

## **'Reactive' Inorganic Mercury: A Critical Examination of Preservation and Storage Techniques**

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Mercury (Hg) studies in the Sacramento-San Joaquin Delta and San Francisco Bay and elsewhere suggest that 'reactive' (stannous chloride reducible) inorganic mercury ( $\text{Hg(II)}_R$ ) in sediment is a reasonable proxy measurement for the *in situ* pool of inorganic Hg(II) that is truly available to bacteria that produce toxic methylmercury (MeHg) from Hg(II). This study rigorously tested the effects of sample handling, holding time, and storage temperature (prior to  $\text{Hg(II)}_R$  analysis), with the goal of identifying an optimal sample treatment and preservation protocol for  $\text{Hg(II)}_R$  analysis. Because specific sediment properties such as organic content, grain size, redox conditions, water content, and total reduced sulfur concentration can affect  $\text{Hg(II)}_R$  concentration, sediment with a range of these parameters was collected from four distinct Hg-contaminated regions surrounding the Sacramento-San Joaquin Delta and San Francisco Bay. For all sites, there was a statistically significant difference in  $\text{Hg(II)}_R$  concentration related to sample holding time (0 to 180 days), but no significant difference related to sample storage temperature (-80 to 5 °C). Samples exposed to oxic conditions did not differ significantly in  $\text{Hg(II)}_R$  from those subsampled in a glove bag under anoxic conditions. The results from this study will be used to develop a standard set of practices with respect to sediment sub-sampling and preservation when  $\text{Hg(II)}_R$  is a targeted analyte.  $\text{Hg(II)}_R$  was identified in the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) Hg Conceptual Model as an important driver affecting the fate and transport of Hg in the Sacramento–San Joaquin Delta ecosystem.

**Keywords:** Reactive inorganic mercury, methylmercury, sediment, preservation and storage techniques

**Poster Topic:** Water and Sediment Quality

## Transfected vs. Native: The Potential for Conflicting Measurements of Endocrine Activity from Different Cell Line Types

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The U.S. Environment Protection Agency has recently recommended that endocrine disruptor screening be conducted on contaminants of emerging concern (CECs), and that wastewater be monitored to assess compounds with potential endocrine activity entering aquatic ecosystems. CECs include the synthetic pyrethroid bifenthrin; due to its broad usage and aquatic toxicity range, and the pharmaceutical ibuprofen, which is not fully metabolized by humans and can enter the sewage system as the parent compound or metabolites. Bifenthrin has been shown to have both estrogenic and anti-estrogenic properties *in vitro* and *in vivo*, and ibuprofen is known to mediate levels of prostaglandin, a lipid mediator that plays multiple roles in reproduction. High throughput screening utilizing cell lines that evaluate the potential for estrogenic or androgenic activity is now a preferred method of prioritizing CECs for further assessment; however, results from cell lines of different origins are often conflicting. Conflicting results may occur between assays such as the CALUX that natively express the estrogen or androgen receptor and those such as the yeast estrogen / androgen screen (YES / YAS) that are transfected with these receptors. Additionally different responses may be seen depending on the concentration used, considering the sensitivity of endocrine responses. As such, to date the majority of *in vitro* assays have used concentrations of bifenthrin and ibuprofen that are much higher than levels detected in the environment. We will present comparative results from tests conducted on environmentally relevant concentrations of bifenthrin and ibuprofen in two *in vitro* systems, the CALUX and YES/YAS, determining their contribution to estrogenic and androgenic activity in aquatic ecosystems, as well as differences in the quantitation of estrogenic or androgenic potency between these two assay types.

**Keywords:** YES assay, CALUX assay, bifenthrin, ibuprofen, contaminants of emerging concern

**Poster Topic:** Water and Sediment Quality

## Evaluating Copper Toxicity in the San Francisco Bay Delta and Estuary: Copper Speciation and Dissolved Trace Metal Concentrations

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Dissolved trace metal concentrations, and in particular dissolved copper concentrations, are elevated in the San Francisco Bay Estuary, generating concern for copper toxicity to microorganisms in the bay. Surface (~1 m) samples were collected from North San Francisco Bay Delta and Estuary in November 2008 and April 2011 in collaboration with the U.S. Geological Survey Water Quality of San Francisco Bay monitoring program. Additional samples obtained from the San Joaquin River and Suisun Slough in November 2008 were analyzed and used in mixing experiments to evaluate freshwater copper-binding ligand sources to North San Francisco Bay. All samples were collected and processed following trace metal clean protocols to avoid sample contamination, and were filtered through 0.4  $\mu\text{m}$  pore size polycarbonate track-etched membrane filters in a positive pressure clean hood. Total dissolved trace metals (Cd, Co, Cu, Fe, Mn, Ni, Pb, Zn) were determined using magnetic sector inductively coupled plasma mass spectrometry following pre-concentration through a Nobias-chelate PA1 resin. Competitive ligand exchange-adsorptive cathodic stripping voltammetry (CLE-ACSV) with multiple analytical windows was employed to determine dissolved copper speciation and to evaluate the potential for copper toxicity in the estuary. For all trace metals measured, dissolved concentrations were elevated within North San Francisco Bay compared to adjacent coastal waters, with the highest trace metal concentrations measured during the higher salinity November 2008 sampling. Dissolved copper was found to be strongly complexed by organic ligands throughout the estuary during both sampling exercises. The complexation of dissolved copper by strong organic ligands reduced the bioavailability of ambient dissolved copper while high concentrations of weaker ligands buffered against copper toxicity at increasing copper concentrations. Bioavailable  $\text{Cu}^{2+}$  concentrations were found to be below toxicity thresholds ( $\sim 10^{-11}$  M) for phytoplankton in all samples.

**Keywords:** San Francisco Bay Estuary; copper toxicity; ligands; dissolved trace metals

**Poster Topic:** Water and Sediment Quality

## Effects of Triclocarban on the Life-Cycle of the Medaka (*Oryzias latipes*) Fish Model

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Triclocarban (TCC) is a common antibacterial additive in personal care products. As a result of extensive human usage and incomplete removal by wastewater treatment plants, TCC has been detected at levels as high as 6.75µg/L in surface waters in the United States. Due to its frequent detection in US surface waters, TCC has become a matter of widespread concern. The objective of this study is to investigate the chronic effects of TCC using the medaka fish model. A full life cycle chronic toxicity test was initiated by exposing 1-day-old embryos to 5 ug/L of TCC continuously for 5 months until full maturation. Growth was assessed by weight and length at multiple time points. Differences in weight and lengths between exposed and control fish were observed. Expression of vitellogenin, a female egg yolk precursor protein, was measured to assess the reproductive health of males. Significant up-regulation of vitellogenin was observed in male fish exposed to TCC at 5 months, indicating potential estrogenic effects due to TCC exposure. Gene expression analysis by qPCR also supports activation of estrogen- related genes, which are responsible for female reproduction. Fertility and fecundity of chronically exposed fish were evaluated through crossbreeding experiments. Fertility in pairs with one or both exposed parents was significantly lower than pairs with both control parents suggesting impaired reproduction from an environmentally relevant level of TCC exposure. These findings observed at the molecular and phenotypic levels significantly advance the understanding of adverse effects due to TCC exposure. Results from this study will be useful in predicting population effects of TCC and provide insight on its environmental impact. A better understanding of TCC toxicity can be used to initiate monitoring of TCC in the Delta. Steps can be taken to control TCC contamination and protect the Bay-Delta ecosystem.

**Keywords:** Triclocarban, Japanese medaka, life-cycle study, reproduction

**Poster Topic:** Water and Sediment Quality

## Surface Sediment Characteristics of the San Francisco Bay Coastal System

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Sedimentary characteristics play a major role in determining the ecologic and economic health of estuarine ecosystems. Sediments influence habitat composition, toxin transport, turbidity, and overall water quality, as well as economic vitality through navigational dredging, aggregate mining, shoreline management, and restoration activities. Despite its importance, knowledge of surface sediment characteristics throughout San Francisco Bay is limited. Although detailed sedimentary studies have been performed in select locations throughout the bay, the only extensive maps of the entire estuary are based upon a limited number of samples that were likely collected over a large time span using different devices and analyzed with varying procedures. From 2010 to 2012 over 400 surface sediment samples were collected from the bay and seafloor, area beaches, and all major drainages throughout San Francisco Bay and along the adjacent Pacific Coast. These samples were collected as part of a larger research project working to establish the primary sources, sinks, and pathways of sediment throughout the region. We present surface sediment maps of grain size characteristics (size, sorting, carbon content, etc.) derived from the analyses of hundreds of sediment samples recently collected throughout the region.

**Keywords:** surface sediment, grain size

**Poster Topic:** Water and Sediment Quality

## **Decentralized Water Disinfection and Designing Low Cost Clean Water Technology in Developing Countries**

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Access to improved water supply is the key purpose of this proposed paper. With the goals of designing low cost, low maintenance tool where little work requires to be done to explore intermediate options between promoting household point-of-use (POU) water treatment technologies (treating drinking water in the home) and city-wide networked water treatment (piped water to individual households); this paper has been developed. According to the WHO statistics it has been found that about 7 million people die every year due to contaminated and infected ground water; as well as 1.4 billion people are affected by the water shortage lack of having adequate supply of potable drinking water. Due to environmental pollution, excessive population growth, lack of proper resource management, and increasing rate of water consumption essentially it can be derived that 60% of the developing countries will not have enough drinking water by the year 2050. The paper will also address this technology gap by developing and evaluating low-cost, in-line chlorination systems; by designing and prototyping appropriate system tools having user acceptability and strategic partnerships that can help in reducing contamination of drinking water in low-income areas of developing countries. With the objectives of automated dosing, low cost, minimal behavior change, no electricity requirement, intermittent supply serving hundred households the paper has been produced. Though on the large-scale technologies for desalination and water disinfection are already installed in many different countries and are working reliably but in rural areas cause of maintenance requirements, lack of improvement skills the promoted ideas do not work out satisfactorily. So the proposed paper plan and idea would be a milestone addition having affordability of rural areas throughout the developing countries.

**Keywords:** Decentralized Water Disinfection, Chlorination Systems, Point of Use (POU) technology.

**Poster Topic:** Water and Sediment Quality

## **Mercury Cycling in Permanent Wetlands in the Yolo Bypass Wildlife Area: A Mass Balance Approach**

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Managed seasonal wetlands often show patterns of elevated methylmercury (MeHg) concentrations and fluxes relative to other habitat types. Proposals to increase total acreage of seasonal wetlands in the Sacramento-San Joaquin Delta through restoration efforts may have unintended consequences of increasing MeHg in water, sediment, and biota. In this study, we investigated the potential for water quality improvement using permanent wetlands as treatment ponds. We utilized two existing permanent wetlands in the Yolo Bypass Wildlife Area in addition to constructing nine replicate large scale experimental permanent wetlands which allowed for controlled studies of mercury cycling. Weekly mass balance models for both the existing and experimental permanent wetlands were calculated. These models yield the net mass reductions of MeHg and relative importance of internal processes such as photodegradation, sediment water exchange, and particulate settling within the wetlands. Results indicate the permanent wetlands act as treatment ponds reducing levels of MeHg in drain water from managed seasonal wetlands. This information is useful to wetland restoration efforts and wetland managers as a way to mitigate MeHg loads from managed wetlands.

**Keywords:** Mercury cycling; Wetlands; Yolo Bypass; Methylmercury

**Poster Topic:** Water and Sediment Quality

## **Is Particulate Organic Matter a Driver or a Reflection of Changing Dynamics in the Delta?**

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Sources, quality, and cycling of particulate organic matter (POM) in the Sacramento-San Joaquin River Delta are poorly understood. Prior studies offer qualitative clues as to allochthonous vs. autochthonous sources, but little is known about how POM abundance and quality interact with habitat characteristics affecting fish abundance and distribution. We sampled for particulate and dissolved organic matter (DOM) at stations in Grizzly Bay, Honker Bay, Suisun Bay, the Sacramento River, and Cache Slough in conjunction with monthly fish surveys during the fall/winter of 2011-12 in order to quantify and characterize DOM and POM concentrations and compositions across the hydrograph, using lignin biomarkers and other tracers to identify sources and estimate processing. Lignin is uniquely produced by vascular plants, with the potential to distinguish between terrestrial vs. algal sources of POM in the Delta, and between different terrestrial sources. We assessed sources and processes within the Delta and interactions between DOM and POM. We will discuss factors that contribute to seasonal changes in POM concentration and composition, the extent to which total POM is supported by vascular plant and aquatic sources, and the extent to which DOM and POM cycling are coupled through similar sources and sorption/desorption processes.

**Keywords:** DOM/POM cycling, estuary, fish habitat

**Poster Topic:** Water and Sediment Quality



## **To and From: The Intricacies and Challenges of DWR's Tidal Flow Monitoring**

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The availability of highly reliable, accurate flow data in the Delta is a very important tool to policymakers, modelers, and environmental managers. Flow data serves as a foundational tool that other high-order questions rely on. Our group is trying to improve upon the accurate collection of flow data to precisely calibrate tidal flow monitoring stations using the index-velocity method.

Some of the challenges we face in collection and calculation of flow data are: constantly changing river state as data collection is happening, aquatic plants interfering with vertical beam level data, and channel traffic such as cargo ships and recreational boating traffic.

To address these challenges, we focused on enacting procedural improvements in data collection processes, increasing accuracy of peripheral measurements using partnerships with other groups, technological improvements to the latest sensors, and processing improvements such as filters and auxiliary sensors.

The Delta is a complex system in a constant state of flux; Channels are constantly eroding and depositing with the seasonal variations. One step we have taken to address these variations is to partner with our office's bathymetry group. They provide us highly accurate bathymetry data to create precise cross-sections that allow our group to quickly react to channel changes by modifying the stage-area equations. Another Delta issue we face is the quantity of aquatic growth produced, interfering with our stage measurements. As such, we have implemented the use of a barometric pressure sensor to provide ambient-corrected pressure to the data logger, allowing us to correct water level measurement errors.

Our poster shows some of the challenges we face with tidal flow monitoring and steps that we are employing to improve upon our data accuracy.

**Keywords:** flow, Delta, tidal, data collection, river, monitoring, measurement, index-velocity, accuracy

**Poster Topic:** Water and Sediment Quality

## Varnished Serpentinite on the Floor of San Francisco Bay

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Serpentinite clasts recovered from dredge hauls in San Francisco Bay during commercial sand mining operations are typically covered with a dark, shiny varnish. Such a varnish is not developed on clasts of the same material from the nearby ocean and bay shores. Energy dispersive X-ray analysis of a varnished pebble showed little significant difference in composition between the varnish and the interior of the pebble. The time of immersion in seawater required for the varnish to develop is not known, however, a simple experiment indicates that it may begin within approximately one year.

**Keywords:** serpentinite, varnish, diagenesis, submarine

**Poster Topic:** Water and Sediment Quality

## **Mercury in California Lakes and Reservoirs: Factors Influencing Bioaccumulation in Black Bass**

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Mercury contamination in California lakes and reservoirs has resulted in elevated fish Hg concentrations which are above safe consumption limits for humans. This study investigated total and methyl mercury in water, sediments, and black bass (largemouth, spotted, and smallmouth bass) in several of California's lakes and reservoirs. The objectives of the study were to 1) investigate correlations between a variety of ecosystem factors and mercury in black bass; and 2) investigate the relationship between total mercury in sediments and mercury in black bass using additional data resources. Several variables were significantly correlated with black bass. These factors were total mercury in sediments and surrounding watershed soils, chlorophyll *a*, and specific conductivity. There was a significant relationship between total Hg in sediments and Hg in black bass ( $R^2 = 0.42$ ;  $p < 0.001$ ). We suggest total mercury in sediments play a much greater role in black bass mercury bioaccumulation in California lakes than previously considered.

**Keywords:** Mercury; Fish; Bioaccumulation; Lakes and Reservoirs

**Poster Topic:** Water and Sediment Quality

## **Salmonella in the Delta: Implications for Human Health, Ecosystem Services, and Resource Management**

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Pathogenic microorganisms in the Sacramento/San Joaquin Delta (Delta) have the potential to jeopardize human health, particularly through body contact recreational activities (REC-1). Pathogens contained in irrigated and non-irrigated runoff from animal agriculture are of specific concern to resource managers. Understanding potential sources of and trends in the occurrence of microbial contaminants is of vital import to the established water quality goals laid out in the Central Valley Basin Plan. A major microbial water quality study was conducted from 2006-2008 at 88 sites located throughout the Delta in an effort to optimize future monitoring efforts by the State Water Resources Control Board. Sites were surveyed each month for standard water chemistry, hydrology and microbial contaminants; one of which was *Salmonella* spp. Statistical and geospatial analyses were performed to determine patterns in the occurrence and concentration of *Salmonella* as a function of season, stream flow, and geography. *Salmonella* was present in 14.9% (n=1740) of water samples. Occurrence and concentration (MPN/100mL) were seasonally dependent; the likelihood of detecting *Salmonella* was greatest during the snow-melt season (April-June). Concentrations of *Salmonella* were highest in samples from the Consumnes-Mokulemne drainage areas, particularly near the pleasure boating communities of Locke and Walnut Grove. *Salmonella* occurrence was negatively associated with the exceedance of REC-1 standards for *E. coli* and Enterococcus, suggesting that current water quality monitoring criteria are inappropriate for predicting risk to human health from exposure to Delta waters. These results, with others, will be discussed in detail placing particular emphasis on management implications and potential impacts to current ecosystem services.

**Keywords:** Salmonella, water quality, Delta, bacteria, pathogens, GIS, ecosystem services

**Poster Topic:** Water and Sediment Quality

## **Biomarker and Stable Isotope Analysis of Reservoir Sediments Offer Insights into Watershed Processes Influencing Organic Carbon Accumulation in Englebright Lake**

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Although trends of declining suspended sediment concentrations in the Sacramento River and decreasing sediment and total organic carbon accumulation in the Delta have been attributed to the construction of dams and reservoirs in the Sacramento-San Joaquin River watershed, there have been no studies examining carbon accumulation in reservoir sediments in California. This study investigates the accumulation and composition of organic carbon in two sediment cores collected from the Englebright Lake reservoir on the Yuba River, a tributary to the Sacramento River. Between 1941 and 2002 approximately 200kg of organic carbon accumulated in Englebright Lake. Lipid biomarker data, including fatty acids and sterols, and stable carbon isotope data were analyzed in sediment cores and compared to biomarker and isotope data from end-member samples collected throughout the Englebright Lake watershed. These data show a positive relationship between the maximum monthly discharge and organic carbon accumulation, suggesting that during periods of high discharge, especially floods, the delivery of organic material to the lake increases. Biomarker analyses of organic carbon reveal that terrestrial plants dominate the organic carbon sources. Signatures from algal sources were also detected but at much lower levels. Relative to end-member stable carbon isotope values, including terrestrial soils, plant materials, and water samples, the stable isotope values for sediment core samples were most similar to soil samples taken near roads and developments. These data suggest that even though individual biomarker components reveal the dominance of terrestrial plant sources, erosion of soil from the surrounding watershed is likely the primary process by which this material is delivered to the lake. The study of organic carbon accumulation in reservoirs offers a high-resolution analysis of the impacts of climate and anthropogenic change that may provide data needed to characterize the impacts of water storage and dams on organic carbon delivery to the Delta.

**Keywords:** organic carbon; lipids; stable carbon isotopes; dams; Englebright Lake

**Poster Topic:** Water and Sediment Quality

## Discarded Plastics and Priority Pollutants: A Multiple Stressor in Aquatic Habitats

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Hazards associated with plastic materials concern environmentalists, scientists, industry and policy makers. Plastics are questioned for their safety due to adverse effects reported from additives and some of the monomers that make up the material itself. In aquatic habitats, plastic pollution is reported globally along the waste stream from freshwater and coastal habitats to the open ocean. Several organisms across multiple trophic levels ingest plastic debris. The material poses a threat to wildlife, and in addition may be another medium for exposure to priority pollutants. Plastic waste sorbs priority pollutants such as persistent organic pollutants (POPs) and trace metals from surrounding waters and thus threatens organisms as a multiple stressor. To understand hazards of plastic debris in aquatic habitats we asked: 1) what is the fate of POPs to different types of plastics, and 2) what are consequences of plastic ingestion for fish. Using field experiments replicated over space and time, we measured sorption of PCBs and PAHs to five types of mass-produced plastics (HDPE, LDPE, PP, PET and PVC) in San Diego Bay. Next, we exposed adult Japanese medaka (*Oryzias latipes*) to three dietary-exposure treatments (control, diet spiked with 10% virgin LDPE and diet spiked with 10% ocean-exposed LDPE) for 1- and 2-month periods and examined several toxic endpoints including: changes in gene expression, transfer of pollutants from plastic to fish tissue, and histopathology. We found that different types of plastics sorb different concentrations of PAHs and PCBs ( $p < 0.001$ ) suggesting that some plastics may be less hazardous as aquatic debris. Results gathered to date regarding contaminant transfer and resulting toxicity to medaka will also be presented. Plastic pollution has been reported in watersheds globally and thus is an important contaminant of concern to quantify and begin to examine potential hazards of this multiple stressor in the Bay-Delta ecosystem.

**Keywords:** plastic, marine debris, persistent organic pollutants, micro plastic

**Poster Topic:** Water and Sediment Quality

## Water Quality Report Card for the Lower Sacramento River

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Measuring the health of the Sacramento River (River) can be accomplished by evaluating indicators of physical, chemical, and biological condition. Measuring River health to address policy, regulatory, and management needs requires interpreting conditions in the environment relative to reference healthy and unhealthy conditions. This study describes the first report card on health of the Lower Sacramento River, in terms of water quality. The approach was based on several key components: 1) health was measured relative to defined numeric targets (“distance to target” approach); 2) all indicators were normalized on a “distance to target” scale of 0 (unhealthy) to 100 (healthy); 3) normalization took into account non-linear responses of ecological outcomes to water quality conditions (e.g., juvenile fish survival response to changing water temperature). This health evaluation is based upon measuring status and/or trends in these indicators: water temperature, nutrients (ammonia, nitrate, phosphate), turbidity/suspended sediment, dissolved oxygen, mercury in fish, fecal bacteria, and chlorophyll a (phytoplankton). Indicator scores ranged from a low of 35 (suspended sediment), to a high of 99 (ammonia toxicity). Water temperature conditions were good (low) when averaged over the year, with periods during the summer when temperatures are generally too high for young salmon and Delta smelt. Nutrient conditions, including ammonia a constituent of wastewater, were good relative to toxicity thresholds, but need more investigation relative to the needs of the Delta food web. Turbidity conditions were poor (low turbidity) for most of the year, with periods of higher turbidity (beneficial for in-migrating Delta smelt) during Winter and Spring. Dissolved oxygen conditions were good (high concentrations), except for late summer and early winter when concentrations were lower. Mercury conditions (2006 data) were moderate, meaning that limitations on fish consumption are needed. Fecal bacteria (*E. coli*) were present during limited times of the year, conditions are usually good.

**Keywords:** water quality, food web, wastewater, indicators

**Poster Topic:** Water and Sediment Quality

## Development of a Statewide Mercury Control Program for Reservoirs

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Mercury is negatively impacting the waters of California. More than 180 rivers, reservoirs, and estuaries in California are designated as impaired by mercury because they have fish mercury concentrations that pose risks to human and wildlife consumers. Mercury control programs have been developed for the San Francisco Bay, the Delta, and several California rivers and reservoirs. However, control programs still need to be developed for more than 100 mercury-impaired reservoirs and rivers. Implementing mercury control programs for upstream reservoirs and rivers is a key component of the effort to reduce mercury inputs to, and achieve safe fish mercury levels in, the Bay-Delta.

The State Water Resources Control Board and Regional Water Quality Control Boards are working together to develop a Statewide Mercury Control Program for Reservoirs. Mercury impairment is due to several inter-related factors: sources of inorganic mercury; conditions in reservoirs that cause conversion of inorganic mercury to methylmercury and its subsequent bioaccumulation in fish; and fish species present.

The project involves: identifying mercury sources to the reservoirs; evaluating reservoir, watershed, and fisheries conditions; determining the linkage between reservoir fish mercury levels, reservoir and watershed conditions, and mercury sources; and identifying controllable factors that determine reservoir fish mercury levels. These analyses build on the robust scientific foundation established for the mercury control programs for the Bay, Delta, and other water bodies.

Statistical models have been developed to explain reservoir fish tissue concentrations. Important factors in explaining fish mercury in California reservoirs include: sediment, soil, and aqueous total and/or methyl mercury; chlorophyll-a; the ratio of methylmercury to chlorophyll-a; reservoir depth, elevation, and water level fluctuations; mine density; and percent forest, vegetation, and open water. Controllable mercury sources include upstream historic mines, surface water discharges from municipal sources and urban areas, and atmospheric deposition from industrial activities.

**Keywords:** mercury, methylmercury, reservoirs, lakes, atmospheric deposition, mines, urban runoff, fisheries

**Poster Topic:** Water and Sediment Quality