Measured mercury contamination in freshwater fish in Rhode Island compared with predictions from a regional environmental mercury model

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Edible tissue of largemouth bass collected at 29 freshwater sites across the variable landscape of Rhode Island, USA showed a 27 fold range in total mercury concentrations [Hg], from 0.04 to 1.0 ppm (wet). Twenty-one variables, including water quality data and geographic information system (GIS) layers, were obtained to describe the land use, human population density, soil and bed rock characteristics, impervious surfaces and vegetative cover within the watersheds and one hundred meter buffer zones surrounding these freshwater sites. Regression analyses were performed to determine which landscape and water quality variables or combinations of these variables were associated with size-corrected [Hg] in largemouth bass from the 29 freshwater sites. Preliminary analyses demonstrated that three variables: pH, chloride and Secchi depth or clarity (all negatively associated with fish [Hg]), explain 58% of the variability in largemouth bass [Hg] among sites. Measured [Hg] results were compared with those estimated for the same sites using the MERGANSER model, a USGS-EPA New England (NE) regional model which uses mercury depositional data and estimated values for continuous water quality and landscape variables to predict [Hg] in fish. Average measured values of fish [Hg] for these 29 lakes were generally similar to predicted values (0.50 and 0.48 ppm, respectively), while variance was slightly higher in the measured data set. Fish [Hg] measured and predicted values were moderately well correlated (r^2= 0.40), and rank order agreed better for lakes with the lowest and highest fish [Hg] values. The pH value measured at sites, which was not used in calculating MERGANSER model estimates of [Hg] because this information was not available for many NE lakes, could explain a higher % of the variability in the model's estimates of [Hg]. Our results suggest that easily measured water quality variables such as pH, chloride and Secchi depth data could provide important information for the prediction of fish [Hg] in unmeasured lakes. Further, these findings indicate more site specific modeling may be required in regions like Rhode Island where site characteristics vary widely across a relatively small geographic range.

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