Non-linear responses of monomethylmercury bioaccumulation factors to the trophic state index in artificial reservoirs

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The aim of this study was to identify how hydrologic (e.g., rainfall, depth, reservoir and catchment area, and water residence time) and chemical factors (e.g., conductivity, pH, chlorophyll-a, dissolved organic carbon, and sulfate) interact to affect spatial variances in monomethylmercury (MMHg) concentration and bioaccumulation factor in various artificial reservoirs. We investigated concentrations of Hg and MMHg in surface waters, sediments, as well as common fish species (barbel steed, bass, mandarin fish, and bluegill) collected from 14 artificial reservoirs in Korea from 2013 to 2015. The chlorophyll-a, pH, conductivity, and other chemical variables from 2013 to 2015 were collected from the national network of Water Resources Management Information System. Multiple tools, including Pearson correlation, a self-organizing map, and principal component analysis, were applied in the statistical modeling of Hg species. The results showed that rainfall amount and hydraulic residence time best explained the variance of dissolved Hg and dissolved MMHg in reservoir water. High precipitation events may mobilize Hg and MMHg in the catchment. On the contrary, algal biomass was a key predictor of the percentage fraction of unfiltered MMHg over unfiltered Hg. The bioaccumulation factors for fish MMHg showed a lognormal distribution along the trophic state index of the reservoirs, and the reservoirs showing the largest bioaccumulation factor were classified as mesotrophics reservoirs, where primary production was limited by total phosphorous and light availability. The MMHg bioaccumulation factors seem to be affected by biomass dilution effects at the base of food web.