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Water Chemistry in Estuaries Around Great Salt Lake, Utah, USA.

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The Great Salt Lake (GSL) in northern Utah is a key natural resource for migratory waterfowl and the local economy. The quality and quantity of water reaching the Great Salt Lake are of concern, particularly as competing interests along source rivers, such as the Bear River, seek to divert and capture more water to meet their needs. This project presents preliminary field study and aims to improve the scientific understanding of the chemical mixing taking place where freshwater rivers discharge into the Great Salt Lake. Water samples were collected in 16 locations in mixing zones between the Bear River Bay, marshes of the mouth of the Ogden River, and shallow water zones in the Great Salt Lake. Water samples were acidified with nitric acid and filtered through 0.2 micrometer filter. Field in-situ parameters: temperature, pH, ORP, dissolved oxygen, and electric conductance were measured using Troll 9500 probe and concentrations of forty elements were analyzed in ICP-MS and ICP-OES. Field in-situ measurements indicated that pH is weekly alkaline with saline waters typically being more alkaline than fresh water. Saline waters are more reducing than fresh waters. Fresh water flows were extensive in very shallow environments. Extremely shallow environments were more affected by high salinity mud deposits. The results indicate higher concentrations of heavy metals transported from the Bear River Bay to the Great Salt Lake than from the Ogden River. The pattern of elemental concentrations is complex. Fresh water fluxes penetrate shallow saline waters over relatively long distances (hundreds of meters). The depth of lake waters was predominantly less than 0.5 meter. ICP-OES measurements showed that overall Bear River samples had somewhat higher concentrations of major ions than in in the Ogden River. ICP-MS measurements indicated similar patterns between trace elements in the Bear River and in the Ogden River. Both areas have relatively higher concentrations of Al, Fe, and Mn. Concentrations of Pb, As, Se, and Hg are also relatively high. Correlation between in-situ parameters indicates complex relationship between different elements. For example more acidic conditions do not necessarily result in higher concentration of metals. Higher concentrations of metals correlate better with more reducing conditions. Concentrations of metals did increase significantly at more acidic conditions, but they typically characterized less saline waters. We will attempt hydrochemical modeling in the next phase of this research which will be verified by laboratory experiments of mixing of waters in question. This will allow controlling the parameters since natural dynamic flow systems driven by wind in a very shallow water and freshwater fluxes flowing far into saline water bodies might compromise accuracy of thermodynamic modeling.