

Factoring Pesticides of Emerging Concern in the TMDL Process

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Most of the arthropod invertebrates used for aquatic toxicity testing are sensitive to insecticides, and account for much of the toxicity in state and regional monitoring programs. Toxicity testing and chemical analyses have led to 303(d) listings and pesticide-related TMDLs in a number of California water bodies. When implementing these TMDLs, detailed plans that include a range of test species are needed to evaluate targeted pesticides and potential alternative pesticides. As the patterns of pesticide use have changed, the test species used in monitoring must evolve to assess risk to aquatic life. For example, TMDLs for the organophosphate chlorpyrifos were developed in four central coast watersheds between 2011 and 2014, but monitoring data from several programs have demonstrated that pesticide usage in these watersheds has already changed to pyrethroids, fipronil (for urban influences) and the neonicotinoid imidacloprid. Organisms such as *Ceriodaphnia dubia* are sensitive to the organophosphate insecticides chlorpyrifos, but are less sensitive to other classes of pesticides. To stay ahead of changing pesticide use, the Department of Pesticide Regulation (DPR) has developed a pesticide prioritization model that incorporates pesticide use as well as chemical properties, monitoring results, and application information at different spatial and temporal scales. Use of this model can inform choice of test species in both ambient and TMDL monitoring. For example, toxicity testing with additional species has been incorporated in the State Water Board's Stream Pollution Trends Program (SPoT). SPoT has added sediment testing with Chironomids to address potential fipronil toxicity. In collaboration with DPR, SPoT will also conduct water column toxicity tests at DPR surface water monitoring locations to determine if water toxicity is caused by current-use pesticides, such as neonicotinoids, or other pesticides of emerging concern. These activities will also inform the design of a statewide urban monitoring framework for pesticides and toxicity as part of SWRCB's Strategy to Optimize Resource Management of Storm Water (STORMS). Successful or meaningful reduction of pesticides in urban and agricultural environments can only be confirmed with up-to-date monitoring tools that include biological measurements and analytical chemistry. This includes the development of next generation bioanalytical tools that have cell lines with neurotoxin receptors. This presentation will discuss examples of changing pesticides, and suggest approaches to provide water quality managers with relevant data to make informed management actions.

Some Supporting Documents:

Anderson, B.S., Phillips, B.M., Voorhees, J.P., Deng, X., Geraci, J., Worcester, K., Tjeerdema, R.S., In Press. Changing patterns in toxicity associated with current use pesticides in agriculture runoff in California. Integrated Environmental Assessment and Management.

Luo, Y., Deng, X., Budd, R., Starner, K., Ensminger, M., 2013. Methodology for Prioritizing Pesticides for Surface Water Monitoring in Agricultural and Urban Areas. Department of Pesticide Regulation. Environmental Monitoring Branch. Sacramento, CA.

(www.google.com/url?q=http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/prioritization_report.pdf&sa=U&ved=0ahUKEwivkZTy0PzTAhWo5lQKHeRpBkcQFggHMAE&client=internal-uds-cse&usg=AFQjCNHiFYZEG_ZSt81mLCxhoLsazIL_5Q)

Maruya, K.A., Dodder, N.G., Mehinto, A.C., Denslow, N.D., Schlenk, D., Snyder, S.A., Weisberg, S.B., 2016. A tiered, integrated biological and chemical monitoring framework for contaminants of emerging concern in aquatic ecosystems. *Integrated Environmental Assessment and Management* 12, 540-547.

Phillips, B.M., Anderson, B.S., Siegler, K., Voorhees, J.P., Tadesse, D., Weber, L., Breuer, R., 2017. Spatial and Temporal Trends in Chemical Contamination and Toxicity Relative to Land Use in California Watersheds: Stream Pollution Trends (SPoT) Monitoring Program. Fourth Report - Seven-Year Trends 2008-2014. California State Water Resources Control Board, Sacramento, CA.

(www.waterboards.ca.gov/water_issues/programs/swamp/docs/workplans/spot_report_and_cover_jan.pdf)