Geostatistical Estimates of Pelagic Fish Production in Freshwater Ecosystems

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Freshwater ecosystems around the world are generally declining in ecological integrity. Ongoing scientific information is needed to properly manage and restore these systems, especially within the context of hydropower operations. Reliable estimates of fish density through the use of traditional passive sampling methods such as netting typically require large amounts of time and effort to obtain. Additional issues arising from fish avoidance and mortality further complicate the interpretation of this data, indicating that a more active and non-invasive approach is desirable. This study makes use of an active multi-frequency hydroacoustic survey system to discover how several different trophic levels varied in density across a Manitoba reservoir. Acoustic surveys were conducted across the short-axis of the Lac du Bonnet reservoir for maximal coverage of the pelagic zone, and data obtained include high-resolution bathymetric mapping, fish sizes (obtained through standard target strength – length relationships) and distributions, as well as plankton densities across the reservoir. Autocorrelation analysis was performed, and geostatistical interpolation was carried out using the semivariograms from several size classes of fish and plankton to perform ordinary kriging techniques. Interpolated values were then used to estimate the density of each class within each of the three basins characteristic of Lac du Bonnet. Preliminary results reveal higher densities of fish in the two northeastern basins, while the riverine section of the reservoir had lower estimates for all size classes of fish and plankton. These survey methods show promise for future freshwater monitoring programs across Manitoba and elsewhere.