patterns.