DEPARTMENT OF PESTICIDE REGULATION

AMBIENT MONITORING REPORT

Date: May 8, 2015

1. Study highlights:

- Study Number: 269
- Title: Study 269 (FY2013-2014). Urban Monitoring in Roseville and Folsom, California
- Author Michael Ensminger

- Study area:
  - County: Alameda, Contra Costa, Placer, Sacramento
  - Waterbody/ Watershed: Pleasant Grove Creek, Curry Creek, Dry Creek (Placer); Upper American River, Arcade Creek, Miner's Ravine, (Sacramento); Kirker Creek, Walnut Creek (Contra Costa); South San Ramon Creek (Alameda)

- Land Use Type: ☐ Ag ☒ Urban ☐ Forested ☐ Mixed ☐ Other

- Water body type: ☒ Storm drain outfall ☒ Creek ☐ River ☐ Pond ☐ Lake ☐ Drainage ditch ☐ Other:

- Objectives: 1. Determine the pesticides and their concentrations in runoff from different urban neighborhoods and creeks in the Sacramento and Roseville area; 2. Compare pesticide concentrations to US EPA benchmarks at monitoring sites in northern California; 3. Determine the toxicity to a subset of the of the samples to Hyalella azteca in 96 hour water column testing; 4. Determine potential pyrethroid toxicity of sediments.

- Sampling period: July 1, 2013 – June 30, 2014

- Pesticides monitored:

  2,4-D, benfluralin, bifenthrin, bromacil, carbaryl, chlorpyrifos, cyfluthrin, cypermethrin, deltamethrin/tralomethrin, diazinon, dicamba, diuron, ethalfluralin, fenpropathrin, fenvalerate/esfenvalerate, fipronil, fipronil amide, fipronil desulfinyl, fipronil desulfinyl amide, fipronil sulfide, fipronil sulfone, imidacloprid, lambda-cyhalothrin, malathion, MCPA, norflurazon, oryzalin, oxyfluorfen, pendimethalin, permethrin, prometon, prodiamine, simazine, triclopyr, trufluralin

- Major findings:

  INSECTICIDES. In water samples, bifenthrin was the most frequently detected insecticide (66% detection frequency [DF], second highest in the study). This was slightly lower than in previous years due to monitoring at some additional creeks and rivers that had few detections, sampled only once during the study (early March 2014, a low use period for bifenthrin). Three other pyrethroids were detected less frequently than bifenthrin but still had moderate detection frequencies: permethrin (26% DF), cyfluthrin (21% DF), and lambda-cyhalothrin (21% DF). Of the detected pyrethroids, bifenthrin, lambda-cyhalothrin, and permethrin were always detected at concentrations above their minimum US

EPA benchmark (BM), except for one bifenthrin detection. The reporting limits for these pyrethroids are at (permethrin, lambda-cyhalothrin), or almost at (bifenthrin), their respective BM.

Fipronil and some of its degradates were also frequently detected. Fipronil was detected in slightly more than half of the samples (58% DF), with the two degradates commonly detected (sulfone, 53% DF; desulfinyl, 31% DF). These DFs were several percentage points higher than in previous years. Additionally, the sulfide degradate was also detected in 22% of the samples; this degradate had never been previously detected in DPR's northern California urban monitoring program above trace levels. The increased detections were due to analyses of 13 samples by CDFW (with 10 detections), which have 10-fold lower reporting limits than CDFA. The increased detections indicate how prevalent and widespread fipronil (and degradates) are in urban waters. Most of the fipronil detections (40% DF) and some of the sulfone detections (13%) were above their respective BM. In CDFA analysis, fipronil's reporting limit is higher than the BM, such that trace detections (27% DF) may have also been detected at concentrations above its BM.

Imidacloprid was also frequently detected (31% DF). However, it was only detected once at concentrations above its BM. Imidacloprid has a relatively high BM (1.05 µg/L) although some aquatic organisms are known to be sensitive to imidacloprid at concentrations lower than its BM. Malathion was the only other insecticide detected more than 10% of the time. It was detected in 38% of the samples; half of the malathion detections were above its minimum BM.

HERBICIDES. 2,4-D was the most frequently detected herbicide (77% DF, highest in the study). Three other herbicides with the same mode of action, (dicamba, triclopyr, and MCPA) were also detected (62%, 36%, and 18% DF, respectively). Two other herbicides were highly detected: pendimethalin (62% DF) and diuron (60% DF). Except for one detection of 2,4-D, none of the herbicides were detected above their respective BMs.

TOXICITY. 96 hour water column toxicity was conducted with the organism *Hyalella azteca* at three sites in Roseville in June 2014. Water from the three stormdrain outfall sites had significant toxicity, but the downstream receiving water site was not toxic to *H. azteca*.

SEDIMENTS. Sediments were collected at seven monitoring sites and analyzed for eight pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin/tralomethrin, fenpropathrin, fenvalerate/esfenvalerate, lambda-cyhalothrin, permethrin). Bifenthrin accounted for the largest percentage (77%) of toxicity units (TUs; an indicator of potential toxicity), followed distantly by cypermethrin (13% of the TUs), lambda-cyhalothrin, and cyfluthrin (both 4% of the TUs). All other pyrethroids contributed little to potential toxicity.

2. Pesticide detection frequency

Table 1. Pesticides detected in water. Complete data set in Appendix IV.

Pesticide	Number of samples	Number of detections	Reporting Limit (µg/L)	Detection frequency (%)	Lowest USEPA benchmark (BM) (µg/L)*		Number of BM exceed-ances	BM exceedance frequency (%)
2,4-D	47	36	0.05	77	13.1	VA	1	2
Benfluralin	16	0	0.05	0	1.9	FC	0	0
Bifenthrin	47	31	0.001/ 0.002**	66	0.0013	IC	30	64
Bromacil	12	0	0.05	0	6.8	NA	0	0
Carbaryl	29	0	0.05/ 0.005	0	0.5	IC	0	0
Chlorpyrifos	16	1	0.01	6.3	0.04	IC	1	6
Cyfluthrin	47	10	0.002/ 0.005	21	0.007	IC	3	6
Cypermethrin	47	2	0.005	4	0.069	IC	0	0
Deltamethrin/ Tralomethrin	44	1	0.005	2	0.0041	IC	1	2
Diazinon	16	0	0.01	0	0.11	IA	0	0
Dicamba	34	21	0.05	62	61	NA	0	0
Diuron	25	15	0.05/0.02	60	2.4	NA	0	0
Ethalfluralin	16	0	0.05	0	0.4	FC	0	0
Fenpropathrin	13	0	0.002	0	0.064	IC	0	0
Fenvalerate/ Esfenvalerate	23	0	0.005/ 0.002	0	0.017	IC	0	0
Fipronil	45	26	0.02/ 0.002	58	0.011	IC	14	40
Fipronil amide	45	4	0.03/ 0.008	9	None	IC	0	0
Fipronil desulfinyl	45	14	0.02/ 0.002	31	0.59	FC	0	0
Fipronil desulfinyl amide	45	0	0.03/ 0.004	0	None	IC	0	0
Fipronil sulfide	45	10	0.02/ 0.002	22	0.11	IC	0	0
Fipronil sulfone	45	24	0.03/ 0.002	53	0.037	IC	6	13
Imidacloprid	45	14	0.05	31	1.05	IC	1	2
Lambda-cyhalothrin	47	10	0.002	21	0.002	IC	9	21
Malathion	16	6	0.02	37.5	0.035	IC	3	19
MCPA	34	6	0.05	18	170	VA	0	0
Norflurazon	12	0	0.05	0	9.7	NA	0	0

Table 1 continued.

Pesticide	Number of samples	Number of detections	Reporting Limit (µg/L)	Detection frequency (%)	Lowest USEPA benchmark (BM) (µg/L)*		Number of BM exceed-ances	BM exceedance frequency (%)
Oryzalin	16	2	0.05	12.5	15.4	VA	0	0
Oxyfluorfen	16	0	0.05	0	0.29	NA	0	0
Pendimethalin	29	18	0.05/ 0.005	62	5.2	NA	0	0
Permethrin	47	12	0.002	25.5	0.0014	IC	11	25.5
Prodiamine	16	0	0.05	0	1.5	IC	0	0
Prometon	12	1	0.05	8	98	NA	0	0
Simazine	12	0	0.05	0	36	NA	0	0
Triclopyr	47	17	0.05	36	100	NA	0	0
Trifluralin	16	0	0.05	0	1.14	FC	0	0

*FA, fish acute; FC, fish chronic; IA, invertebrate acute; IC, invertebrate chronic; NA, non-vascular acute; VA, vascular acute
**RL from CDFA and CDFW, respectively (CDFA/CDFW)

Table 2. Pesticides detected in sediment. Complete data set in Appendix IV.

Pesticide	Number of samples	Number of detections	Detection frequency (%)	LC_{50} (µg/g OC)*	Detection frequency of sediments $\geq$ 1 TU*	Median TUs*
Bifenthrin	20	20	100	0.52	100	3.7
Cyfluthrin	20	19	95	1.08	5	0.2
Cypermethrin	20	18	90	0.38	10	0.4
Deltamethrin/Tralomethrin	20	10	50	0.79	0	0.02
Fenpropathrin	20	0	0	None	0	0
Fenvalerate/Esfenvalerate	20	5	25	1.54	0	0
Lambda-cyhalothrin	20	18	90	0.45	0	0.2
Permethrin	20	17	85	10.83	0	0.02

*Sediment Toxicity Units (TUs) are calculated using the formula, use $TU = C/LC_{50} * \% TOC * 10$, where C = concentration (µg/kg dry weight), LC_{50} is derived from accepted published values (from Amweg et al. 2005, Toxicol. Chem. 24:966-972; Amweg and D.P. Weston 2007, Environ. Toxicol. Chem. 26:2389-2396; Maund et al. 2002, Environ. Toxicol. Chem., 21:9-15), % TOC is stated in the sediment results Appendix III, and 10 is a conversion factor. One TU is equal to the LC_{50}. If using other LC_{50} values, list value and reference.

3. Laboratory QC summary

QC Type	Water Samples		Sediment Samples	
	Total Number	**Number of QC out of contro1**	**Total Number**	**Number of QC out of control**
Lab Blanks	172	0	60	0
Matrix Spikes/Duplicates	173	0	62	0
Laboratory Control Spikes/Duplicates	0	0	20	0
Blind Spikes	14	1	0	0
Surrogate Spikes	14	0	35	0
Other QC: Describe	Enter No.	Enter No.		
Other QC: Describe	Enter No.	Enter No.		
Explain out of control QC and interpretation of data:	All lab QC was within control limits except for one blind spike for diazinon (37% recovery). Diazinon is rarely detected in Northern California urban monitoring (1 detection in 115 dry weather samples [in 2009]; the associated data was a dry weather sampling event in August 2013). It was concluded that diazinon was not likely to be detected or likely to be a pesticide of a frequently detected concern. All data was deemed acceptable.			

4. Supporting Information

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Appendix I. Study protocol

Appendix II. Sampling site information and pictures

Appendix III. Water quality data

Appendix IV. Water or sediment monitoring data

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