Urban Pesticide Runoff from Neighborhoods in Northern California and their Contribution to Pesticide Contamination in Urban Creeks

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Introduction

- Study initiated in 2008
  - Previous monitoring by other agencies
  - High urban pesticide use
    - Homeowner use not reported
    - Estimated ~20% total pesticide use
    - High potential for runoff in urban areas
    - Concern, toxicity to aquatic organisms
  - Uniform state-wide program, multi-areas of California
    - Ongoing
Objective 1: What Pesticides are in Surface Water?

R Budd 2011
Objective 2: Stormdrain vs. Receiving Water
Objective 3: Seasonal Differences

Dry Season

Rain Storm Event
Objective 4: Toxic?

EPA Benchmarks: “Comparing...concentration of a pesticide...can be helpful in interpreting monitoring data, and to identify and prioritize sites and pesticides that may require further investigation”

- Euglenozoans
- Green algae
- Diatoms
- Dinoflagellates
- C. dubia
- Hyalella

An aquatic food chain:
- Producers
  - Phytoplankton
- Primary consumers
  - Zooplankton
- Secondary consumers
  - Delta smelt
- Tertiary consumers
  - Killer whale
- An aquatic food chain

- Objective 4: Toxic?
- EPA Benchmarks: "Comparing...concentration of a pesticide...can be helpful in interpreting monitoring data, and to identify and prioritize sites and pesticides that may require further investigation"
Methods
Results – by Main Areas

- Pleasant Grove Creek
- Grayson Creek
- Alamo Creek
San Francisco Bay Area - Grayson Creek -
San Francisco Bay Area - Alamo Creek watershed -
San Francisco Bay Area
- Alamo Creek watershed -

Detection Frequency

- Stormdrain
- Receiving Water

- Bifenthrin
- Carbaryl
- Permethrin
- Fipronil
- Malathion
- Diazinon
- Chlorpyrifos
San Francisco Bay Area
- Alamo Creek watershed -

Detection Frequency

- Stormdrain
- Receiving Water
Sacramento Area
- Pleasant Grove Creek -

Detection Frequency

- Stormdrain
- Receiving Water

Bar chart showing the detection frequency of various pesticides in stormdrain and receiving water samples.
Effect of Rain on Pesticide Runoff

![Box plot showing the number of pesticides detected during the dry season and during a rainstorm.](image)
Comparison to US EPA BMs

Bifenthrin - Stormdrain outfalls

- Bifenthrin
- acute fish (75)
- chronic invert (1.3)

Folsom

Roseville

Bifenthrin Concentration (ng/L)

Time (April 2008 – August 2012 [per section])

RL = 1
Comparison to US EPA BMs

FPs concentration (µg/L)

- FPs
- Invert Chronic (0.011)
- Invert Acute (0.11)
- RL

Time (April 2008 – August 2012 [per section])
Three stormdrain outfalls, Roseville

RL = 0.02

0.01
0.1
1
Conclusions

- Multiple pesticide detections at any given time
  - Median = 4 per sample

- Detections in stormdrain outfalls ~ to receiving waters

- Rain increases the number of pesticides detected
  - Median = 2 vs. 6 pesticides per sample
Conclusions

Regional differences (SFB vs. SAC):
- SAC > fipronil, pyrethroids (bifenthrin, cyfluthrin, cypermethrin, permethrin)
- SAC > dicamba, pendimethalin
- SFB > diuron, triclopyr, OPs

Bifenthrin, fipronil main concern for aquatic tox
Conclusions

- Main detections (> 25% DF):
  - Insecticides: bifenthrin, fipronil, imidacloprid (limited monitoring)
  - Herbicides: 2,4-D, triclopyr, dicamba, diuron, pendimethalin, MCPA