LAND USE, POLLUTANTS, AND WATER QUALITY IN CALIFORNIA STREAMS

Stream Pollution Trends (SPoT) program begins with survey of watersheds statewide

Overview

The State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) has released the second report on results from a continuing statewide program that measures trends in pollution levels and toxicity in major California watersheds. The program is called the Stream Pollution Trends monitoring program (SPoT), and it is one of three statewide projects funded by SWAMP. The report, Initial Trends in Chemical Contamination, Toxicity and Land Use in California Watersheds, summarizes results from the 2009 – 2010 annual SPoT surveys and represents an assessment of large watersheds across California to determine how stream pollutant concentrations are affected by land use, with an emphasis on urban and agricultural development. These data were compared to the 2008 SPoT sampling year, allowing a preliminary assessment of emerging trends. SPoT is improving our understanding of the long-term trends of watershed contamination and associated toxicity. This program investigates the impacts of land development on water quality, helps prioritize water bodies in need of water quality management, and evaluates the effectiveness of management programs designed to improve stream health. SPoT forms the foundation for other regional programs and provides a statewide perspective so that local and regional water quality monitoring efforts can evaluate how conditions in their streams compare to those in other California watersheds.

About the Survey

To most efficiently detect pollutant trends in California streams, the SPoT program measures contaminant concentrations and toxicity in sediments that accumulate in the lower reaches of large watersheds. In 2008, samples were collected from 92 of the nearly 200 major hydrologic units in California. Sediment samples are collected once per year when streams return to base flow conditions after the high flows that carry

pollutants washed from watershed surfaces during storms. Sediments are monitored because the majority of contaminants entering streams accumulate in sediments, and this environmental compartment integrates pollution signals over time. Each sample is analyzed for industrial compounds, pesticides, and metals, and is tested for toxicity to a resident aquatic crustacean, the amphipod *Hyalella azteca*. Results are compared across watersheds throughout the state, and pollutant concentrations are compared to land use and other human activities.

Findings

A number of spatial patterns were evident in this survey of watersheds from throughout California. Stream sediment concentrations of heavy metals, such as cadmium, copper, lead and zinc, tended to be highest in urbanized Los Angeles and San Francisco Bay area watersheds. Metal concentrations in sediments from San Leandro Creek (SF Bay area), Ballona Creek and San Gabriel River (Los Angeles area) were among the highest in the state. These metals are released to the environment from brake pads, plumbing, industrial and commercial activities. Industrial organic compounds such as PCBs (banned since the 1970s), PBDEs (flame retardants) and PAHs (hydrocarbons) were also generally highest in stream sediments from the Los Angeles and San Francisco Bay areas, though high concentrations were also measured in some more remote locations. In contrast to this urban pattern, mercury concentrations were highest in sediments from watersheds where it is geologically abundant and historically mined, though some urban streams also had relatively high mercury levels. The persistent legacy pesticide DDT was found in stream sediments from most urban and agricultural watersheds, where recent soil disturbance from development and tillage likely mobilizes DDT residues from applications more than 40 years ago. Pyrethroid pesticides are increasing in use in California and were detected in 55% of the samples statewide (51 of 92). The highest pyrethroid concentrations were measured in sediments collected from urban watersheds, plus two agricultural watersheds along the central coast. Approximately one quarter of the sediment samples collected were significantly toxic to amphipods, which are resident crustaceans representative of important aquatic food web links. Of these samples, 6.5% were identified as highly toxic. The highly toxic samples were collected from agricultural watersheds in the Tulare basin and central

coast, in urban areas of southern California, and in the Tijuana River. Other toxic samples were collected from a wide range of watershed types, including those along the north coast, the Tahoe area, and urban and agricultural areas across the state.

On a statewide basis, watersheds with greater than 10% urban land cover had consistently higher sediment pollutant concentrations and toxicity than did watersheds characterized by agricultural or other land cover types. Metals, industrial compounds, DDTs, and pyrethroid pesticides were all found at significantly higher concentrations in urban streams. This pattern is evident at the statewide level, but other local and regional studies have previously shown that pollution levels and toxicity can be strongly related to agricultural and other land uses in specific areas. This is because the “agricultural” land use category used in the SPoT analysis is comprised of many different types of crops and farming practices, and the amount of polluted runoff from these lands varies depending on the types of practices employed.

Pajaro River in central California. Photo courtesy of California Coastal Records Project. Used by permission.Copyright ©2002-2010 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.californiacoastline.org

What's Next?

The SWAMP Team has continued to survey the SPoT program sites once each year to determine how stream pollution is changing over time. As land use changes and management programs work to improve water quality, the SPoT program will provide a valuable indication of the effectiveness of our efforts to protect California streams. The second SPoT report, covering data collected from 2008 to 2010, will be submitted for review later this year.

The SPoT program was developed to inform a number of management initiatives and provide a network linking state, regional, and local monitoring programs. These SPoT surveys provide statewide context and specific data for developing the California Integrated Report. SPoT data on stream pollution are useful for evaluating watersheds in the EPA Measure W program, as well as determining chemicals of concern for total maximum daily load allocations in impaired streams. Stormwater agencies and Regional Water Boards will use SPoT data to determine compliance with water quality regulations, and to evaluate the effectiveness of management practices to improve water quality. SWAMP will continue to integrate its statewide and regional programs so that SPoT chemistry and toxicity data will be assessed in conjunction with ecological data collected at the same sites by the SWAMP Perennial Streams Assessment, the Southern California Stormwater Monitoring Coalition, the Bay Area Stormwater Management Agency Association's Regional Monitoring Coalition and other regional programs. SPoT data on mercury and other bioaccumulating chemicals in streams will help identify sources and transport pathways for chemicals measured in edible fish tissues by SWAMP Bioaccumulation Program surveys of downstream lakes, rivers, and coastal waters.

Urban stream near the southern California coast

Acknowledgments

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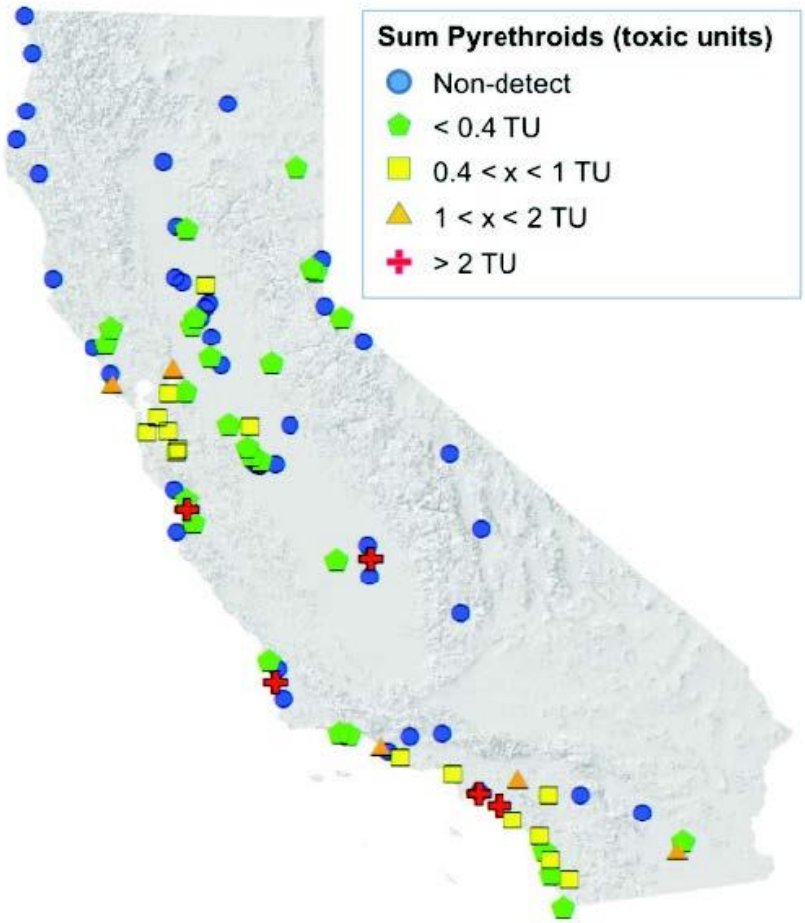

Concentrations of pyrethroid pesticides measured in sediment from streams draining large watersheds throughout California. Each symbol represents concentrations of the 8 different pyrethroid pesticides measured at each site, with the concentrations converted to toxic units and then added together to give an estimate of their cumulative potential impact on aquatic organisms. One toxic unit is equivalent to a concentration lethal to half of the toxicity test organisms, which in this case are amphipods of a genus resident to California waters. Previous studies indicate that pyrethroid concentrations above 0.4 toxic units are associated with adverse impacts to similar organisms in the field.

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