



1 Great Salt Lake, United States: Evidence of anthropogenic pressures to the fourth largest terminal lake in the world

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Great Salt Lake (GSL), in the western United States, is a terminal lake with a surface area that can exceed 5,100 km². The GSL ecosystem receives industrial, urban, mining, and agricultural discharge from a 37,500 km² watershed which includes over 1.7 million people. The open water and adjacent wetlands of the GSL ecosystem support millions of migratory waterfowl and shorebirds from throughout the Western Hemisphere, as well as a brine shrimp industry with annual revenues exceeding 70 million dollars (U.S.). Despite the ecologic and economic significance of GSL, little is known about the biogeochemical cycling of trace contaminants and no water-quality standards currently exist for this highly saline system (salinities exceeding seawater by over 5 times). Analysis of recent sediment cores indicates increasing anthropogenic impacts to this saline lake, which is a critical component of the Western Hemisphere Shorebird Reserve Network. Sediment cores spanning deposition over the last 300 years indicate increasing concentrations of Cu, Cd, Hg, Se, Zn, and PAHs in sediments deposited during the last 50 years. Selected water samples collected since 2000 were found to contain elevated concentrations of As (90 ug/L), total Hg (50 ng/L), and methyl Hg (26 ng/L). The elevated levels of methyl Hg exceed the standard for protection of aquatic life in marine systems and are likely the result of high rates of SO₄ reduction and associated Hg methylation in persistently anoxic areas of the lake at depths greater than 6.5 m below the water surface. The median Hg concentration

(wet weight) in brine shrimp increased seasonally from the spring to fall time period. Brine shrimp are the primary food source for eared grebes during the fall molt (August through December); the Hg concentration in eared grebe livers also doubled during this time period. In 2005, Hg concentration in breast muscle tissue from Common Goldeneye and Northern Shoveler duck species was found to consistently exceed the U.S. Environmental Protection Agency screening level of 0.3 mg/kg (wet weight), resulting in a health advisory by the State of Utah to duck hunters regarding consumption of these duck species from the GSL ecosystem. As a result of increasing concerns over anthropogenic inputs to GSL, the State of Utah formed a technical advisory group in 2004 to initiate the required research to set water-quality standards for contaminants of concern.