Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35802

Mercury Dynamics in Aquatic Ecosystems under Heavy Rainfall: Insights from Fish Mercury Isotopes

DR. SAEBOM JUNG, PHD[1], SAE YUN KWON[1] AND KYUNG-HOON SHIN[2]

[1]Pohang University of Science and Technology
[2]Hanyang University

Heavy rainfall events reshape aquatic ecosystems by altering physical habitats, food-web structure, mercury inputs and biogeochemical processes, and mercury accumulation in fish. Nearshore ecosystems are particularly sensitive to these perturbations because they integrate upstream nutrient and contaminant inputs and serve as key interfaces linking riverine mercury export to the coastal ocean and human exposure via fish consumption. Yet, substantial knowledge gaps remain regarding how rainfall events modify riverine mercury sources and dynamics, and how sensitively fish mercury isotopes respond to such rainfall-driven environmental changes. In this study, we collected four fish species, skygager (*Cahanodichthys erythropterus*), crucian carp (*Carassius carassius*), korean piscivorous chub (*Opsariichthys uncirostris*), largemouth bass (*Micropterus salmoides*), from the Geum estuary on the west coast of South Korea, during pre- and post-monsoon periods. We used stable carbon (C) and mercury (Hg) isotopes, together with compound-specific isotope analyses (CSIA) of nitrogen (N) in amino acids, to evaluate whether and to what extent rainfall-driven changes in mercury sources and biogeochemical processes are reflected in fish mercury isotopes. Total mercury concentrations did not differ significantly between pre- and post-rainfall fish. However, relative to pre-rainfall fish, post-rainfall fish exhibited lower mercury isotope values (δ^{202}Hg and Δ^{199}Hg) by 0.31 ‰ and by 0.14 ‰, respectively, with the largest shift observed in crucian carps. The negative δ^{202}Hg and near-zero Δ^{199}Hg values in post-rainfall fish were consistent with those of previously reported riverine fish and watershed-derived sediments, indicating a greater post-rainfall influence of terrestrial runoff and watershed-derived mercury inputs via rainfall-driven erosion. This pattern was accompanied by a similar negative shift in carbon isotopes (δ^{13}C) in the same fish and a contraction of the $\delta^{13}C-\delta^{15}N_{Phe}$ isotopic niche, together indicating increased ecological disturbances and reduced diet availability after heavy rainfall. The observed shifts in fish mercury isotopes were modest but environmentally realistic under natural field conditions. It was particularly evident in opportunistic feeders, which can rapidly switch to newly available food sources after rainfall. Our study provides an essential basis for identifying appropriate isotopic indicators and fish species for mercury monitoring under accelerating climate-driven environmental change, thereby supporting precise and targeted mercury pollution management through fish-based biomonitoring.