Current-Use Pesticides in the Low Salinity Zone

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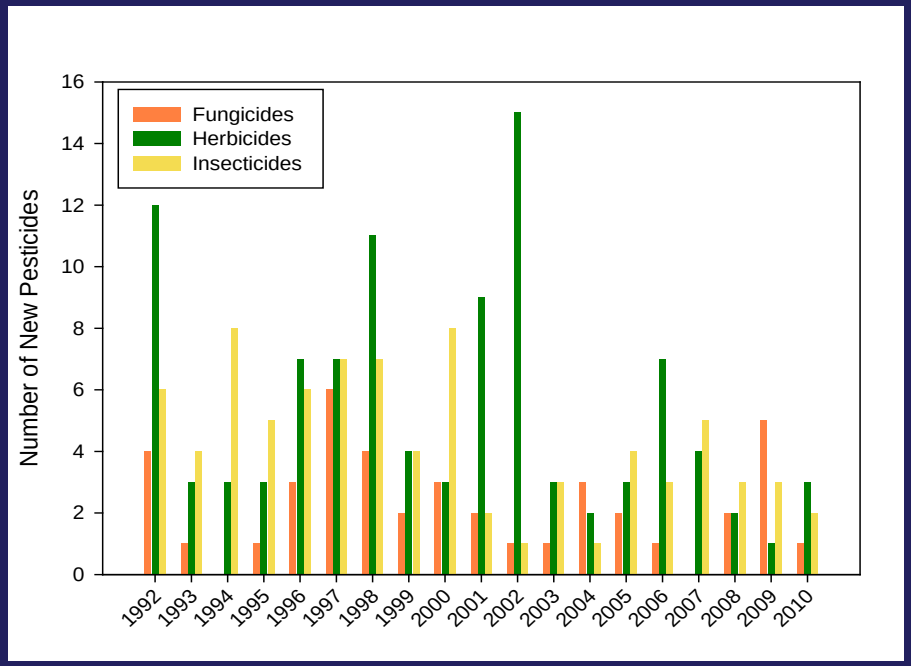
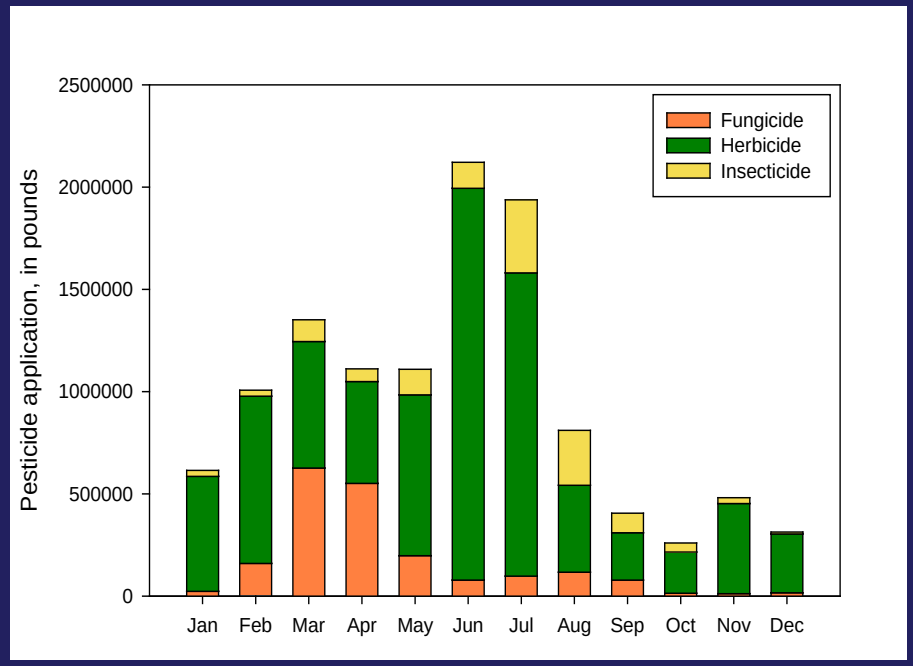
Changing Pesticide Use

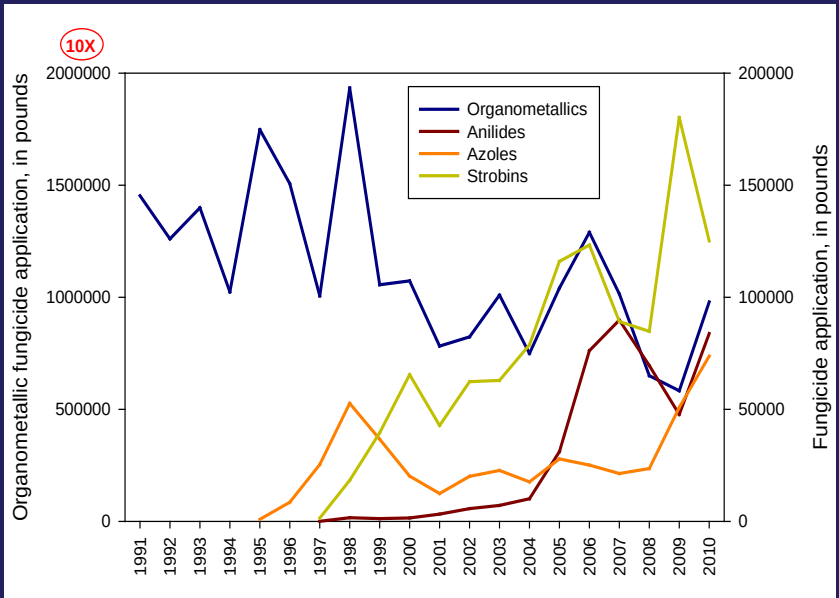




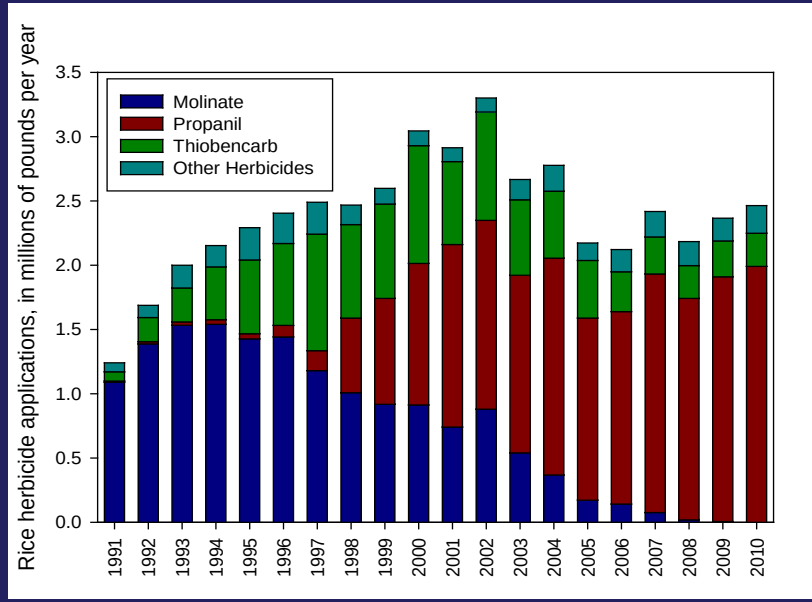
- Since 2000 an average of 12 new pesticide active ingredients have been introduced per year in Estuary watershed
- The types and amounts of pesticides applied varies throughout the year and year to year

Changing Pesticide Use

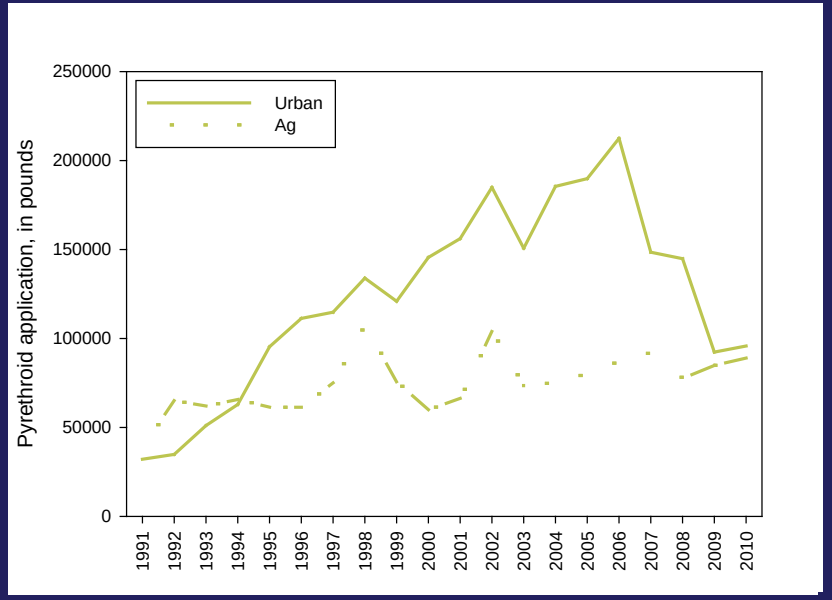
Fungicides



Herbicides



Insecticides



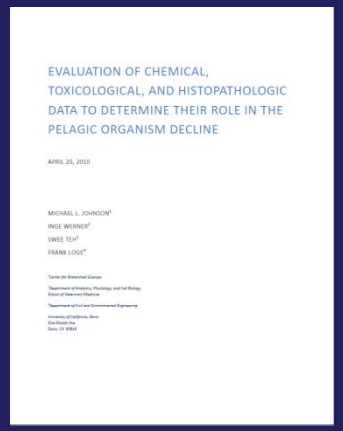
Summary Reports

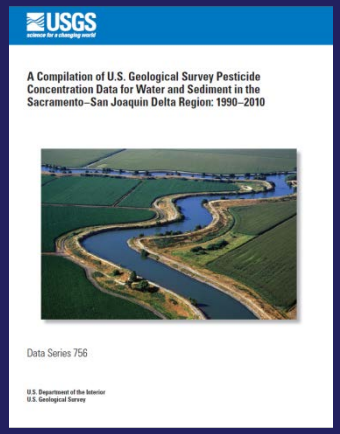
"…163 pesticides applied (> 500 kg) in 2007 and over half have never been monitored in the watershed"

(Kuivila and Hladik, 2008)

"…there were few chemicals with sufficient data available to draw conclusion about the role of contaminants in the POD".

(Johnson and others, 2010)



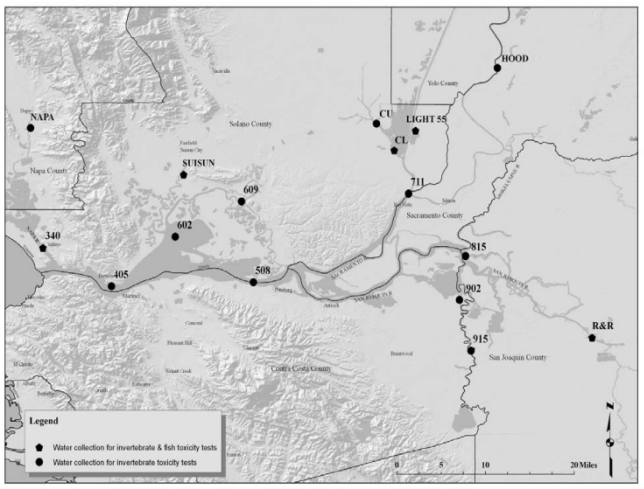


Significant data gaps….. few samples within the Delta proper…..the numbers of samples collected in recent years has declined substantially….lack of sediment data

(Orlando, 2012)

2007-09 POD Water Quality/Toxicity Testing

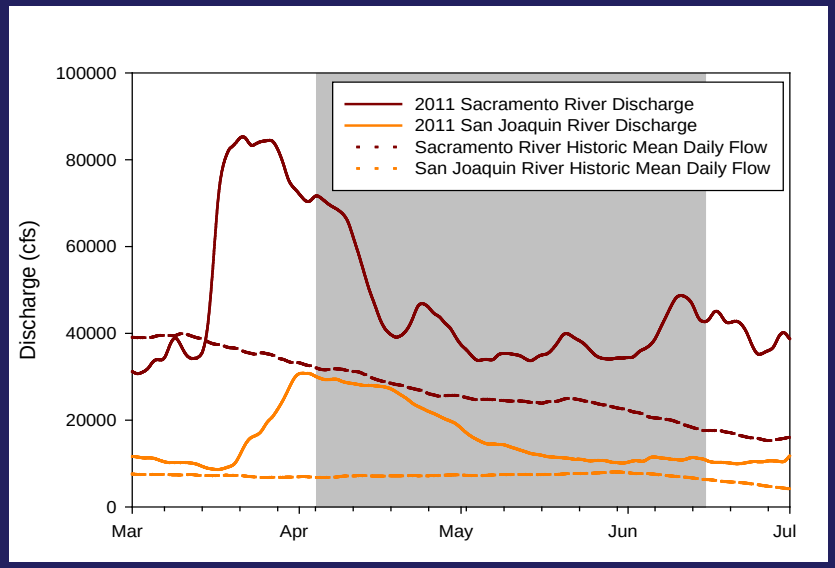
- Bi-weekly water samples for toxicity with subset analyzed for pesticides
- Acute or chronic toxicity observed in some samples
- Pyrethroid insecticides likely the cause

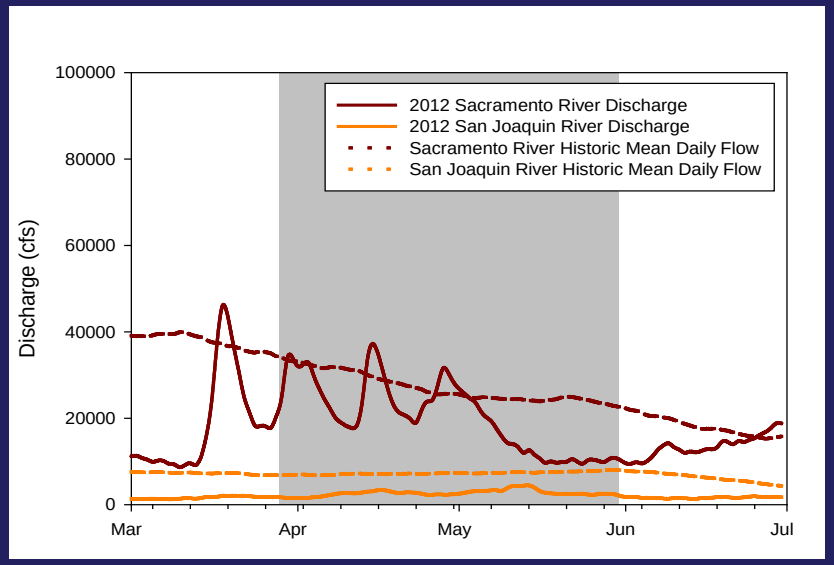


- Some effects observed with pyrethroids below detection limits
- Other pesticides detected as well
- Most samples contained multiple pesticides

2011-2012 Suisun Bay Study

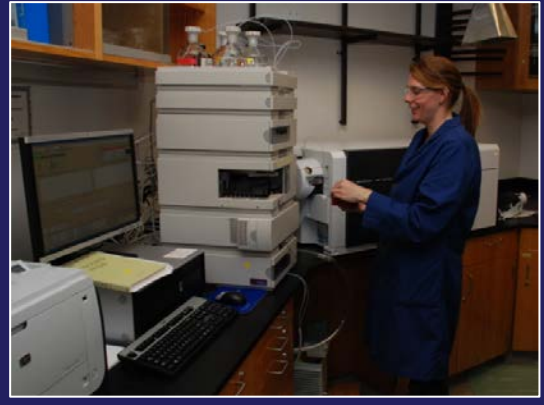
- Collaborative study with biologists and toxicologists researching phytoplankton occurrence inhibition
- Sampled in Spring 2011 and 2012
- 2011 was wet with above average streamflow
- 2012 was dry with below normal streamflow





Suisun Bay Phytoplankton Study 2011-2012

Water Analysis Methods



SPE: Filtered 1 L samples using Oasis HLB cartridges

GC/MS

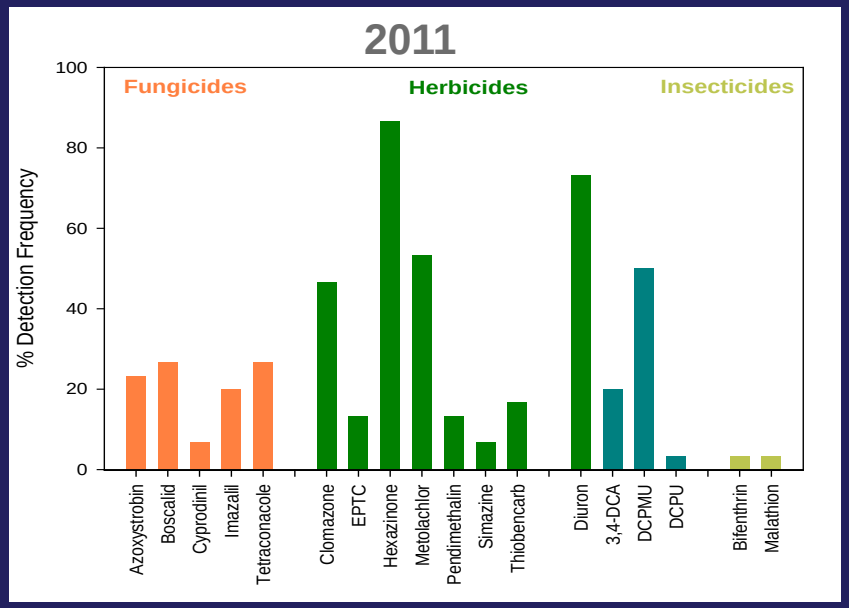
- 90 pesticides and degradates
- Including 34 fungicides
- Newer rice pesticides
- MDLs 0.9 - 10.5 ng/L

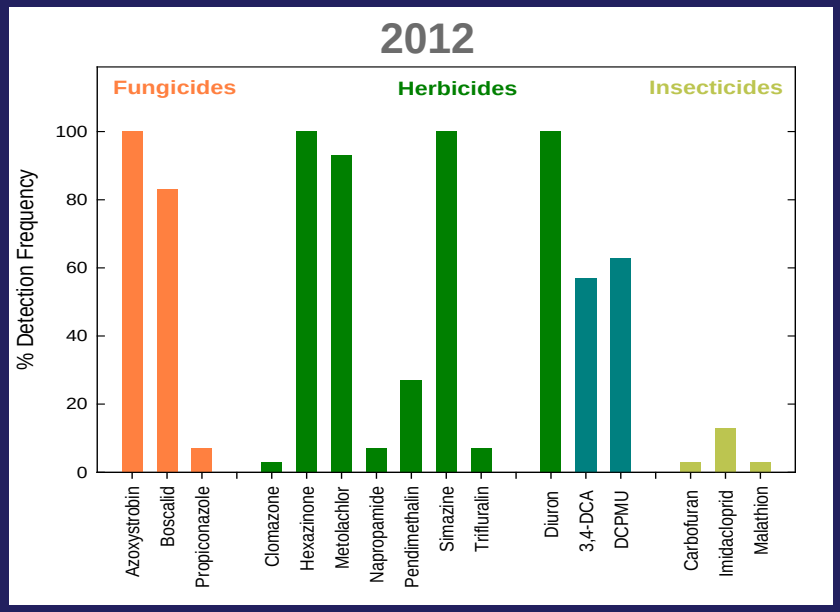
LC/MS/MS

- 10 pesticides and degradates
- Diuron and 3 degradates
- Neonicotinoid insecticides
- MDLs 3.0 – 6.2 ng/L

2011-2012 Suisun Bay Study

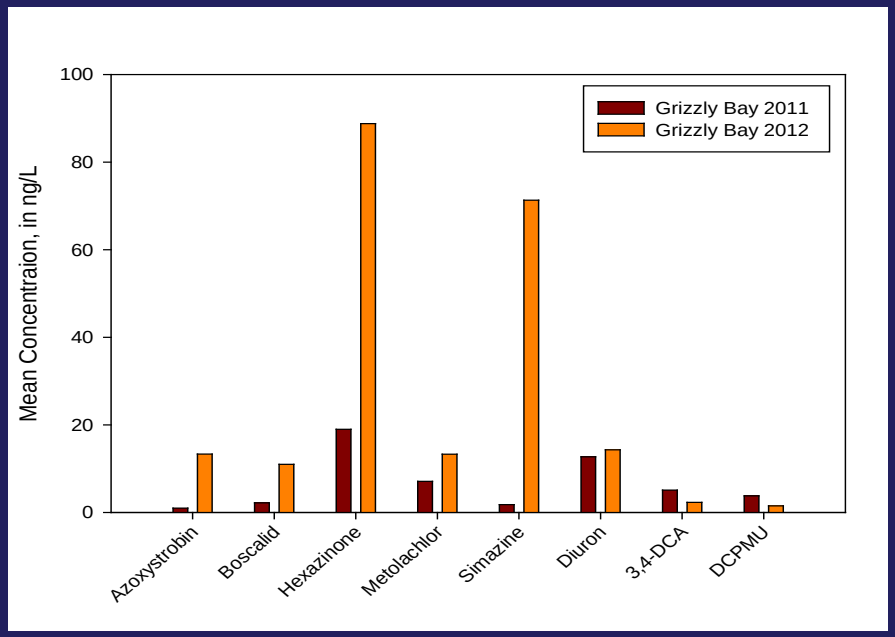
- Overall, detected 23 pesticides/degradates
- Similar pesticides detected in both 2011 and 2012
- Detection frequencies were higher in 2012 with at least 6 pesticides detected in every sample
- Insecticides rarely detected

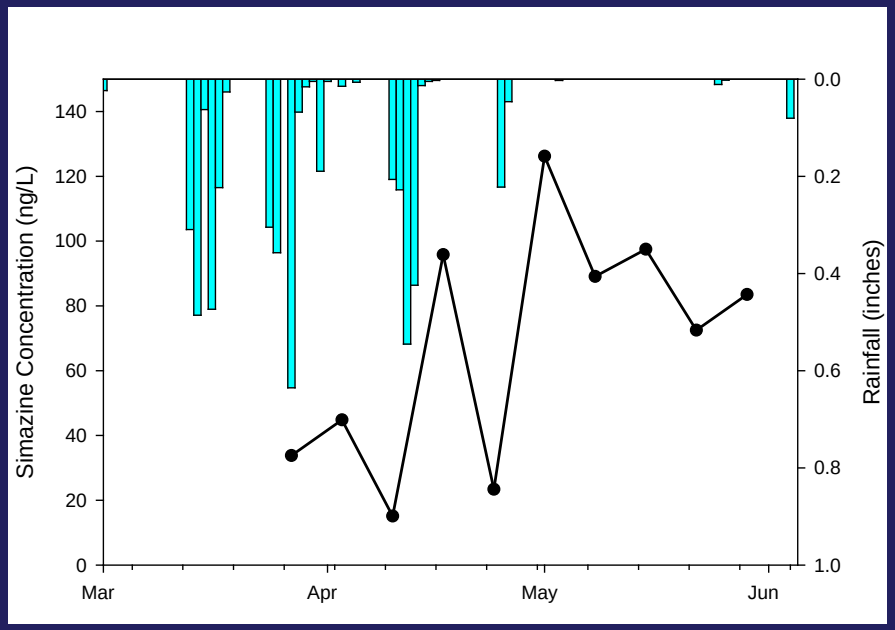




2011-2012 Suisun Bay Study

- Concentrations were generally higher in 2012
- Concentrations increased following rainfall in 2012
- Concentrations were below established aquatic-life benchmarks



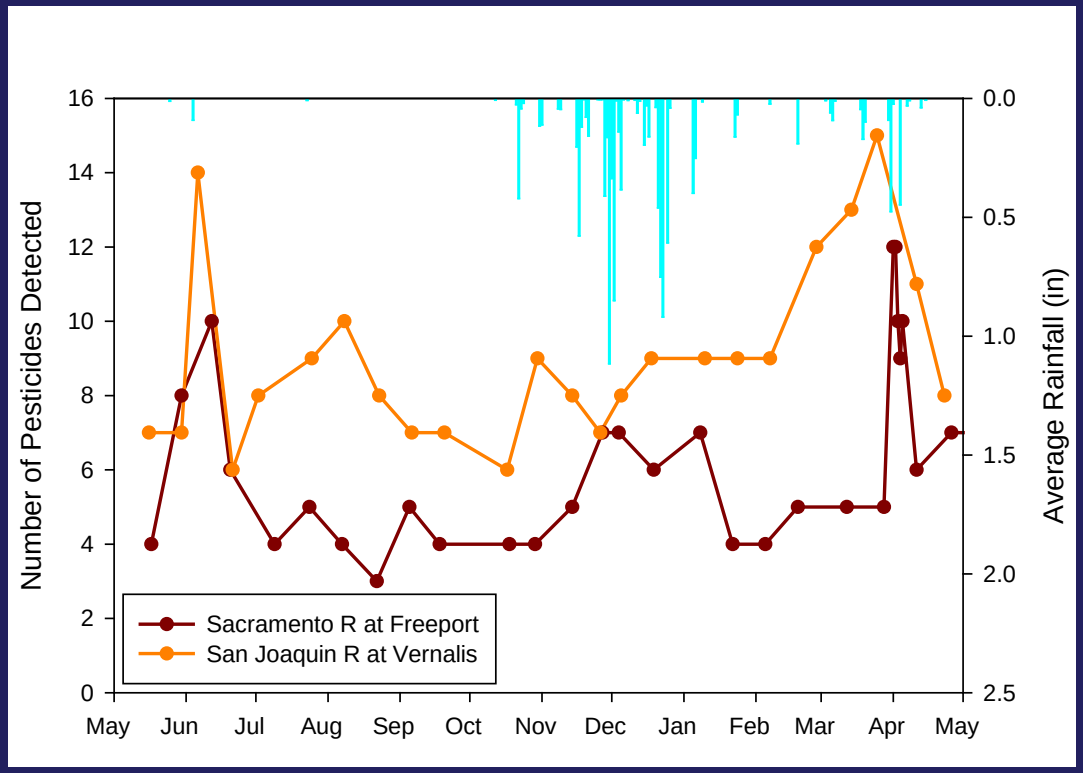


Freeport & Vernalis 2012-13

- Twice monthly sampling of major freshwater inputs to Delta
- Update of early 90's study with current analytical methods
- Detected 34 pesticides/degradates (17 herbicides, 11 fungicides, 6 insecticides)

Detecting Mixtures

- Multiple pesticides detected in every sample

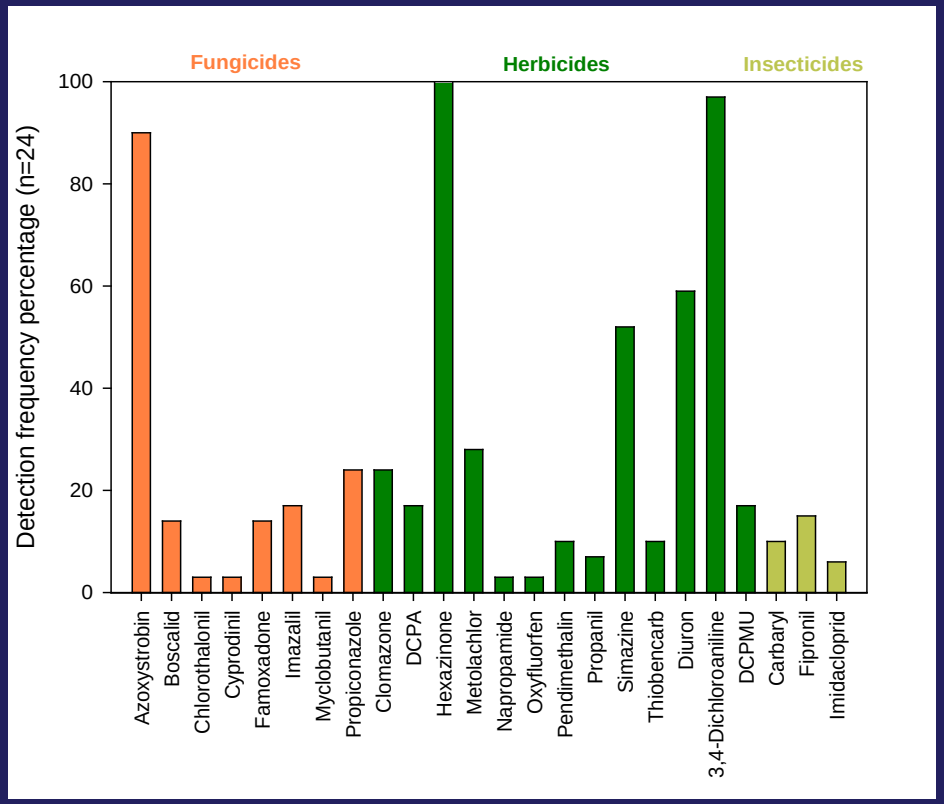


Freeport	**Maximum = 12***	**Average = 6**
Vernalis	**Maximum = 15**	**Average = 9**

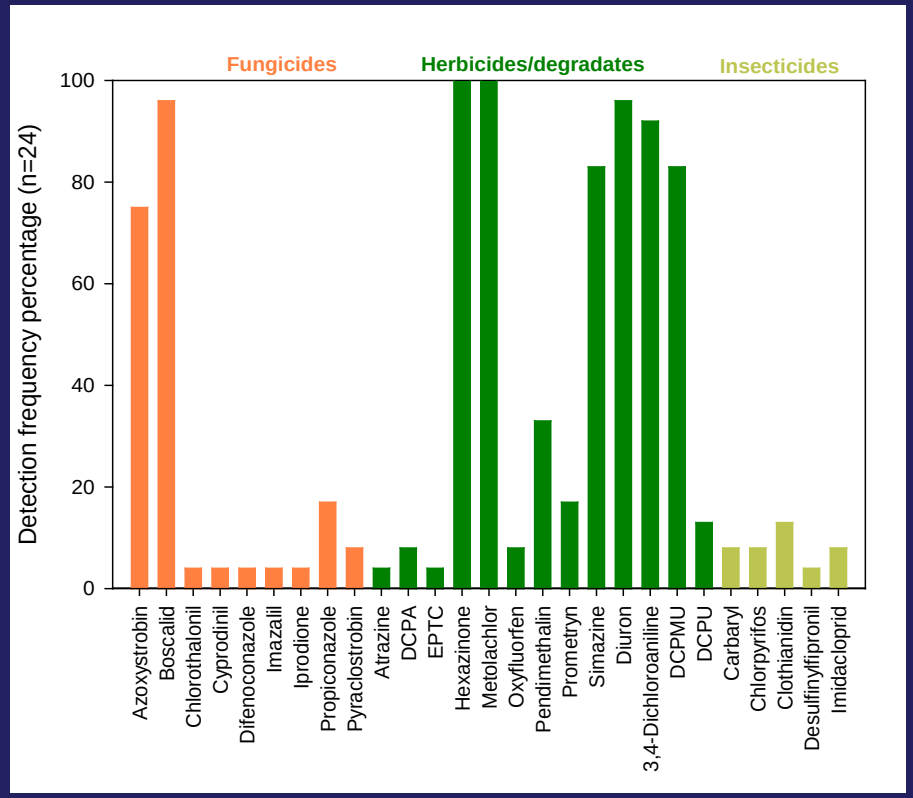
Detections By Basin

- Similar pesticides detected with exception of rice pesticides in the Sacramento River

Sacramento River at Freeport



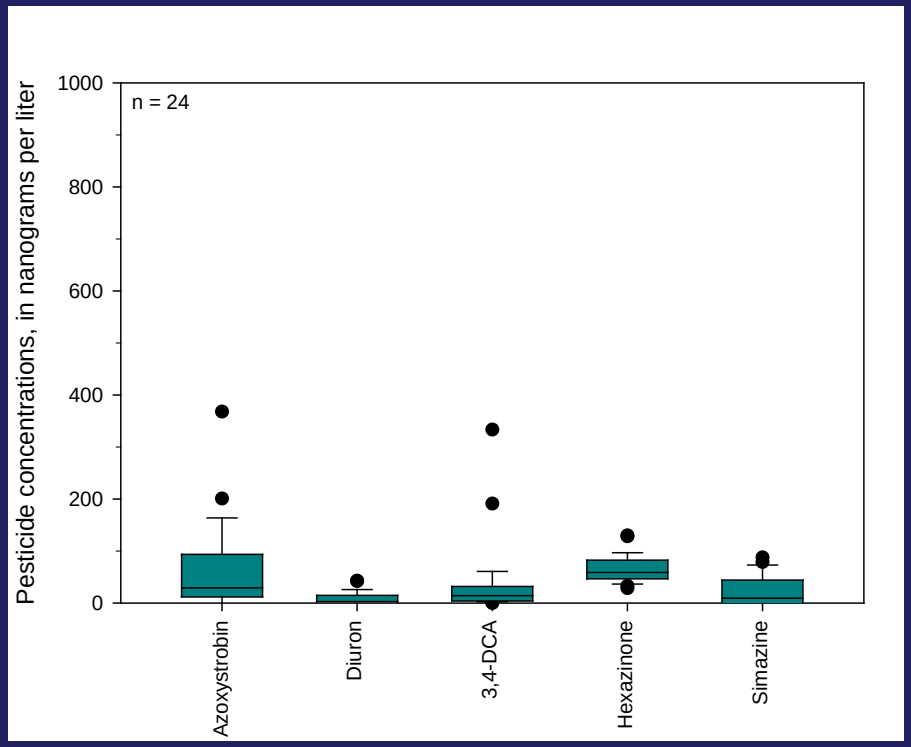
San Joaquin River at Vernalis



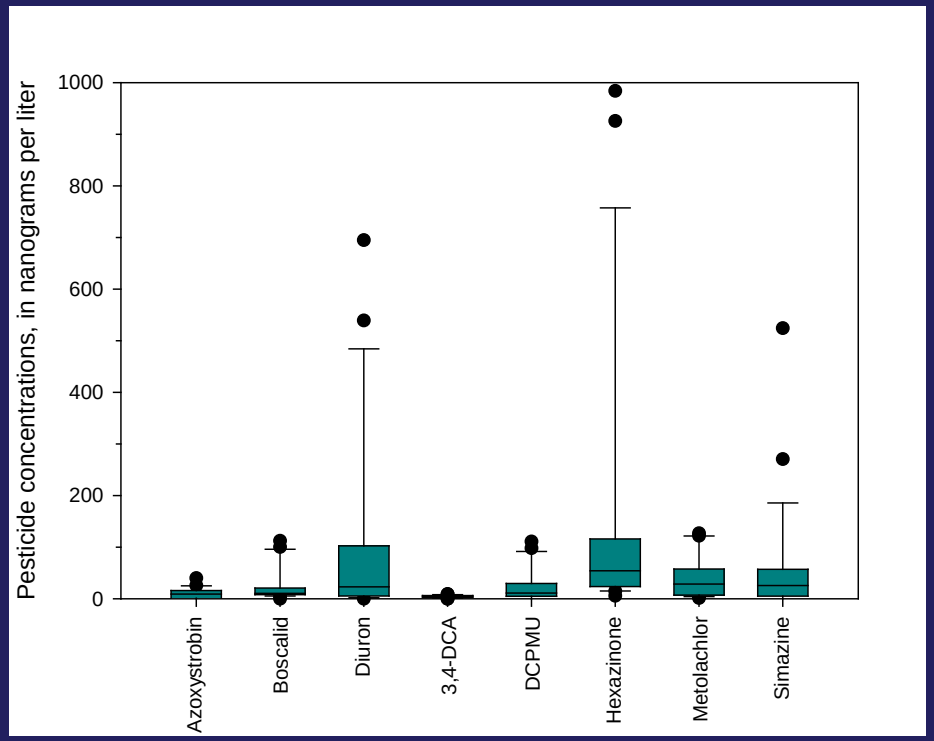
Concentrations

- Similar concentrations < 100 ng/L with the exceptions of diuron, hexazinone and simazine

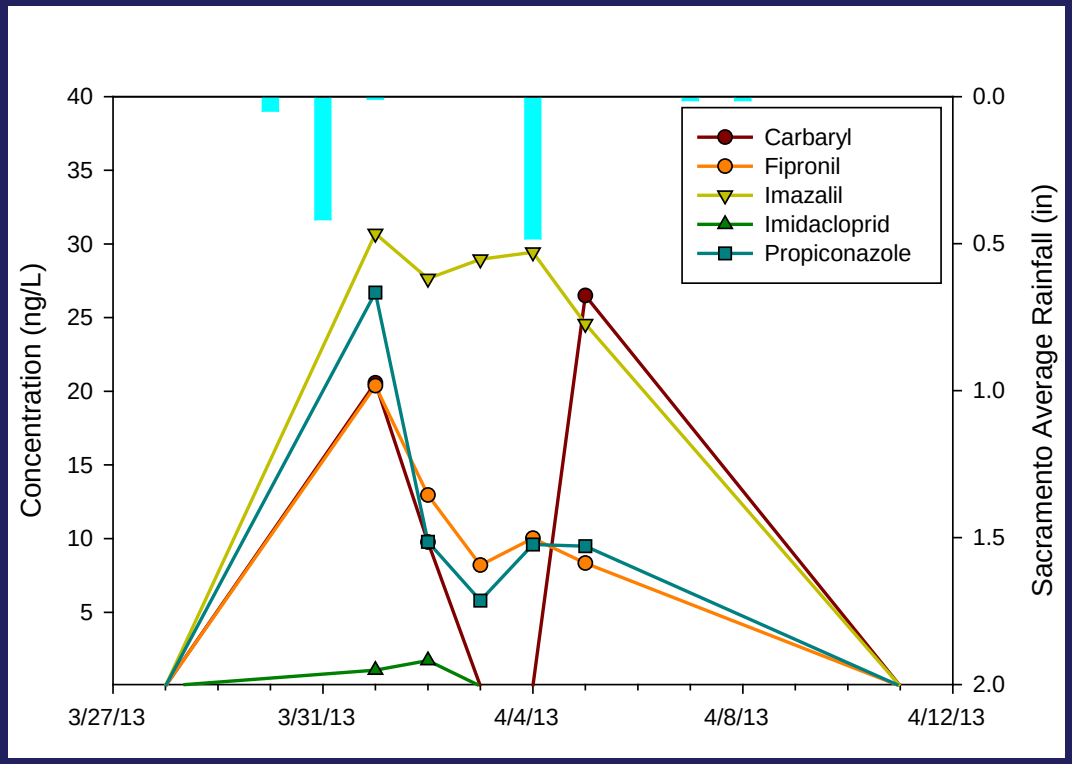
Sacramento River at Freeport



San Joaquin River at Vernalis



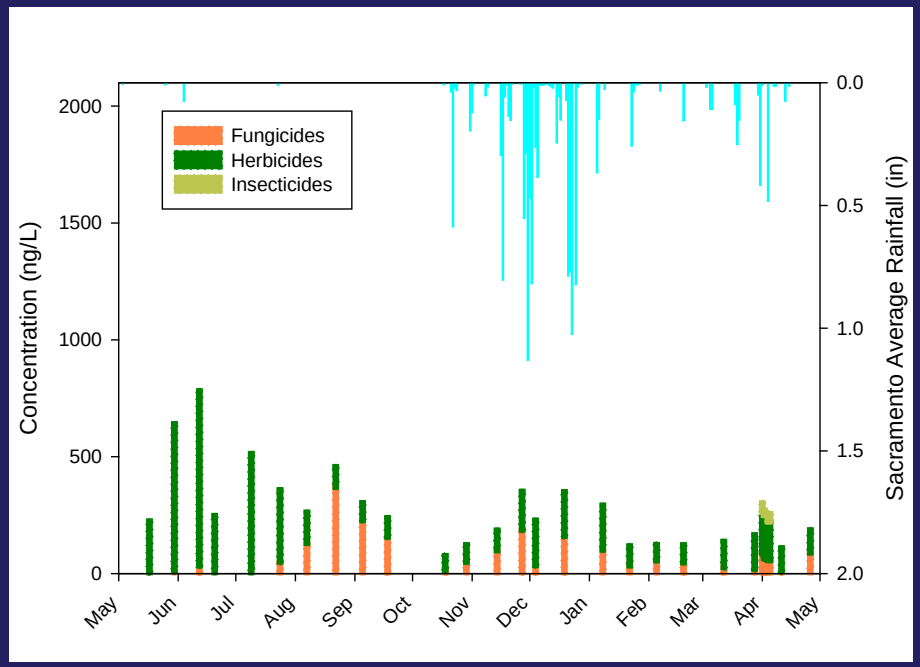
Sacramento Urban Storm Runoff



- **5 urban/home use pesticides detected in urban runoff**
- **Fipronil exceeded EPA chronic invert benchmark (11 ng/L)**
- **These were the only detections of insecticides at Freeport**

Total Concentrations

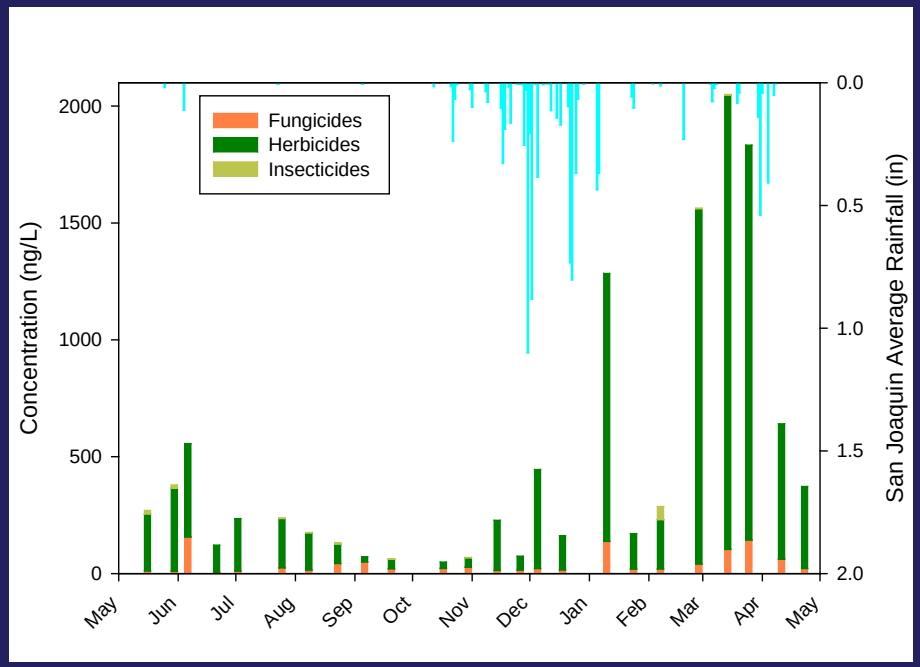
Sacramento River at Freeport



Average Contribution

Herbicides 71%
Fungicides 28%
Insecticides 1%

San Joaquin River at Vernalis

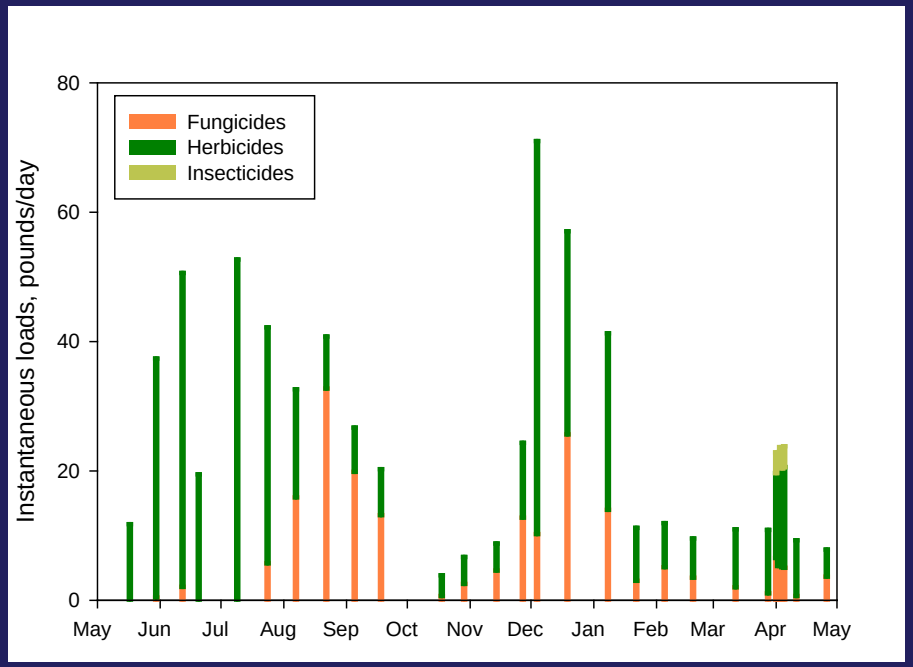


Average Contribution

Herbicides 83%
Fungicides 16%
Insecticides 2%

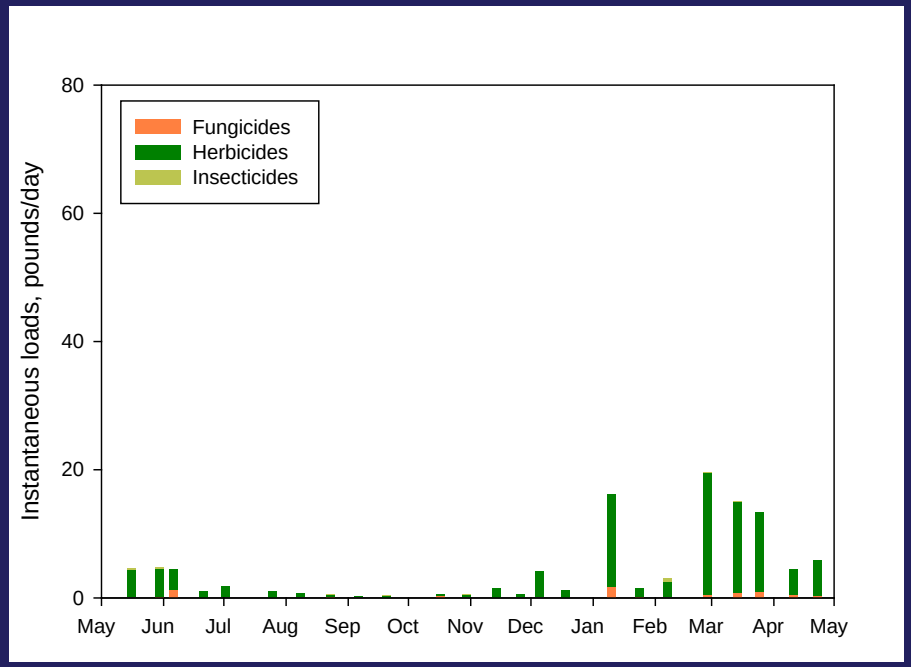
Pesticide Loads

Sacramento River at Freeport



Herbicides	69%	517 lbs	2800 lbs
Fungicides	30%	207 lbs	1230 lbs
Insecticides	<1%	10 lbs	10 lbs

San Joaquin River at Vernalis



Herbicides	91%	98 lbs	634 lbs
Fungicides	8%	9 lbs	56 lbs
Insecticides	1%	1 lb	7 lb

Summary

- Consistently detect mixtures of multiple pesticides
- Concentrations can be higher during low flow periods
- Herbicides and fungicides make up the bulk of the pesticide burden
- Few detections of insecticides in recent studies
- Storm runoff often shows increased detections and concentrations and may be particularly important in urban systems

Data Gaps

- Data is primarily from input sites to the Delta
- Lack of data on pesticides in sediment
- Toxicity of mixtures is poorly understood especially to primary producers
- Need for an integrated Delta Regional Monitoring Program