The Relationship Between Mercury Loading And Fish Mercury Concentrations: Some Modeling And Field Perspectives

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Two mechanistic models of mercury cycling and bioaccumulation are presented, as well as observations from field studies involving increased mercury loading to sites. The models presented are the Everglades Mercury Cycling Model (E-MCM) for Everglades marshes, and the Dynamic Mercury Cycling Model (D-MCM) for lakes. Field studies discussed include the METAALICUS project, East Fork Poplar Creek, TN, and Clay Lake, Ontario. The latter two sites, discussed only briefly, involve high levels of industrial contamination. The METAALICUS project involves the ongoing addition of stable mercury isotopes to an ecosystem with an upland, wetland and lake, to investigate the response in fish and other compartments. The models and field studies are discussed in the context of the following question: "What is the relationship between mercury loading and fish mercury concentrations?" Field and laboratory studies clearly indicate that high levels of mercury contamination can increase fish mercury concentrations. It appears that for highly contaminated sites, the increase in fish is not proportional to the increase in inorganic loading. The linearity of this relationship at lower Hg loading levels is unclear, but important in the context of potential changes in atmospheric mercury deposition. Applications of E-MCM and D-MCM as components of TMDL studies are discussed, including strengths and limits of these efforts. The ability of models to predict the magnitude and timing of the response of fish mercury concentrations to changes in loading is not currently adequate, and reflects gaps in the state of knowledge. An improved scientific understanding of the relationship between inorganic mercury loading and methylmercury production is needed to estimate the magnitude of the response. To better predict the timing of the response, an improved understanding is needed of various pool sizes and turnover rates for both inorganic and methylmercury in aquatic and terrestrial systems.