Temporal and Spatial Changes in Copper Speciation in the Long Island Sound: Effect of Water Temperature and Dissolved Oxygen Levels

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The Long Island Sound (LIS) is an urban estuary, and is subject to heavy anthropogenic influence. As a result, input of toxic metals from such sources as municipal and industrial wastewater may have a major role in its ecological health and stability. Furthermore, despite the billions of dollars spent on lessening point-source inputs, sediment-associated historical pollutants may now also be a substantial source of toxic metals to the water column. The recent collapse of lobster fisheries in the LIS has raised concerns regarding the environmental health of the Sound, and has led to recognizance of the need for data on the spatial, temporal, and species distribution of toxic metals in the LIS. Because crustaceans show heightened sensitivity to copper toxicity, copper was chosen as the metal of focus.

Chemical speciation was operationally defined as the extractible portion of the total dissolved Cu pool using two different resins, C-18 (non-polar organic) and Chelex-100 (labile/bioavailable). Results show that the urban area surrounding New York City is the major source of total dissolved Cu input to the LIS. Kinetically labile species of Cu range from 0.2 - 8nM. This labile Cu is delivered to surface waters through river flow and wastewater discharge. Labile Cu in surface waters appears to be regulated by picocyanobacteria, which may affect a shift to non-labile organic Cu species. Labile Cu in bottom waters has a diagenetic source, and is strongly influenced by increased temperature and hypoxic conditions. Labile Cu in bottom waters appears to be regenerated from sediment reservoirs, suggesting that historical pollution continues to be a source of ecological stress.