Impact of Small Urban Reservoirs on Water Quality in East Bay Watersheds

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The urban San Francisco Bay area is home to more than 200 reservoirs. These reservoirs are maintained for a variety of uses including recreation and irrigation water storage. The influence of major freeways, historic mines, and continued development alters contaminant loads. Understanding biogeochemical cycles in urban watershed/reservoirs systems provides new insight into anthropogenic influences on the function of these systems. Differing management strategies in these systems may mitigate or exacerbate contaminant discharge to the urban-influenced coastal ocean. Understanding these impacts is critical to future best management of these systems for improved water quality and beneficial use.

Our study investigates three East Bay region watershed/reservoir systems to better understand contaminant cycling and mobility in urban environments. Study sites include Lion Creek/Lake Aliso, influenced by acid mine drainage, and San Lorenzo Creek/Don Castro Reservoir, impacted by freeways and residential land uses. Wildcat Creek/Lake Anza, which lies primarily in parkland, serves as a background comparison. Water quality data (including standard geochemistry, as well as nutrient and trace element concentrations) from reservoir inlets and outlets at each of these systems is collected bimonthly. Depth profiles of pH, conductivity, temperature, and dissolved oxygen within each lake are also collected biweekly. In addition, sediment cores from multiple locations in each lake were collected and analyzed for nutrient and trace element concentration (see poster by K. Faul).

Results suggest urban reservoirs are important controls on biogeochemical cycling in urban watersheds and downstream water quality. Reservoir mixing varies over the course of a year and leads to reducing conditions prevailing during warm summer months and oxidizing conditions dominating during more winter months. The redox state of these reservoirs determines whether metals and nutrients are mobilized or retained by the lakes. Therefore, these lakes provide great insight into how best to manage water levels to reduce contaminant outfluxes.

Keywords: Reservoirs, Metals, Nutrients, Urban, Watershed, Water Quality, Dam, Lake

Poster Topic: Reservoir Monitoring

Sediment Core Derived History of Metal Cycling through Small Urban Reservoirs in the San Francisco East Bay Area

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Urbanization and a long local mining legacy have left many San Francisco Bay region watershed/reservoir systems contaminated with pollutants. Small reservoirs may serve as previously unquantified sinks for metals, organic carbon, and nutrients from urban streams that might otherwise discharge into the San Francisco Bay.

To reconstruct the history of deposition of these contaminants over the life of the reservoirs, we collected sediment records from three urban stream/reservoir pairs in the East Bay region: Leona Creek/Lake Aliso, impacted by urbanization and acid mine drainage, San Lorenzo Creek/Don Castro Reservoir, impacted by urbanization, and Wildcat Creek/Lake Anza in Tilden Park, which is relatively unimpacted. Sediment cores were collected using a vibracoring system and were analyzed for color, grain size, bulk density, metals, organic carbon, nutrients, stable isotopes of carbon and nitrogen, and Pb-210. In addition, bimonthly water quality data from reservoir inlets and outlets at each of these systems as well as depth profiles of pH, conductivity, temperature, and dissolved oxygen within each lake are collected (see poster by L. Rademacher).

Preliminary isotopic data suggests variations in source for organic matter to the lakes. Scanning x-ray fluorescence measurements indicate that metal concentrations varied through depth in the core in individual lakes and in space at different lakes. Analysis of discrete samples for metals in the sediment cores by inductively coupled plasma optical emission spectrometry will be combined with Pb-210 analysis to produce a detailed time constrained history of metals cycling in the reservoirs.

These analyses will provide insight into whether small reservoirs act as sinks for pollutants or allow pollutants to pass through the system and ultimately discharge in the Bay. Results from this research will be useful in developing reservoir management strategies in the San Francisco Bay area.

Keywords: San Francisco East Bay, metals, reservoir, sediment records, nutrients

Poster Topic: Reservoir Monitoring