

California's Surface Water Ambient Monitoring Program

Stream Pollution Trends: Initial Trends in Chemical Contamination, Toxicity and Land Use in California Watersheds



Agenda Item 7
August 20, 2013

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SWRCB/OIMA/SWAMP



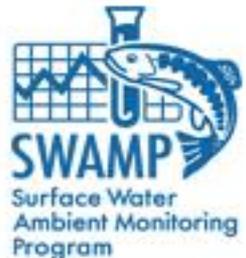
Organization of the Presentation

- Brief background of the project
- Results of three-year monitoring
- Future directions
- Conclusions



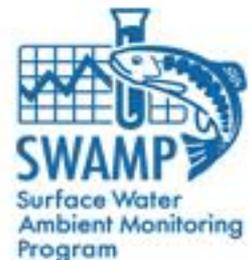
Background

- Stream Pollution Trends (SPoT) Monitoring Program is one of the three important Surface Water Ambient Monitoring Program's (SWAMP) statewide monitoring efforts
- SPoT is a long-term trends monitoring
- Provide information for state, regional, and local programs
- Funding sources are WDPF monitoring surcharge & US EPA
- Sampling started in 2008 & ongoing



Goals

1. Determine long-term trends in stream pollutants concentration and effects at the bottom of large watersheds statewide
2. Relate water quality indicators to land-use characteristics and management efforts
3. Establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, and federal monitoring



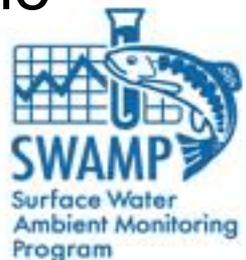
Monitoring Questions

- What are concentrations of pollutants in streams sediments?
- Are sediments in streambeds toxic and what is the magnitude of toxicity?
- What is the contribution of land uses to pollutant concentrations and toxicity in the watershed?
- What is the magnitude of change in pollutant concentrations and toxicity?



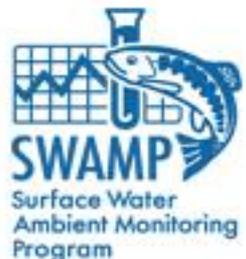
Monitoring Design

- Based on the US Geological Survey's National Water Quality Assessment (NAWQA) integrator site concept
- Integrator sites:
 - Located at the bottom of large watersheds
 - Accumulates pollutants from the upstream watershed
- Sediments collected from these sites provide a composite record of pollutants mobilized from the watershed

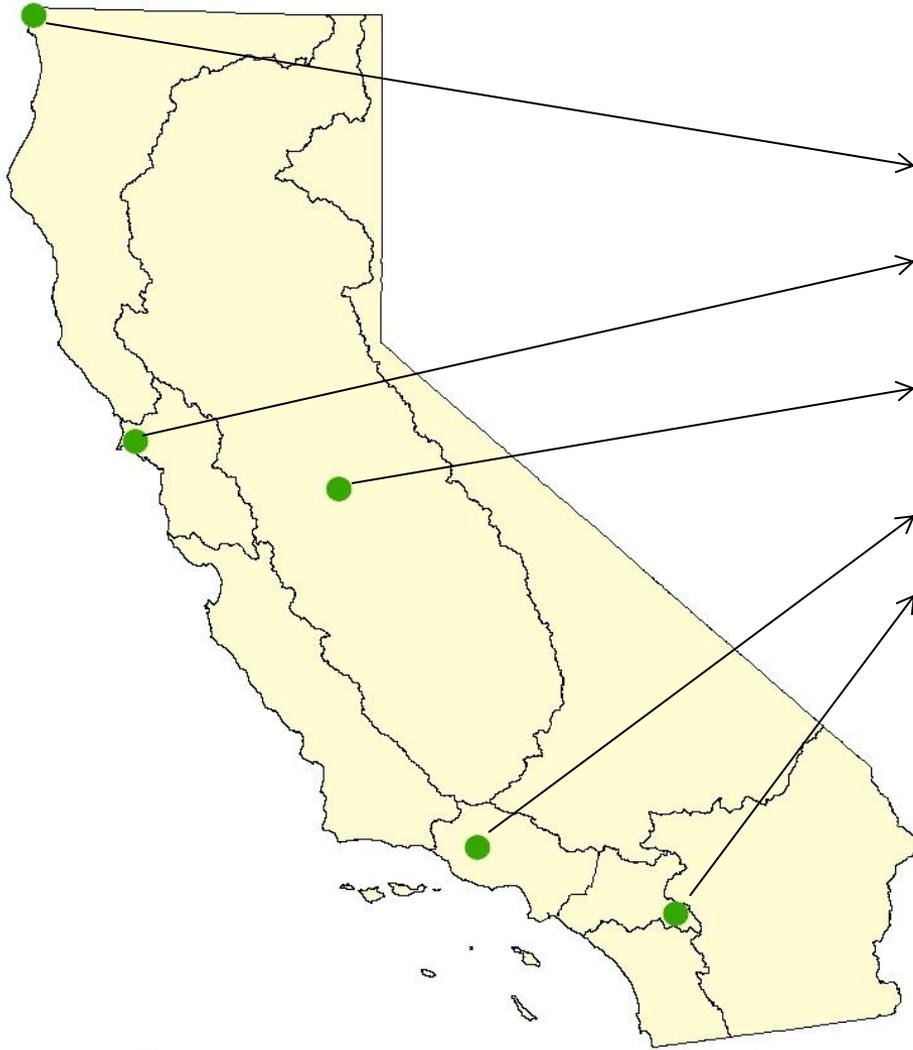


Program Coordination

- Regional Boards SWAMP
- Region 2 Municipal Regional Permit Program
- Region 3 Cooperative Monitoring Program
- Region 5 Irrigated Lands Regulatory Program
- Independent Regional Monitoring Programs
- So Cal Stormwater Monitoring Coalition
- USGS National Water Quality Assessment Program
- Yurok Tribe Environmental Program



Reference Sites



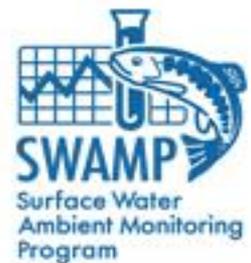
Location

1. Smith River @ Sarina Road
2. Lagunitas Creek @ Coast Guard
3. Tuolumne River @ Old LaGrange Br.
4. Sespe Creek
5. San Jacinto River



SPoT sites

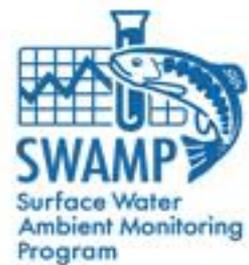
Region	Number of sites			
	2008	2009	2010	2011
1	9	2	8	8
2	10	3	11	11
3	11	3	11	13
4	7	2	8	8
5	31	4	34	34
6	9	1	10	10
7	3	3	2	3
8	5	2	4	4
9	7	3	7	9
Total	92	23	95	100



Legend

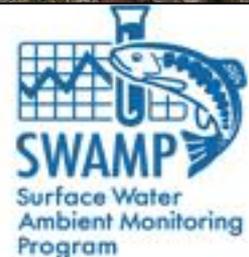
- Reference Sites
- SPoT sites

Land Cover



Indicators & Measurements

- Toxicity – 10-day growth & survival test, the standard amphipod *H. azteca*
- Currently used pesticides
- Legacy pollutants
- Metals



Statistical Analysis

- For determining toxicity, US EPA's test of significant toxicity (TST) was used and then coded

Non-toxic

Some Toxicity

High Toxicity

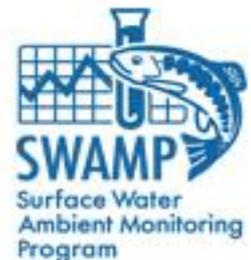
- Pollutants were grouped into classes and summed for analysis (DDTs, PCBs, PBDEs, Pyrethroids and, Metals)



Results

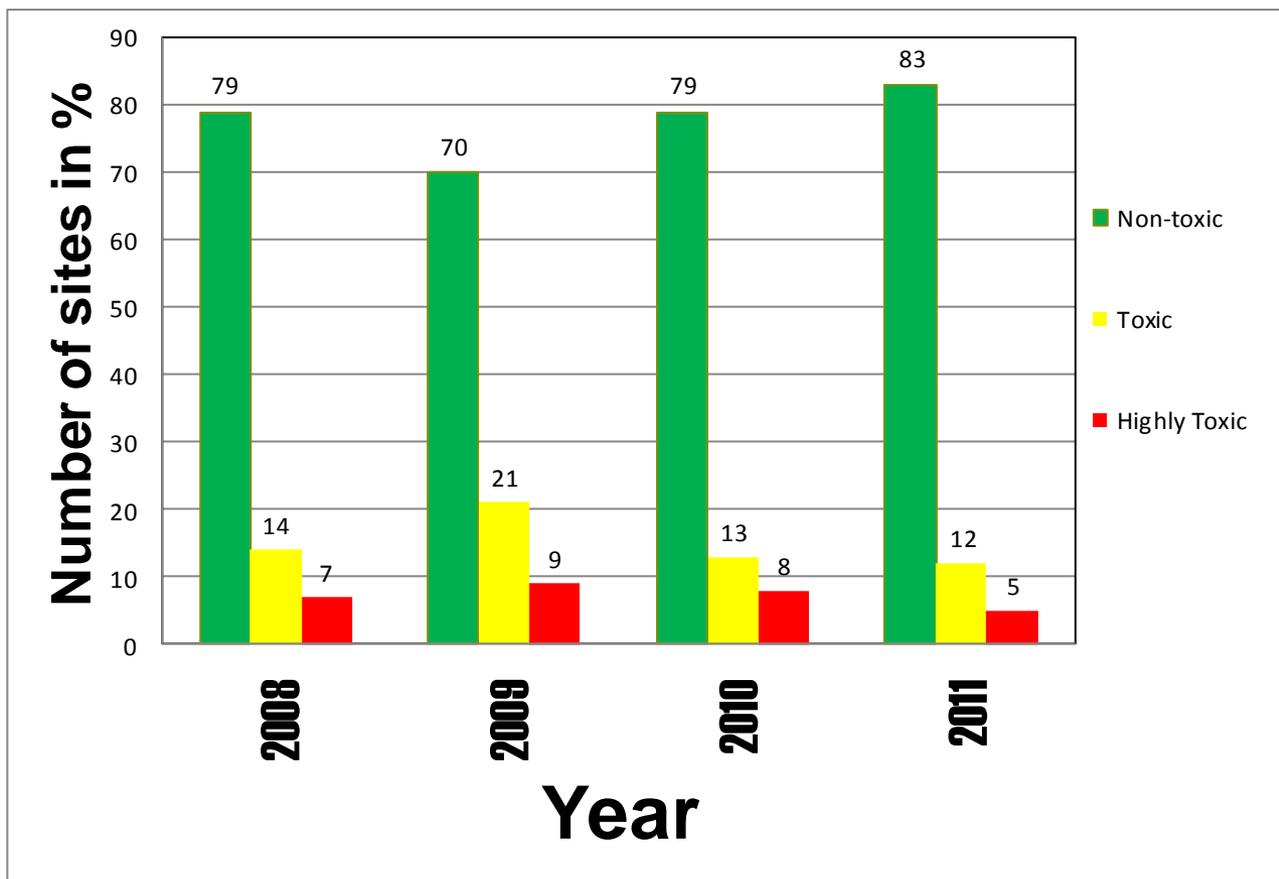
Trends in toxicity in reference sites

Station	Magnitude of toxicity		
	2008	2009	2010
Smith River @ Sarina Road	Green	Green	Yellow
Lagunitas Creek @ Coast Guard	Green	Green	Green
Sespe Creek	Green	No monitoring	Green
Tuolumne River @laGrange Br.	Green	No monitoring	Green
San Jacinto River	Green	Green	Green

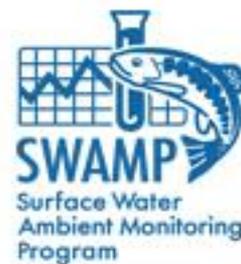
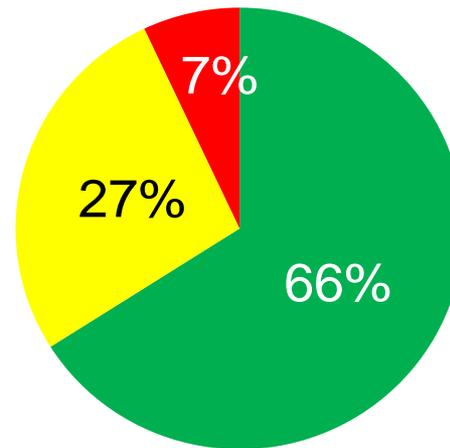
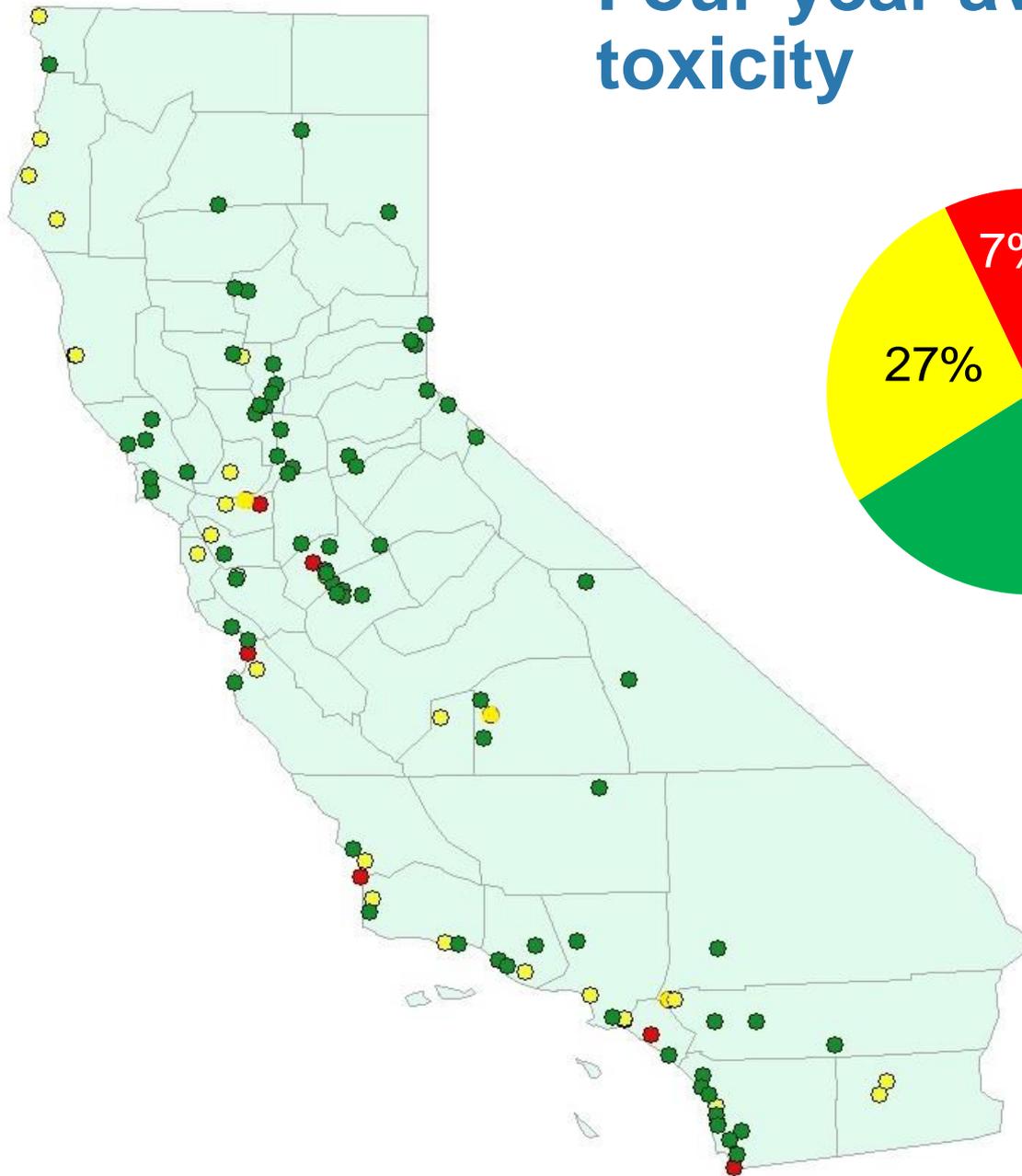


Results

Toxicity Trends in monitoring sites

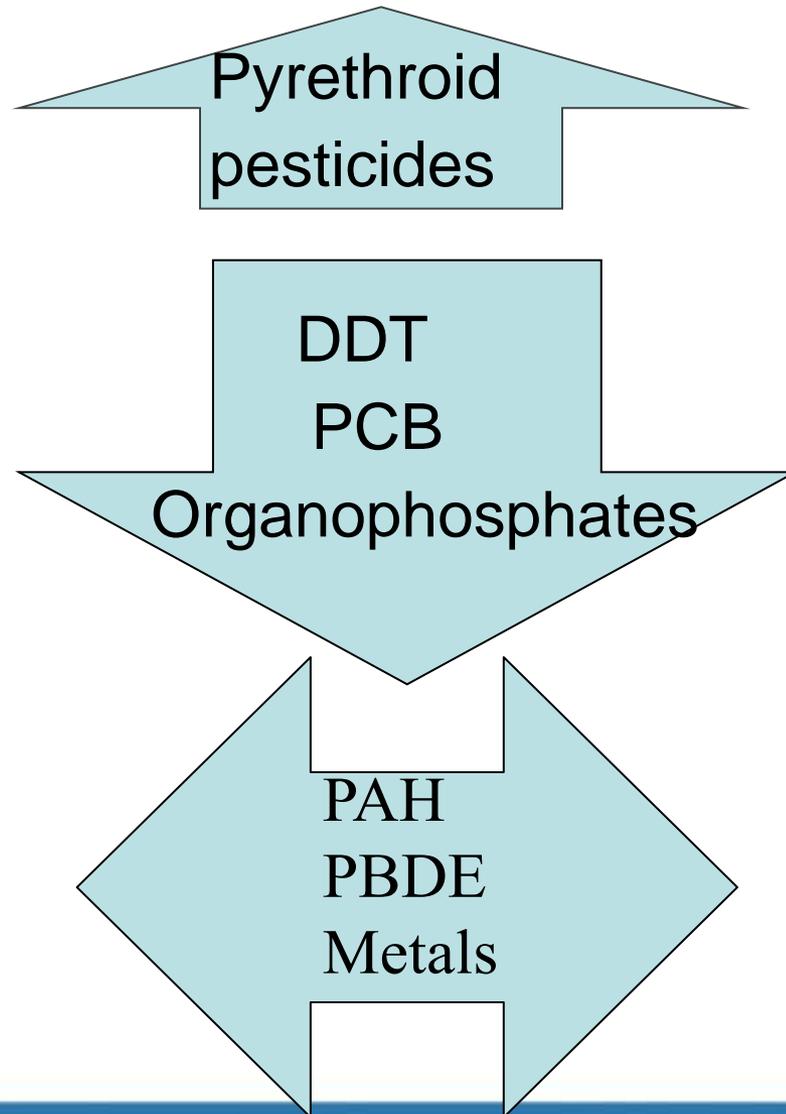


Four-year average toxicity



Results

Trend in Pollutants Concentrations



Correlations of Pollutants Concentrations & Toxicity

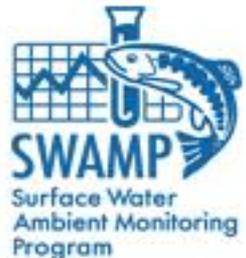
Significant Correlations Between Pollutant Concentrations and Toxicity

Analyte Group	2008	2009	2010
Pyrethroids			
DDT			
PAH			
PBDE			
PCB			
Metals 8			
Metals 8 (<63 µm)			
Metals 4 (Cd, Cu, Pb, and Zn)			
Metals 4 (<63 µm)			

Results

Toxicity Trends by Regional Boards

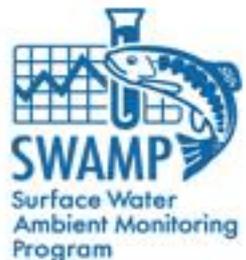
- No toxic or highly toxic sites were found in Region 6
- Toxic sites increased in Regions 1, 4, 5, 7, and 8
- Toxic sites decreased in Region 2
- No change was observed in Regions 3 & 9



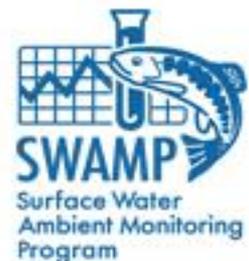
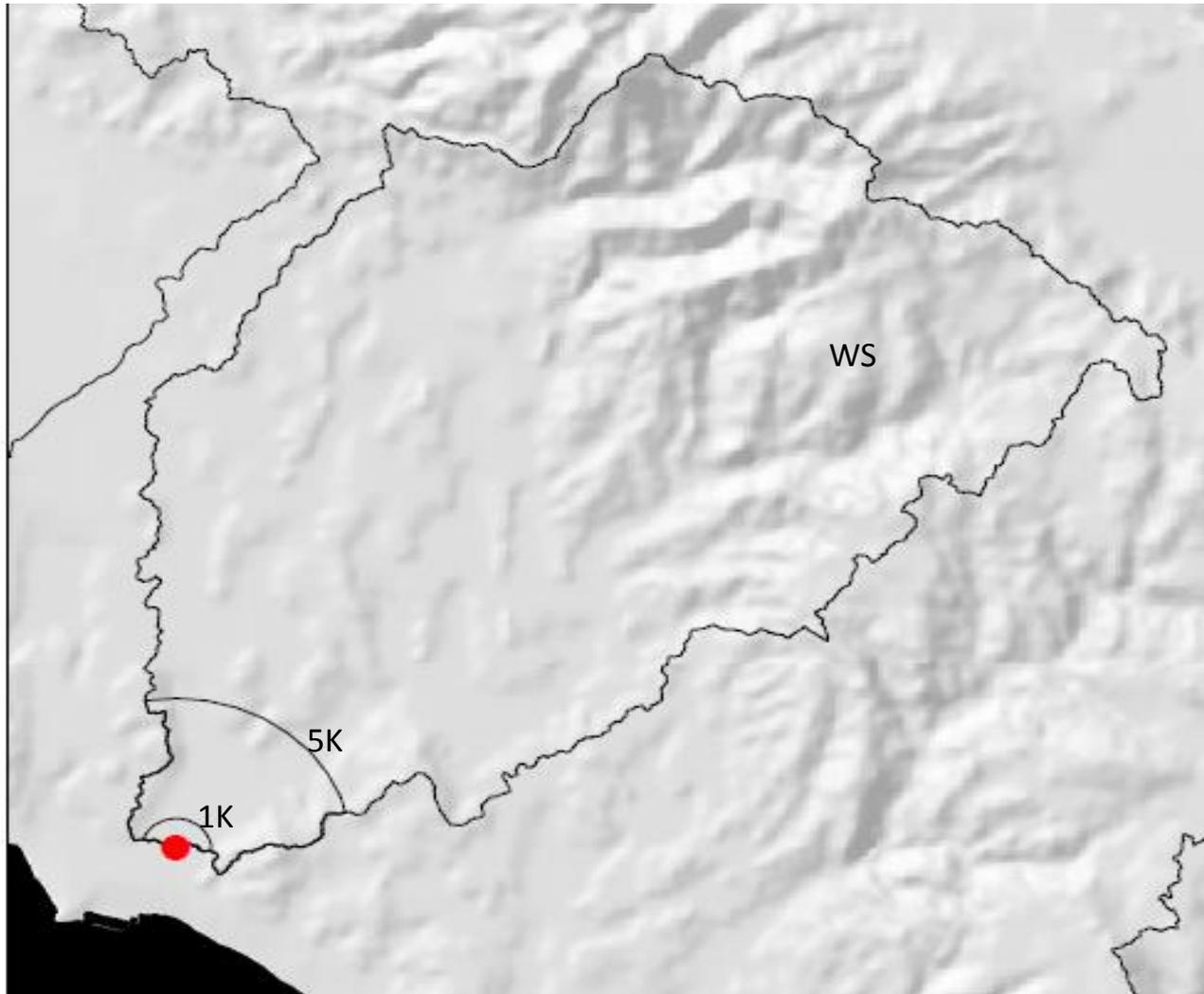
Results

Pollutants Concentration Trends by Regional Boards

- With exceptions of pyrethroids, all other pollutant groups decreased in concentrations in all Regions
- In 2010, PCBs were not even detected in Regions 1, 3, 5, 6, and 7 and DDT was not detected in Regions 1 and 6
- Pyrethroid concentrations increased in Regions 4, 5, 6, 7, 8, and 9
 - remained almost the same in Region 2
 - decreased in Regions 1 and 3

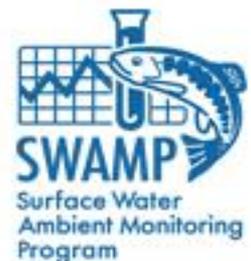


Watershed delineation @ 1km, 5km and watershed scale



Land Use Classification

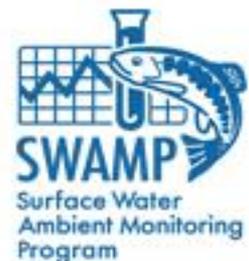
- Urban = >10% urban cover
- Agriculture = >10% cultivated crop cover
- Other



Results

Land Use in % at three scales

SPoT	Urban			Agriculture		
	1K	5K	WS	1K	5K	WS
2008	28	23	10	23	26	8
2010	29	23	9	23	27	8

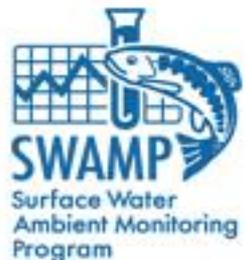
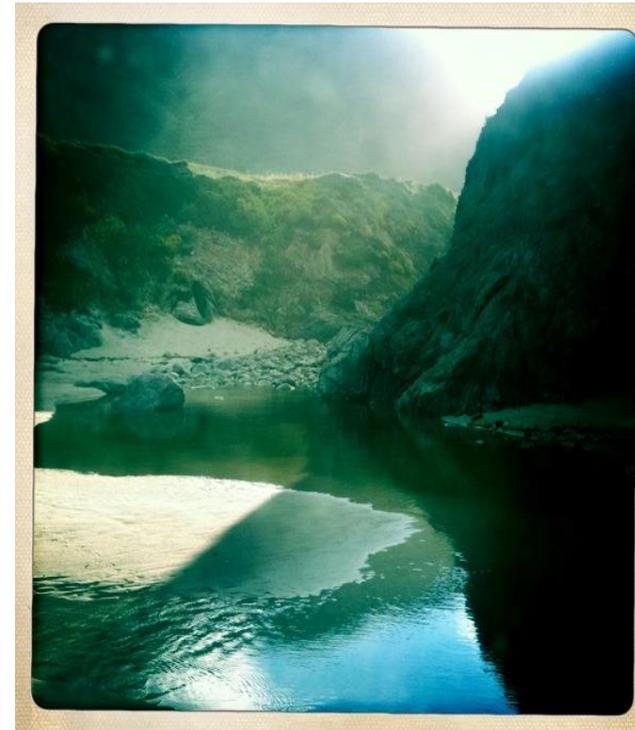


Correlations of Toxicity to Land Uses

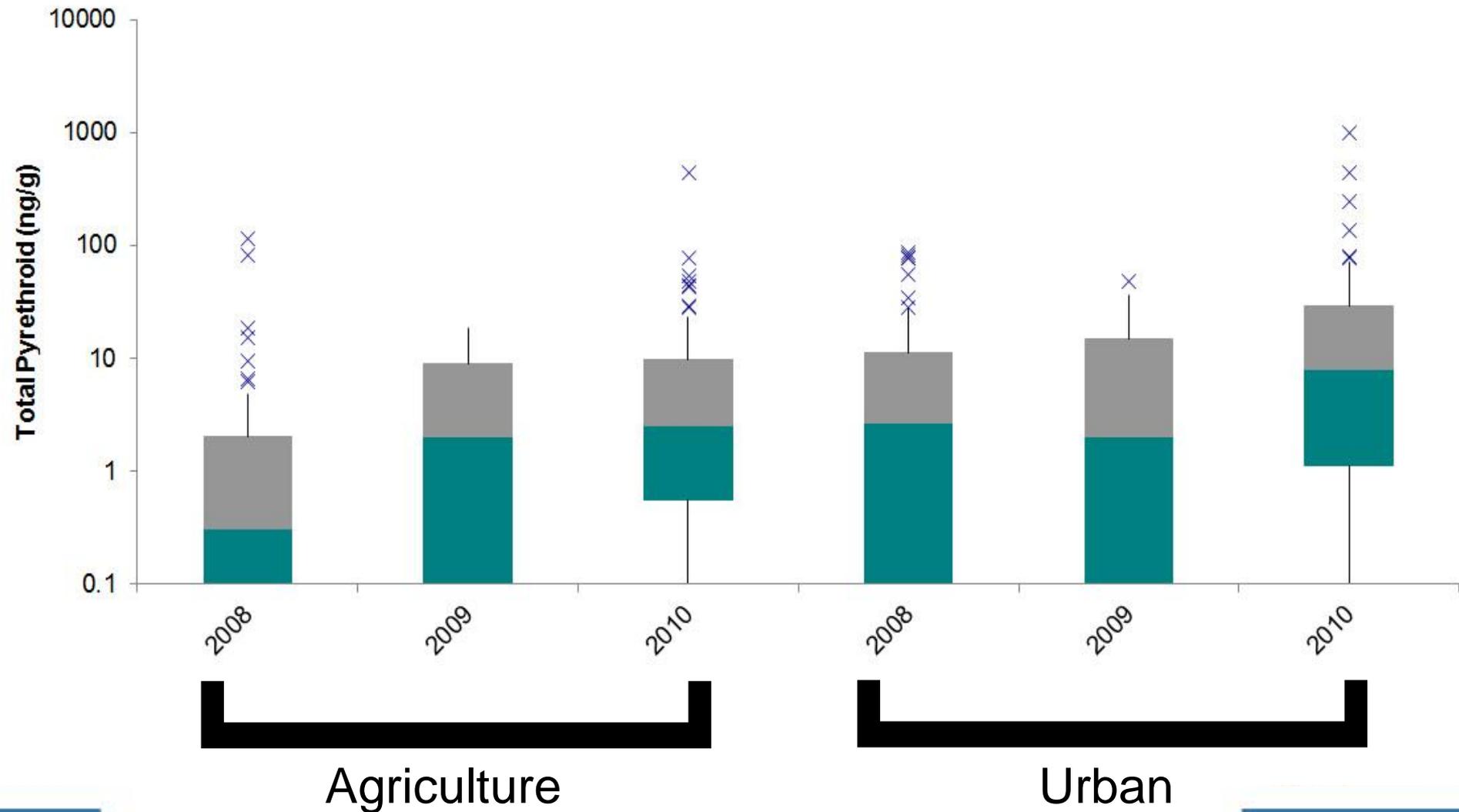
Land Use	Scale	Correlation of Toxicity to Land Use		
		2008	2009	2010
Urban	1k	Green	White	Green
	5k	Green	White	Green
	Watershed	White	White	Green
Agriculture/ crop land	1k	White	White	Green
	5k	White	White	Green
	Watershed	Green	White	Green

Correlations of Pollutants Concentration to Land Use

- In all three years, pollutants were highly correlated to urban land use.
- DDT was highly correlated with agricultural land use at all three scales in 2010.
- Metals were correlated to urban land use at all scales in all three years



Pyrethroid trends related to land use (1k scale)



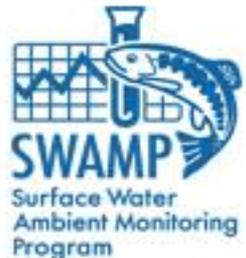
Future Direction

- Review the analyte list, add new emerging pollutants
- Pollutants with decreasing trends will be monitored every two years
- Continue working closely with other programs to integrate data



Conclusion

- SPoT is a foundation for long-term monitoring in the State
 - Relates chemistry, toxicity and land use
 - Answers key management questions
- The ability of the program to detect trends and the results of management activities will only be realized when sampling is done for longer period of time with an adequate number of samples
 - monitor > 90 sites annually
 - over ~10-year period



Acknowledgment

Researchers

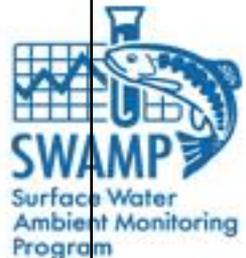
- Brian Anderson, UCD
- Bryn Phillips, UCD
- Katie Siegler, UCD
- Jennifer Voorhees, UCD

Science Advisory Committee

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- Dr. Lester McKee, SFEI

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- Karen Worcester (R3)
- Michael Lyons (R4)
- Alisha Wenzel (R5)
- Tom Suk (R6)
- Jeff Geraci (R7)
- Hope Smythe (R8)
- Lilian Busse (R9)
- Lori Webber (SB)
- Rich Breuer (SB)
- Karen Larsen (SB)





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

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