THE DETROIT RIVER AS A CHEMICAL LOADINGS SOURCE TO LAKE ERIE

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The Detroit River, one of 42 designated areas of concern, has been classified as one of the most polluted rivers in North America. This system receives chemical loadings from a variety of sources including upstream discharges, industrial/municipal point sources, combined sewage outflows, non point sources and re-suspension of historically contaminated sediments. Despite the rapid discharge rates (5800 m3/s) and short residence times (19-21 h), water concentrations of several organic contaminants (PAHs, PCBs and organochlorine pesticides) and trace metals, many times, increase from headwaters to the mouth of the river. Lake Erie receives approximately eighty percent of its water inflow, an estimated 1.4 x 106 t of sediments, and a substantive influx of chemical loadings from the Detroit River each year. The long-term records of organic contaminant and heavy metal loadings from the Detroit River to Lake Erie are rather limited. Some of the best trends for heavy metal loadings indicate long-term declines for lead, copper, and zinc. Loading estimates for organic contaminants (eg. PCBs) are even more sparse but suggest a long-term decline. The effects of these apparent load decreases on Lake Erie are casual and are not necessarily well-documented in terms of reduction-recovery; however, decreases in Lake Erie sediment concentrations, contaminants in fish, and recovery of mayfly populations may be indicators of improvements.

In this study, we summarize the results of water biomonitoring surveys (1996-2000), sediment surveys (1999) and food web sampling surveys (1991-2000) performed along the Detroit River length and contrast these data with a reference site located at Middle Sister Island (MSI), in the western basin of Lake Erie. Biomonitor estimated water concentrations of tPCBs and tPAHs averaged 0.7±0.2 and 202±16 ng/L throughout the Detroit River, similar to concentrations determined at MSI (0.64 and 304 ng/L, respectively). Sediment tPCBs and tPAHs exhibited pronounced chemical gradients along the river length, increasing from 1.1±0.8 and 14±4 ¼g/g OC wt at headwaters to 5.0±1.2 and 404±32 ug/g OC wt. at the mouth. The latter values were similar to the MSI site which exhibited sediment tPCB and tPAH concentrations of 3.07 and 217 ug/g OC wt, respectively. Elevated sediment/water fugacity ratios (ranging from 3 to 10 for various organochlorines) observed at each site highlight the importance of sediment entrainment/re-suspension towards contaminant flux along the river and as a loadings source to Lake Erie.

Interpretation of the above datasets to estimate annual Lake Erie loadings rates, requires the development of calibrated hydraulic models. The development of a Detroit River hydraulic model, its application, and validation of model predicted loading rates using appropriate sampling and monitoring designs are to be discussed. It is apparent that the Huron-Erie corridor should be considered a "Management Unit" and monitoring, modeling, and decisions should be made on a corridor-wide basis.