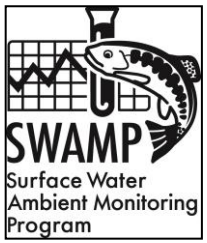
Integrating Measures of Bioassessment, Toxicity, and Pesticides to Evaluate Watershed Health

Stream Pollution Trends Program (SPoT)

Bryn Phillips
UC Davis Department of Environmental Toxicology
Granite Canyon Laboratory



California Department of
Pesticide Regulation

Importance of Surface Water Toxicity Monitoring in California

- Surface water toxicity is pervasive in California.
- Between 2001 and 2010, 50% of sites had at least one toxic water or sediment sample.
- Evidence suggests toxicity to invertebrates is primarily caused by pesticides – chemistry + TIEs.
- A growing number of 303(d) listed water bodies have been listed due to toxicity caused by pesticides.
- Water and sediment toxicity are linked to macroinvertebrate community impacts.

SPoT

1. Statewide program to measure trends in toxicity and contaminants and to link these trends to changes in land use and resource management activity.

2. Monitors 100 watersheds. Sites are located at the base of each watershed.

3. Directed design focusing on sediment contaminants and toxicity to *Hyalella azteca* (added *Chironomus dilutus* in 2015).

4. Trend detection can be accomplished at three scales: statewide, by land use, or individual sites.

5. The statewide network of sites provides context for the findings of local and regional programs.

SPoT's Reach

Stream Pollution Trends Program	
Intensive Site Study with the Department of Pesticide Regulation	Determine the effectiveness of new pyrethroid pesticide label regulations (effective 2012)
Agricultural Surface Water Monitoring with the Department of Pesticide Regulation	Collaboration with Regions 3 and 7 to determine toxicity to alternate species and presence of emerging pesticides
Cyanobacteria CEC Monitoring with CSUMB	Determine presence and potential effects of the cyanotoxin microcystin
Collaboration with Bioassessment Monitoring Programs	Linking SPoT toxicity and chemistry data with bioassessment data to support causal assessments
State and Regional Water Board 303(d) Listings through the Integrated Reporting Process	Water Boards assess water quality monitoring data for California's surface waters to determine if they contain pollutants at levels that exceed protective water quality standards
Agricultural Monitoring for the Region 3 - Cooperative Monitoring Program	SPoT provides data for conditional waiver of waste discharger requirements
Agricultural Monitoring for the Region 5 - Irrigated Lands Regulatory Program	SPoT provides data for the monitoring of agricultural runoff in the Central Valley
Stormwater Monitoring for Region 2 Stormwater Permits	SPoT data provide long-term trends for San Francisco Bay Area municipal stormwater permits
Regions 4, 8 and 9 Stormwater Monitoring Coalition Site Overlap	SPoT sites overlap with several SMC monitoring locations and provide additional data

Projects that support and inform SPoT

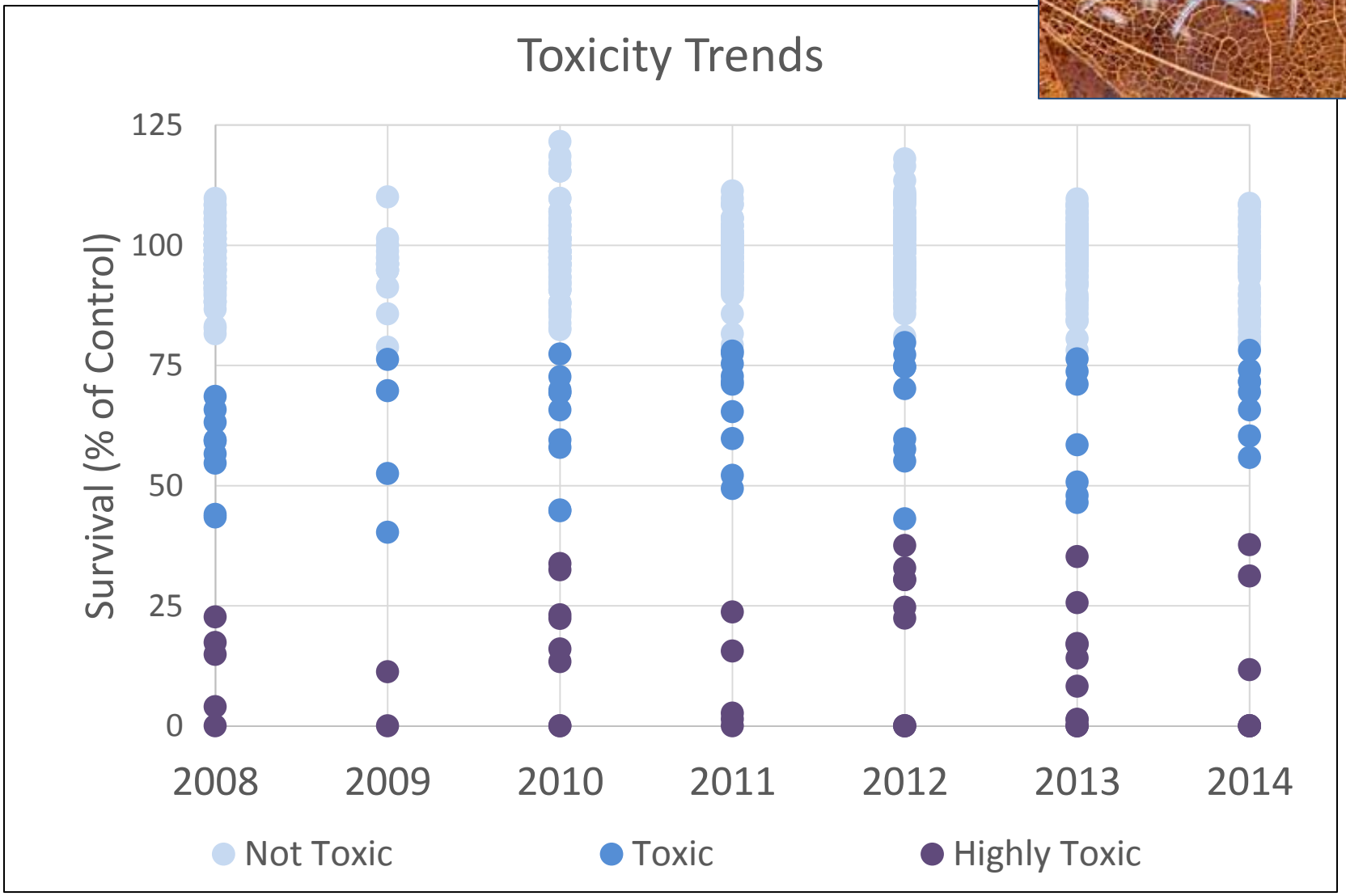
1. SWAMP Regional monitoring at DPR agricultural monitoring stations have provided toxicity and chemistry data on current-use and emerging pesticides.

2. Management practice effectiveness projects demonstrate the treatment of contaminants associated with toxicity.

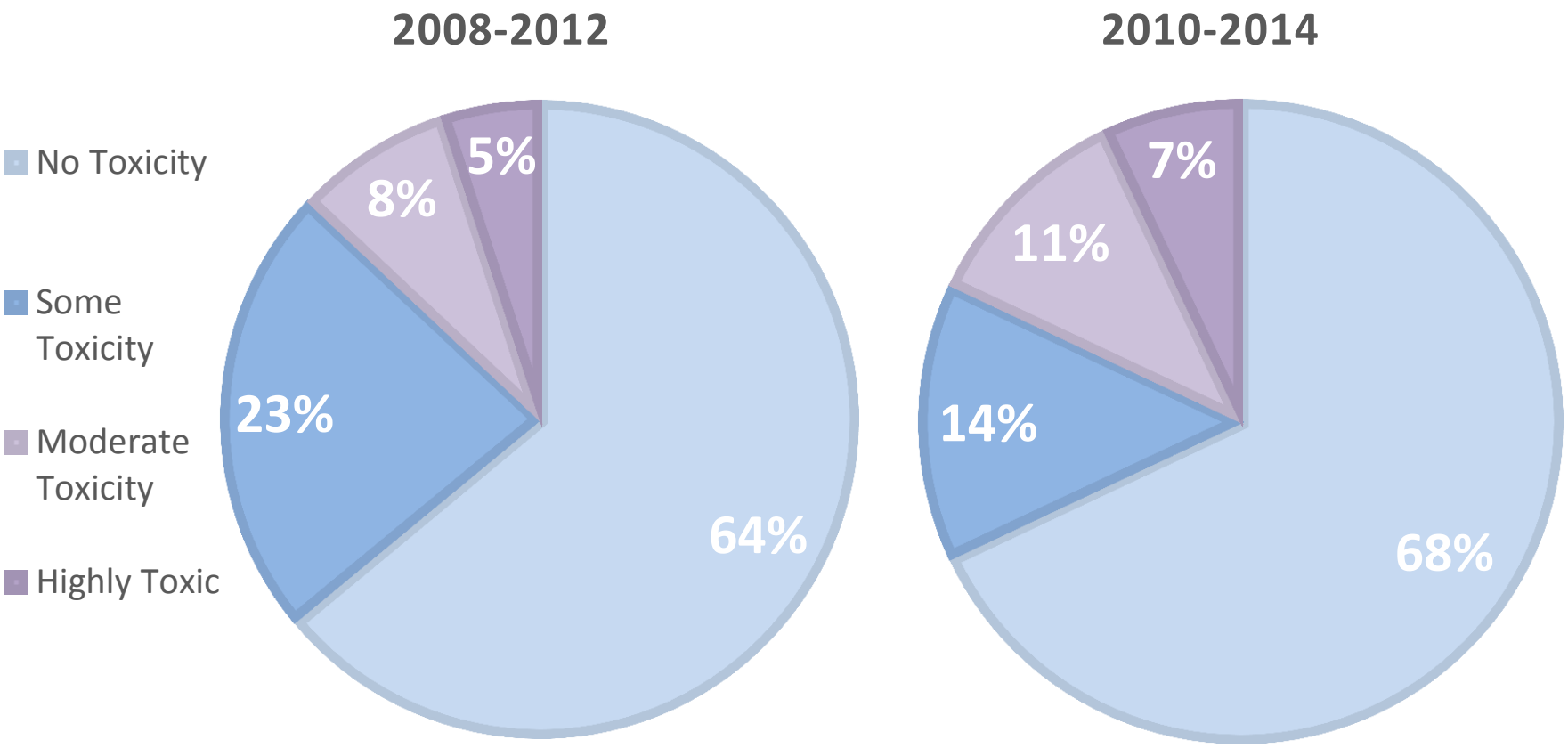
Current SPoT Design

Sites	50 Annually 50 Bi-Annually
Toxicity	*Hyalella azteca* (All Sites), *Chironomus dilutus* (Urban Sites)
Cold Toxicity	*Hyalella azteca* (subset)
Pyrethroids, OPs, OCs, PCBs, PAHs, PBDEs and Metals	All Sites
Fipronil (2013)	Urban Sites
Microcystin (2013)	All Sites

Are beneficial uses impaired?



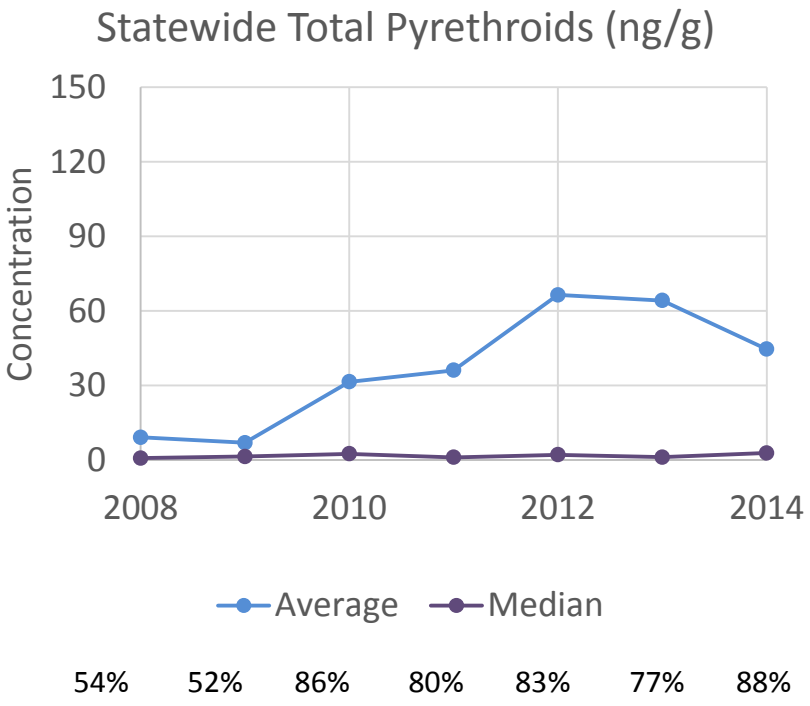
Are conditions getting better or worse?



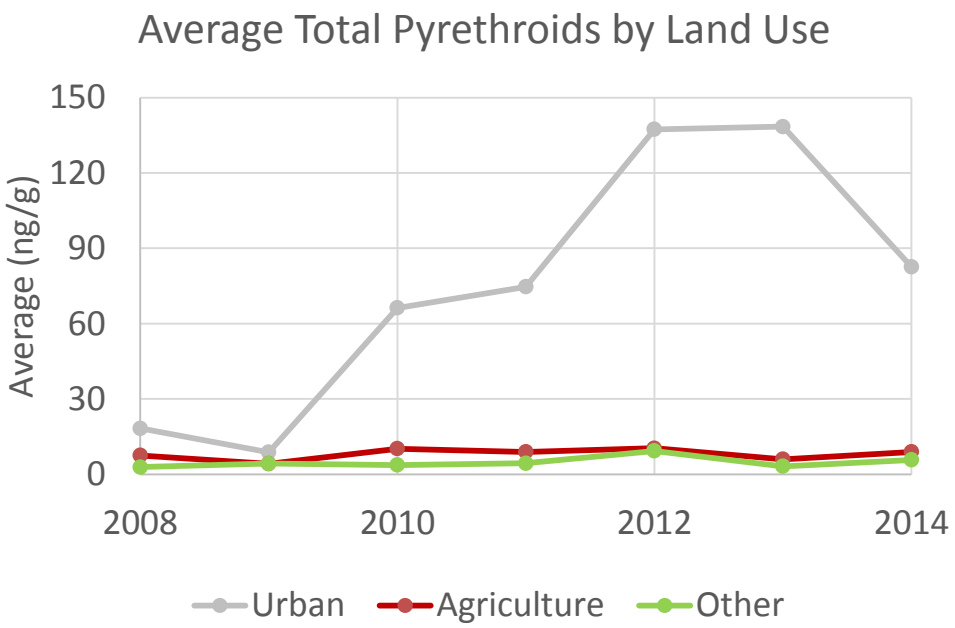
Rolling averages for two periods

Are conditions getting better or worse?

What is the magnitude and extent of any problems?



54% 52% 86% 80% 83% 77% 88%



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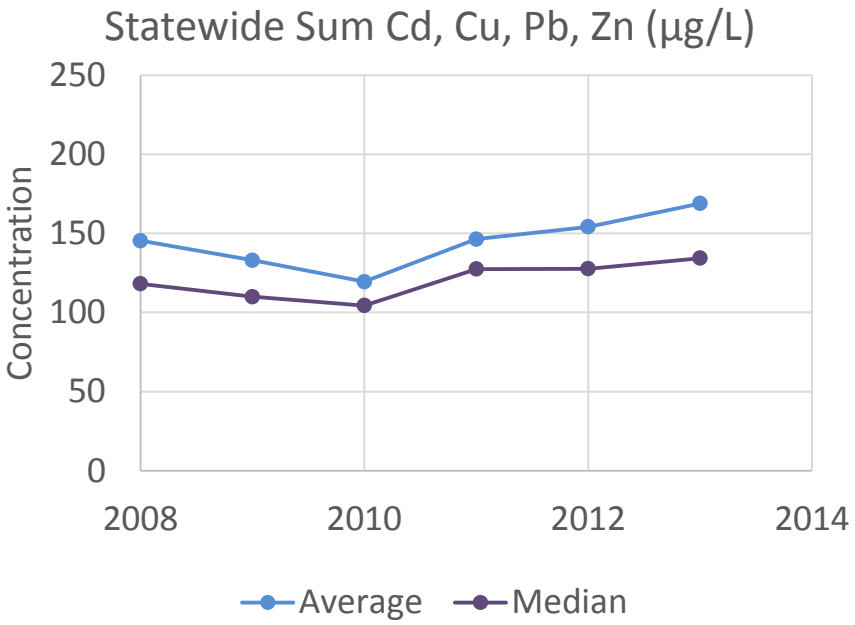

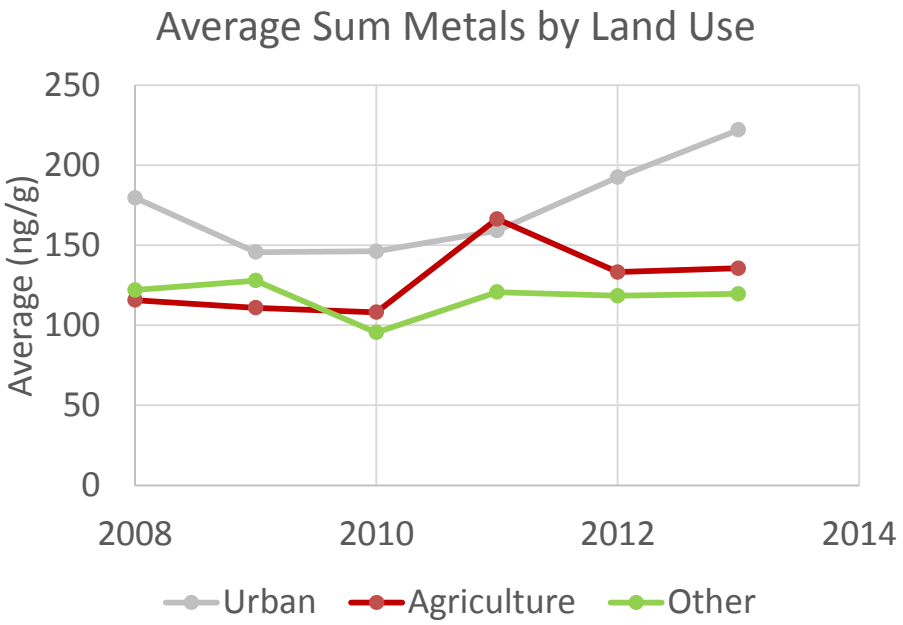

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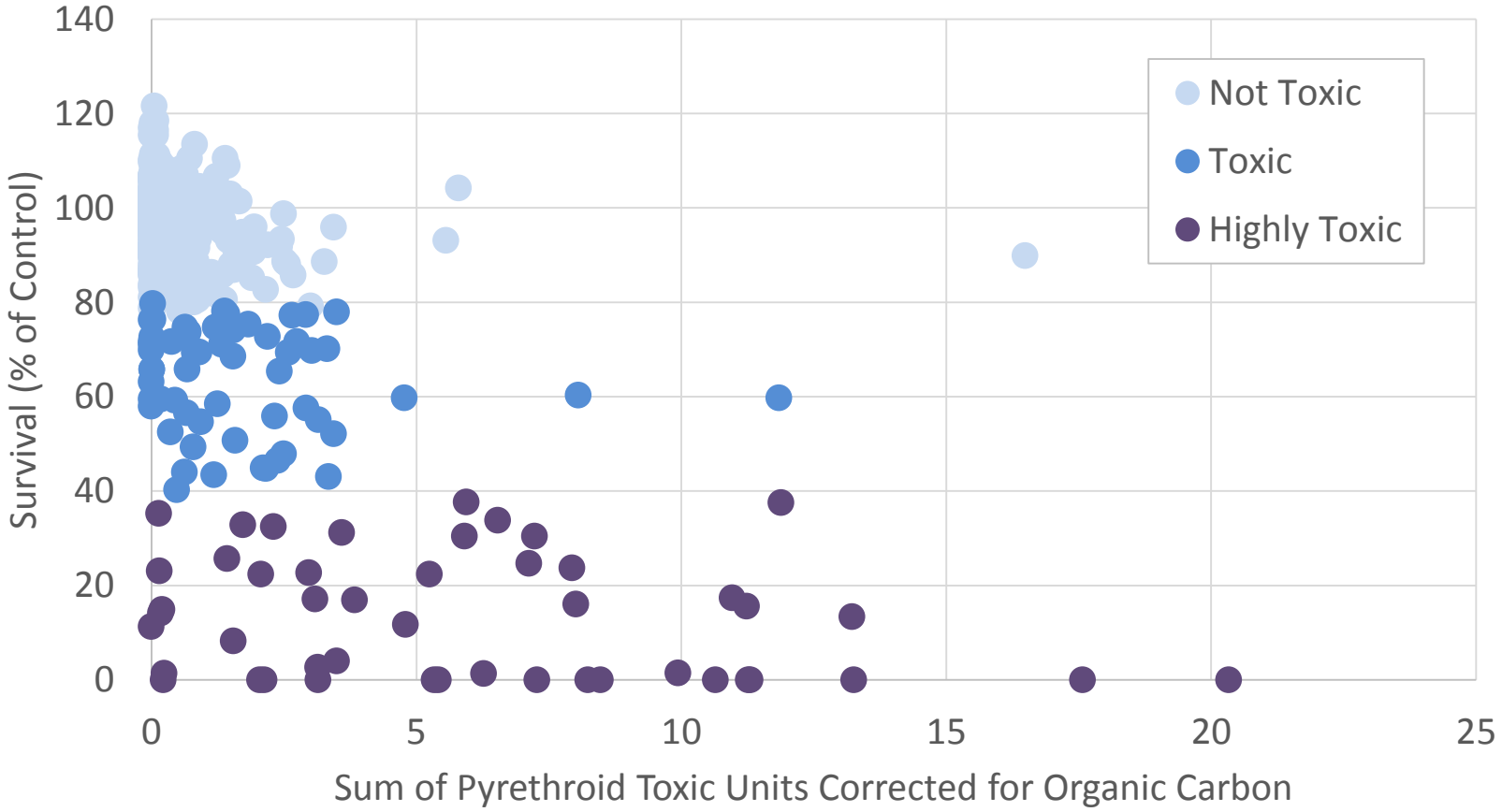
What is the magnitude and extent of any problems?

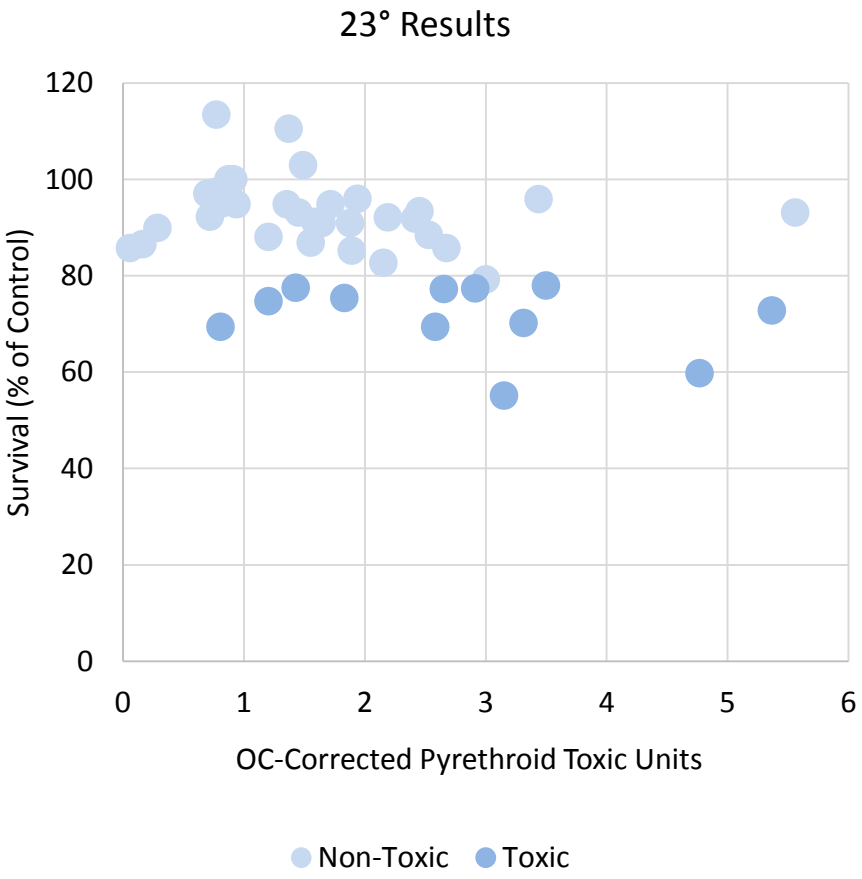
2013-2014 Tier II Fipronil Results	Year	Fipronil	Fipronil Sulfide	Fipronil Sulfone	Fipronil Desulfinyl
% Detection	2013	18	40	60	33
	2014	30	47	77	43
Avg. Concentration	2013	0.536	0.434	2.81	1.29
	2014	1.267	0.641	3.55	3.07
Max Concentration	2013	13.1	6.42	51.0	35.1
	2014	27.4	8.83	58.5	70.7

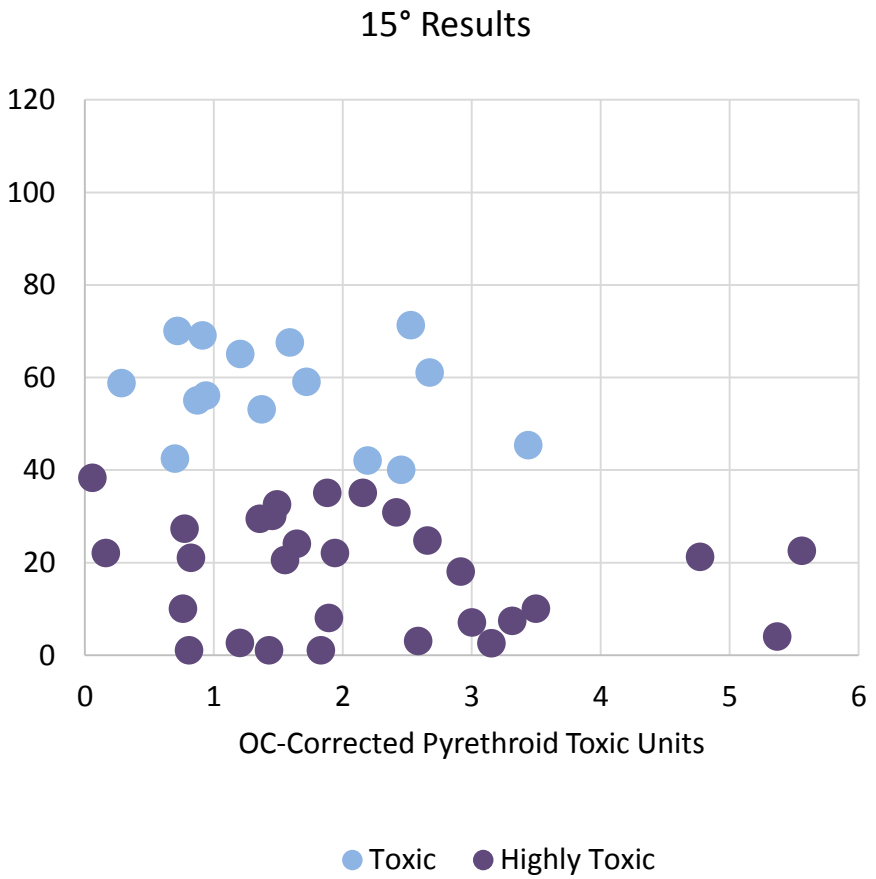
What is causing the problem?



- Toxic unit calculated by dividing the measured concentration by the median lethal concentration (LC50) for *Hyalella azteca*.
- Pesticide LC50s were exceeded in 19% of the samples.

What is causing the problem?





- Comparison of two temperature toxicity results plotted against organic carbon-corrected toxic units.

Collaborations with Department of Pesticide Regulation

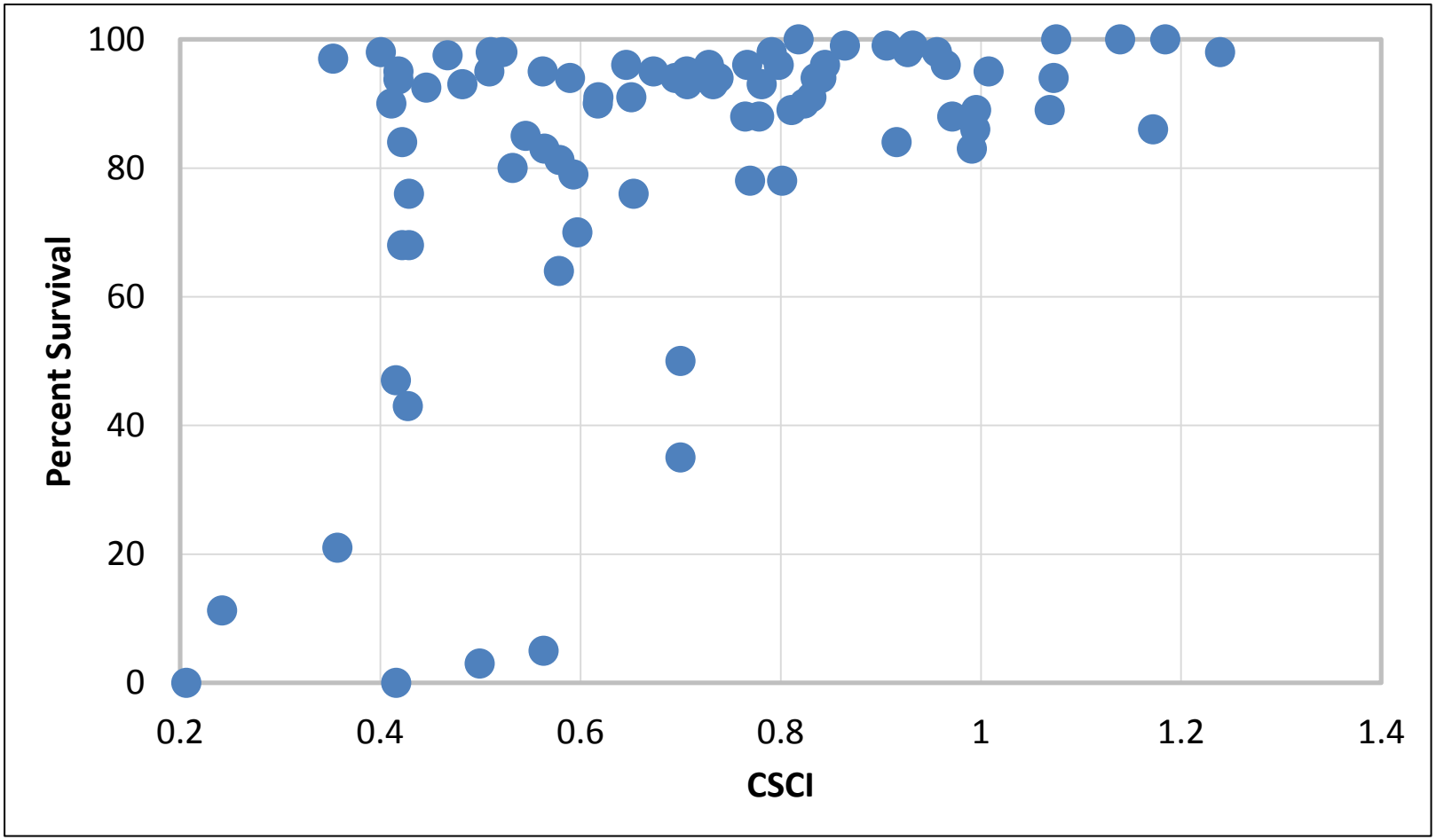
1. Intensive Site Study – Monitoring four stations (2 DPR and 2 SPoT) for significant decreases in concentrations of pyrethroids as a result of new label laws implemented by DPR. New labels went into effect in 2012.
    1. Results so far show no significant decrease in pyrethroid concentrations.
2. Regional Water Board Studies – Conducting toxicity testing with alternative species at DPR surface water monitoring stations (Regions 3 and 7).
    1. Results show significant toxicity at many of DPR's agricultural monitoring stations when tested with *Hyalella azteca* or *Chironomus dilutus*.
    2. Agricultural monitoring in Region 3 through the Cooperative Monitoring Program showed no toxicity when tested with EPA 3-species.
    3. Results led to SWAMP memo on toxicity organism recommendations.

Contaminants of Emerging Concern

1. The Pesticide Treadmill (or Pesticycle) has led us through a number of chemical classes:
    1. Organochlorines (DDT) > Organophosphates (chlorpyrifos) > Pyrethroids (bifenthrin) > Phenylpyrazoles (fipronil) > Neonicotinoids (imidacloprid)
2. Lists of CECs from SFEI and SCCWRP include pyrethroids and fipronil, but detections of imidacloprid are on the rise.
3. Continued collaboration with DPR's Surface Water Monitoring will enable SPoT to stay ahead of the Pesticycle and detect emerging pesticides before significant impacts occur.
    1. Additional funding will enable the SPoT Program to implement a water monitoring component that will screen DPR stations for toxicity to *Hyalella azteca* and *Chironomus dilutus*.
    2. DPR connection will also aid the State Board Stormwater Strategy to Establish Statewide Framework for Urban Pesticide Reduction.

Collaboration with Bioassessment Programs

- Linking laboratory toxicity results and field contamination with impacts to benthic macroinvertebrates will support causal assessments. Ultimately formulate hypotheses to test.



Summary

- SPoT monitors trends in stream pollution by measuring sediment toxicity and chemistry.
- Current SPoT results indicate significant increasing statewide trends pyrethroids, metals and PBDEs.
- Collaborations with DPR have begun to monitor urban pyrethroids, but have also detected water toxicity in DPRs surface water samples.
  - SPoT proposes to expand this study into a statewide water analysis component.
- Collaboration with the Bioassessment Programs should support causal assessment and eventually determine if there are links between contamination and ecological effects.
- Collaboration with Stormwater Programs

Thank you.

Questions?

bmphillips@ucdavis.edu

http://www.waterboards.ca.gov/water_issues/programs/swamp/spot/

www.granitecanyon.org