



Watching Over California's Waterways: The Aquatic Health Program

The Aquatic Health Program based at the School of Veterinary Medicine serves California's people, wildlife and the environment by monitoring and carefully measuring the adverse impacts of chemical and physical stressors on aquatic organisms in the laboratory and in the field.

From the Klamath River to the Salton Sea—Toxicologists test water samples from watersheds throughout California to learn as much as possible about such ecosystems as the Sacramento-San Joaquin River Delta, Los Angeles River, Colusa Basin, Big Chico Creek, San Diego, Walker Mine, Tuolumne River and many more. Experts collect samples from Sierra snow melt, sediment, agricultural drainage canals, flooded inland areas, water treatment facilities and other sites along streams and rivers, particularly in the Sacramento-San Joaquin Delta, the source of 60% of California's water supply.

Critical data for environmental agencies and regulators—By identifying chemicals and other compounds that may cause toxicity and assessing how they affect surface water quality, invertebrates and fish, the program provides critical data to California regulatory agencies, regional authorities and nonprofit groups such as the California State Water Resources Control Board, Scripps Institution of Oceanography, CalTrans and the US EPA. The team has gathered significant baseline data on a number of issues, for example, aquatic biological community structure and physical habitat.

Strategic innovations—Aquatic health experts have developed and evaluated tools to determine the impacts of new water treatment procedures, non-chemical pest management strategies, and other innovations designed to protect water resources, including tests tailored to specific regions. Some of its water quality assessments and biomarker tools have been implemented statewide. Just a few testing capabilities are:

- Aquatic toxicity
- Sediment toxicity
- Statistical modeling
- Toxicity in the copepod, a tiny crustacean and a standard indicator of water quality
- Behavior analysis, one gauge of the effects of chemicals on an organism
- Biomarker analysis, a method to measure how toxins affect sentinel organisms
- Evaluation of reproductive health in sentinel organisms

Gasoline additives harm aquatic creatures—Toxicologists identified negative health effects of MTBE and ethanol, which are added to gasoline seasonally, in runoff waters on indigenous shrimp, rotifers and fish embryos.

Plastic debris twice as hazardous—Program researchers learned in 2012 that plastic debris, a hazard in aquatic habitats, may also be absorbing a "cocktail of contaminants" (pesticides, flame retardants and petroleum

hydrocarbons, and metals such as lead and copper) that may present as much danger to aquatic animals as the plastics alone. Aquatic Health Program personnel have provided baseline data regarding bioaccumulation of chemicals from plastics and associated health effects in fish, sensitive animals of great ecological and commercial importance.

Old mines pose current risks—Program experts found that selenium, copper and mercury remain in significant quantities in Northern California rivers and streams from old mining operations. These metals can travel through the food chain in animal tissues. For example, Aquatic Health Program experts demonstrated that copper was the cause of toxicity to all three test species in the laboratory.

Evidence of pesticides found—Monitoring projects reveal that agricultural pesticides and herbicides have washed into the largest rivers of California from widespread sources. Program scientists have identified organophosphorus pesticides as the primary cause of toxicity to sentinel organisms and documented adverse effects of carbamate insecticides in an ecological preserve. The toxicologists have also discovered that dormant spray pesticides cause a significant impact on water quality. Projects to monitor pesticide toxicity in EPA-designated "impaired waterways" are ongoing.

Urban and highway runoff—Faculty have discovered that storm drains and other collection sites in cities show seasonal changes in urban water pollution stemming from a range of substances including residential lawn care products and residues of flea shampoos.

Protecting the environment during road construction—On behalf of Caltrans, the toxicology team analyzed the toxicity of runoff from new surface road materials, providing data to help the agency address environmental concerns during construction projects.

Cleaning up "toxic hot spots"—In support of a massive project designed to improve water quality in California's bays and estuaries, the Aquatic Health Program has provided major data on chemical compounds found in several "toxic hot spots" that are high-priority areas in the San Francisco Bay Protection and Toxic Cleanup Program.

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