

April 19, 2021 Statistics Seminar
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Title: Messy, multivariate, and multi-source data - A Bayesian hierarchical model for speciated lake nitrogen

Abstract: Concentrations of nitrogen provide a critical metric for understanding ecosystem function and water quality in lakes. However, varying approaches for quantifying nitrogen concentrations may bias the comparison of water quality across lakes and regions. Different measurements of total nitrogen exist based on its composition (e.g., organic versus inorganic, dissolved versus particulate), which we refer to as nitrogen species. Fortunately, measurements of multiple nitrogen species are often collected, and can therefore be leveraged together to inform our understanding of the controls on total nitrogen in lakes. We develop a multivariate hierarchical statistical model that fuses speciated nitrogen measurements obtained across multiple methods of reporting in order to improve our estimates of total nitrogen. The model accounts for lower detection limits and measurement error that vary across lake, species, and observation. By modeling speciated nitrogen, we obtain more resolved inference regarding sources of nitrogen and their relationship with complex environmental drivers. We illustrate the inferential benefits of our model using speciated nitrogen data from the LAke GeOSpatial and temporal database (LAGOS).