Water Quality Monitoring for the Irrigated Lands Regulatory Program in the Central Valley of California

Central Valley Regional Water Quality Control Board, Irrigated Lands Regulatory Program

John Swanson, Environmental Scientist

Monitoring and Implementation Unit

Presentation Overview
Irrigated Lands Program Monitoring

- Data Sources
- Analytical Parameters and Constituents
- Data Analysis
- Mitigation of Water Quality Impairment through Coalition Management Plans

Data Sources

- Coalition Group Monitoring Data
- Irrigation District Monitoring Data
- ILRP Contract Data: UC Davis, UC Berkeley, CA Dept. of Fish & Game
- SWAMP, TMDL programs

- 2004-2006 data summarized and presented in July 2007; data acquisition and evaluation is continuous

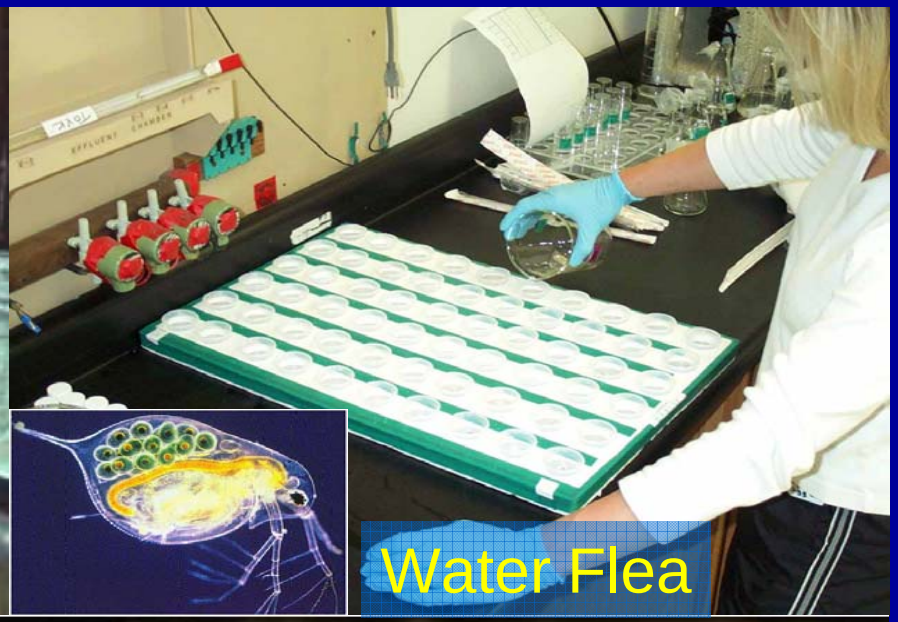
Analytical Parameters and Constituents

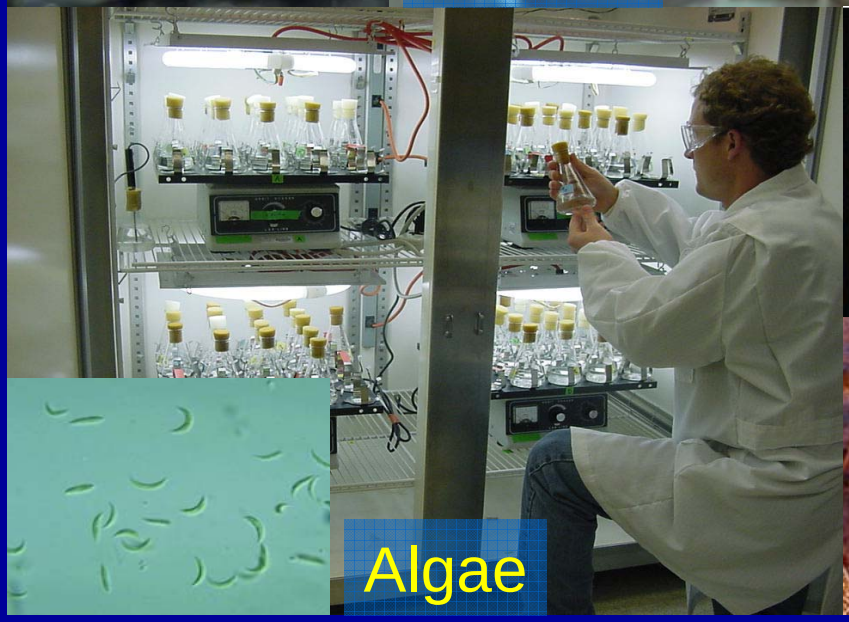
- Toxicity to Aquatic and Sediment Test Species
- Select Pesticides
- E. coli as an Indicator for Pathogens
- Select Metals
- Nutrients (N and P compounds)
- General parameters (salt as EC or TDS, pH, DO, turbidity, etc.)

Data Analysis – Overview
High Priority Constituents

- Toxicity: some significant impacts observed
- Pesticides:
  - 300 to 500 are used in significant amounts in CA;
  - About 60 routinely monitored
  - 10 to 15 are chronically problematic (cause toxicity or exceed protective concentrations)


Minnow


Water Flea


Algae

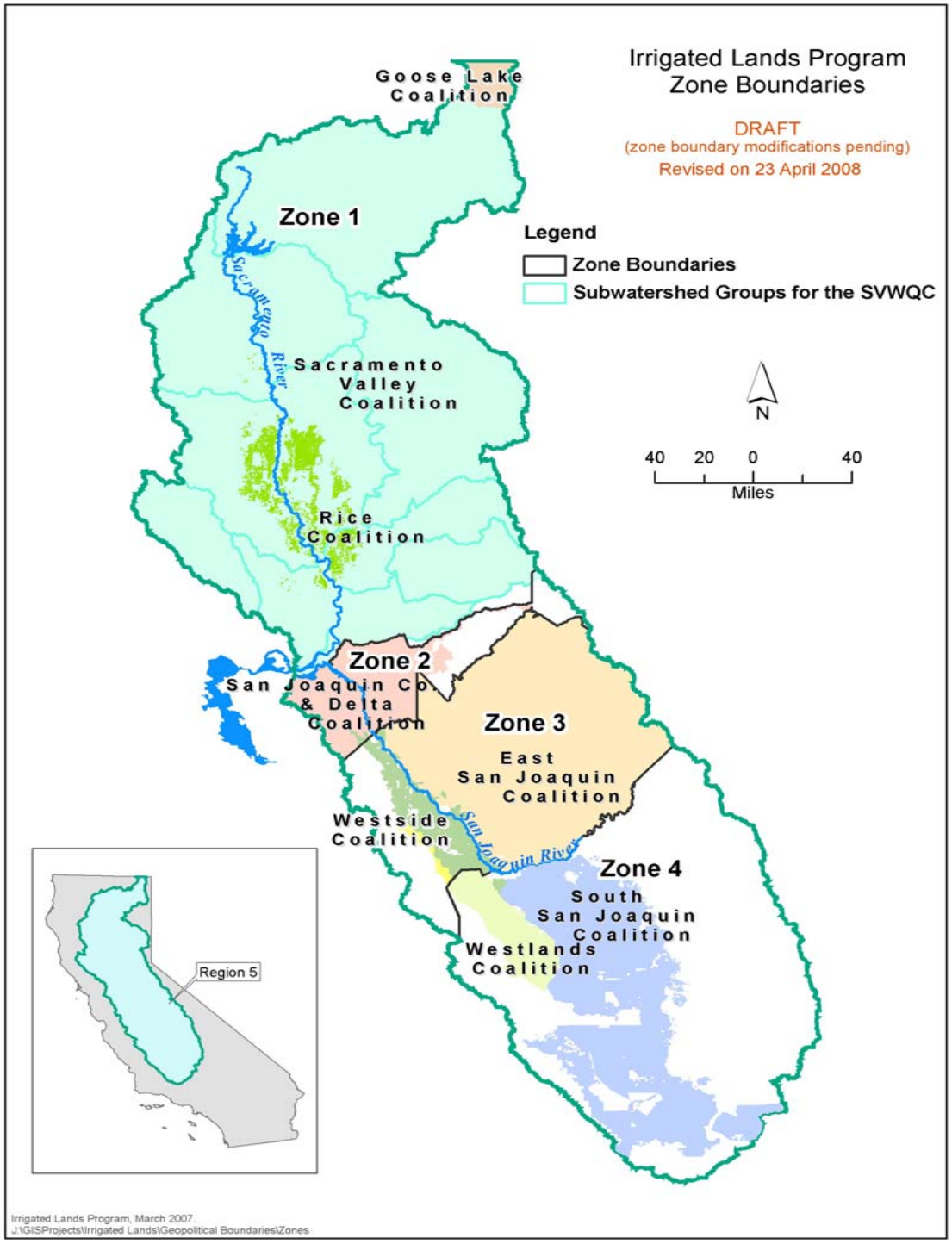

Hyalella

Toxicity Tests - Advantages

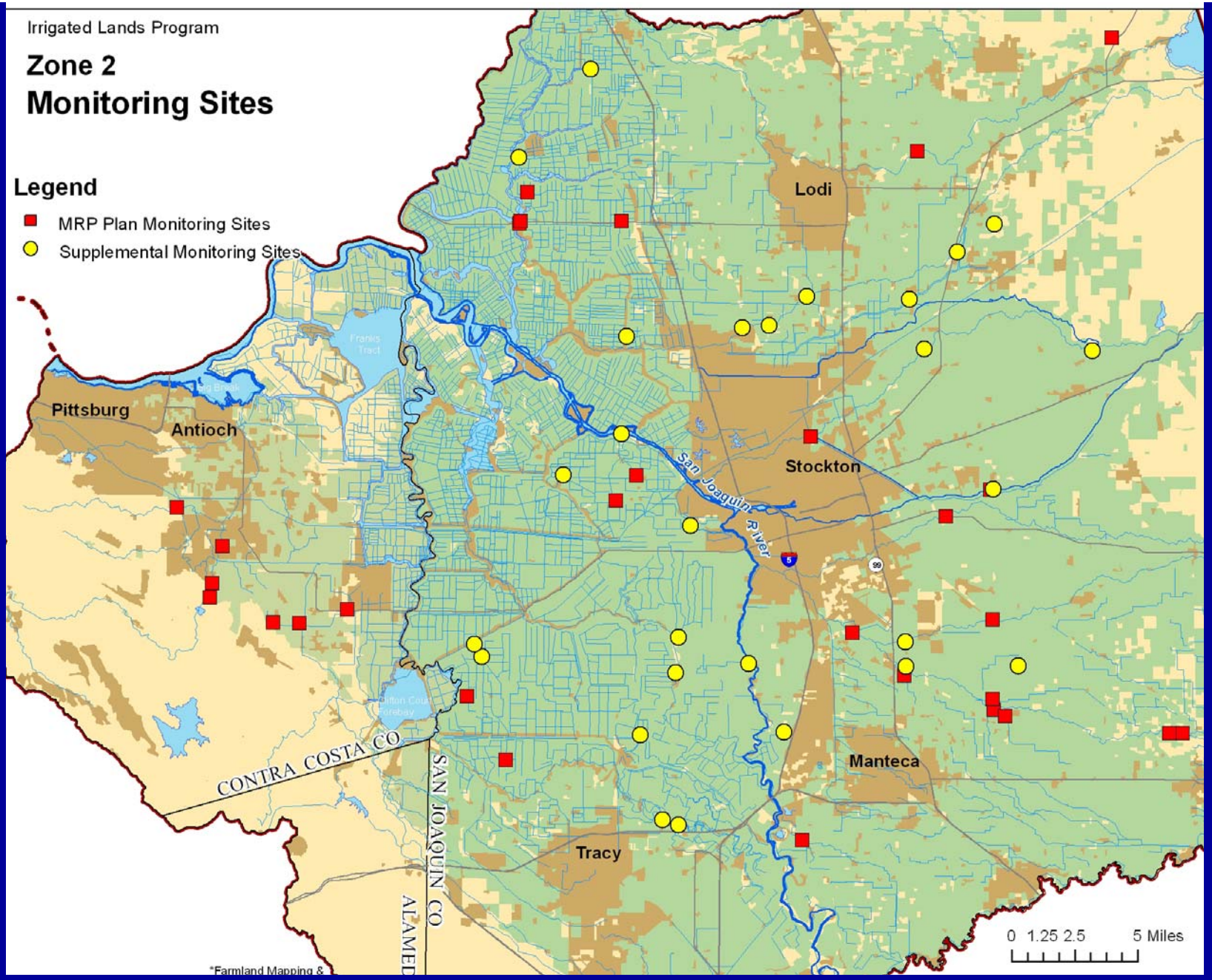
- Integrate toxicity from all constituents (includes additive or synergistic effects)
- Measure bioavailability of toxicants
- Measure toxicity directly
- With TIEs, the cause of toxicity may be categorized or even identified
- Reliably predict in-stream impacts

Toxicity Tests - Limitations

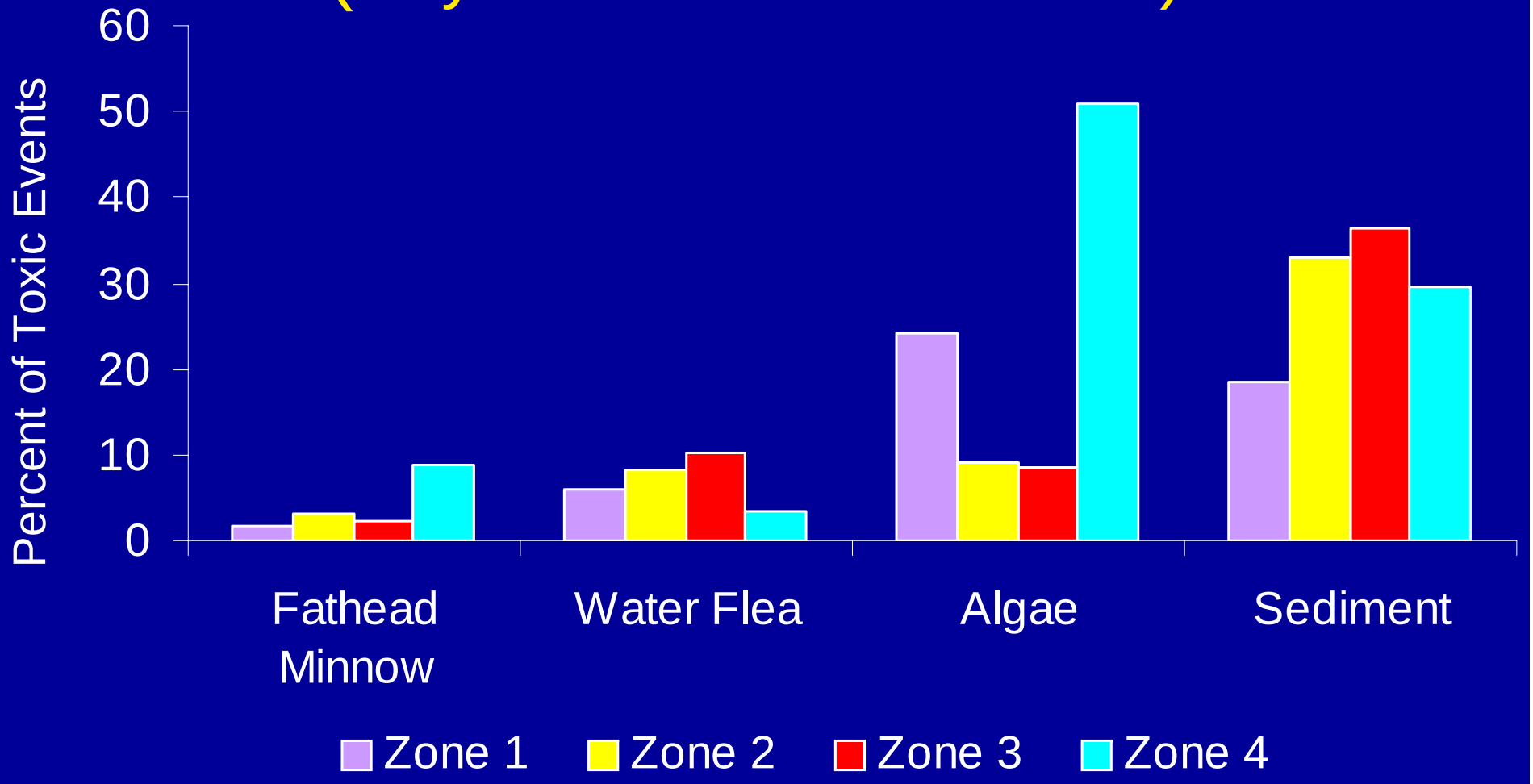
- Incomplete toxicology
- No direct treatment available
- Persistence not measured
- Laboratory exposures differ from environmental conditions
- Incomplete knowledge of causative toxicant
- Does not measure delayed impacts



Central Valley Zones


Irrigated Lands Program
Zone 2
Monitoring Sites
Legend
MRP Plan Monitoring Sites
Supplemental Monitoring Sites
Lodi
Pittsburg
Antioch
Stockton
San Joaquin River
Manteca
Tracy
CONTRA COSTA CO
SAN JOAQUIN CO
0 1.25 2.5 5 Miles

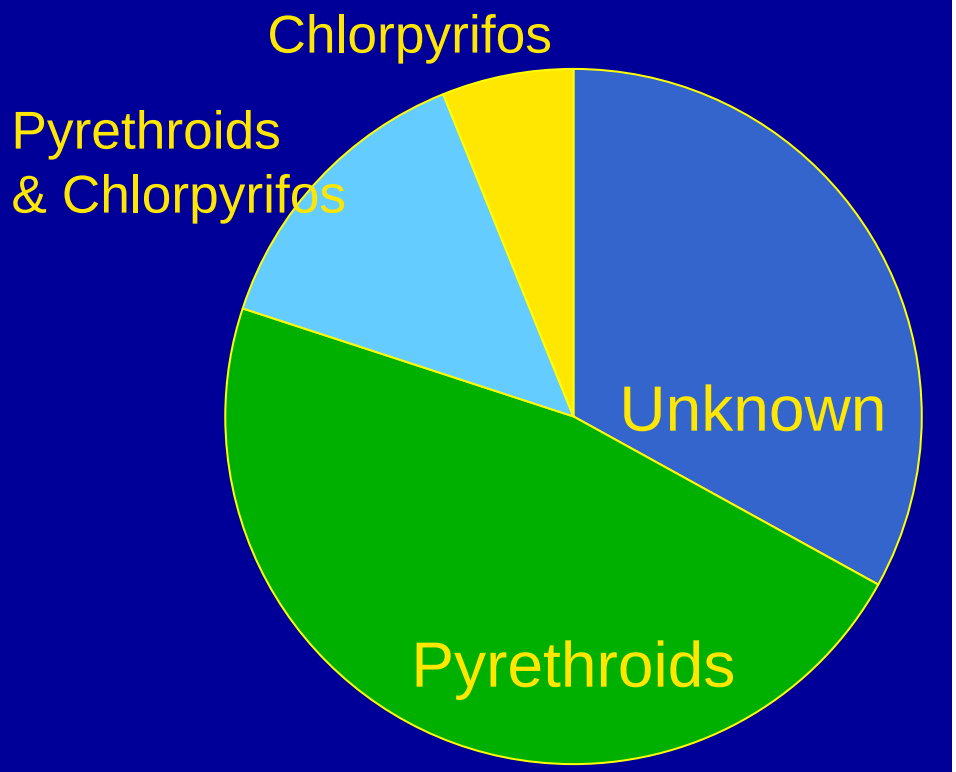
Summary of Toxic Events (July 2004 to October 2006)



Causes of Sediment Toxicity

- 67% of toxic samples
  > LC50 concentration for pyrethroids and/or chlorpyrifos

- DDT detected in 93% of sediment samples, but has not exceeded LC50s



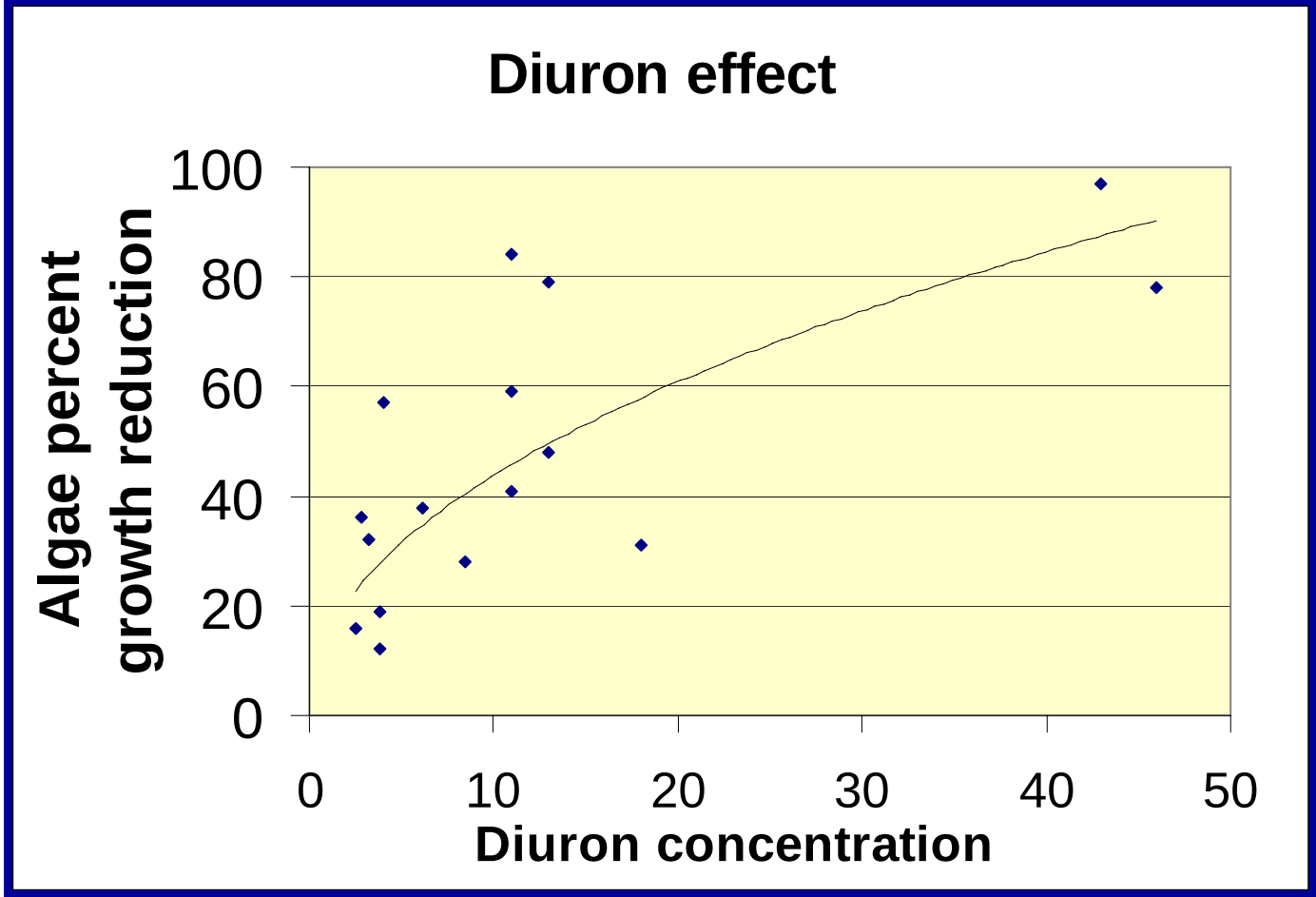
Reference:

D. Weston, J. You, E. Amweg, and M. Lydy
Department of Integrative Biology, University of California
"Sediment toxicity in agricultural areas of California and the role of hydrophobic pesticides" (Article in review).

Sediment Discharges

San Joaquin River at Hwy 132

Causes of Algae Toxicity (Westside Coalition Data)

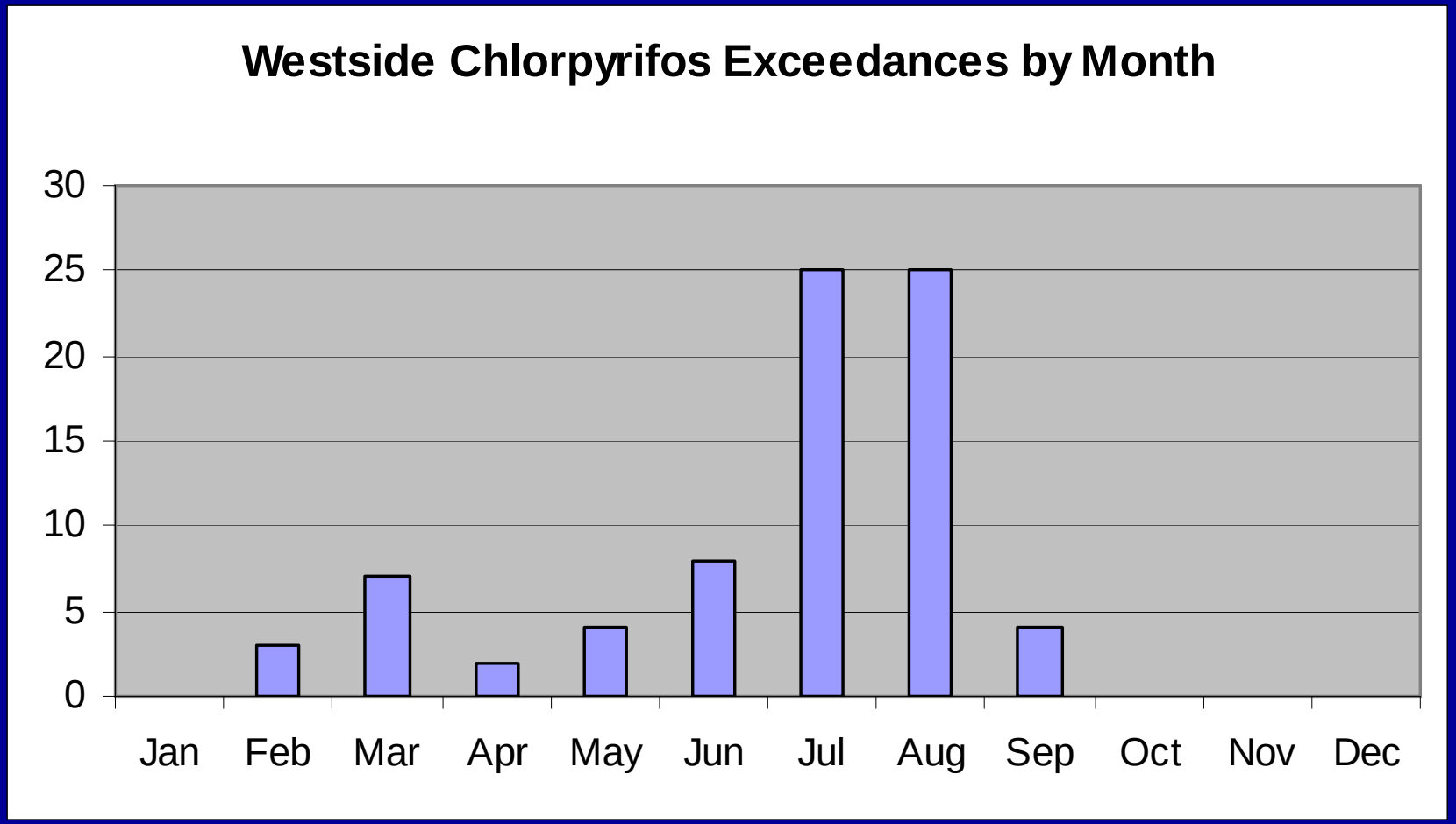


100% of samples with > 2 ug/L diuron were significantly toxic to algae; toxicity increased with increasing diuron concentration

Causes of Water Flea Toxicity

- Mostly organophosphate insecticides (chlorpyrifos, diazinon, malathion, parathion-methyl)
- Between May 2004-Oct. 2006, in Zone 3, 19 of 49 samples (39%) that were toxic to Ceriodaphnia, also had Chlorpyrifos > 0.1 ug/L
- Literature-based LC50 for chlorpyrifos to Ceriodaphnia is 0.06 to 0.08 ug/L

Seasonal Trends: Westside Coalition Total # Chlorpyrifos Exceedances by Month, 2004-2007



Workload for Coalitions

Number of Management Plan Requirements (Sites) Triggered by Pesticide or Toxicity Monitoring

Chlorpyrifos	43
DDT/DDE	23
Diuron	16
Diazinon	8
Simazine	4
Dimethoate	3
Trifluralin	3
Parathion-methyl	3
Malathion	2
Atraton	2
Disulfoton	1
Carbofuran	1
Thiobencarb	1
Toxicity, Hyalella	37
Toxicity, Algae	53
Toxicity, Minnow	4
Toxicity, Water Flea	36
Total	217

Updated 25 September 2008

Salinity

- Measured with EC, TDS
- Problematic in the San Joaquin River
- Sources primarily from west side (Delta Mendota Canal imports salts from the Delta to the West side)
- Loads (mass/unit time) from specific waterways and important aspect for problem solving
- Regional problem, regional solution likely needed
- Two other programs involved: CV-SALTS and Salt TMDL

Nutrients

- Data acquired for baseline (nitrate, nitrite, Kjeldahl nitrogen, ammonia, total phosphorus, ortho-phosphate)
- Not currently evaluated for bio-stimulatory potential (algae toxicity testing indicates some evidence of greatly enhanced growth, but no criteria available for comparison)
- Potential impacts: Bio-stimulation, algal blooms, low dissolved oxygen
- Nitrate, nitrites compared to human health risk levels; ammonia compared to eco-risk levels

Pathogens

- E coli used as indicator of potential pathogen threat
- Nearly half of all samples exceed threshold for safe contact recreation, with most locations exhibiting 2+ exceedances
- Beneficial uses of ag channels, sources of E. coli, background levels not clear
- Additional study needed to determine contribution from ag and actual risk

Mitigation and Management Plans

Eight components of Management Plan

1. Identify/characterize ag source
2. Identify MPs to be implemented
3. MP implementation schedule
4. MP performance goals and schedule
5. Waste-specific monitoring schedule
6. Process/schedule for evaluating MP effectiveness
7. ID participants that will implement MPs
8. Reporting schedule

Additional Management Strategies

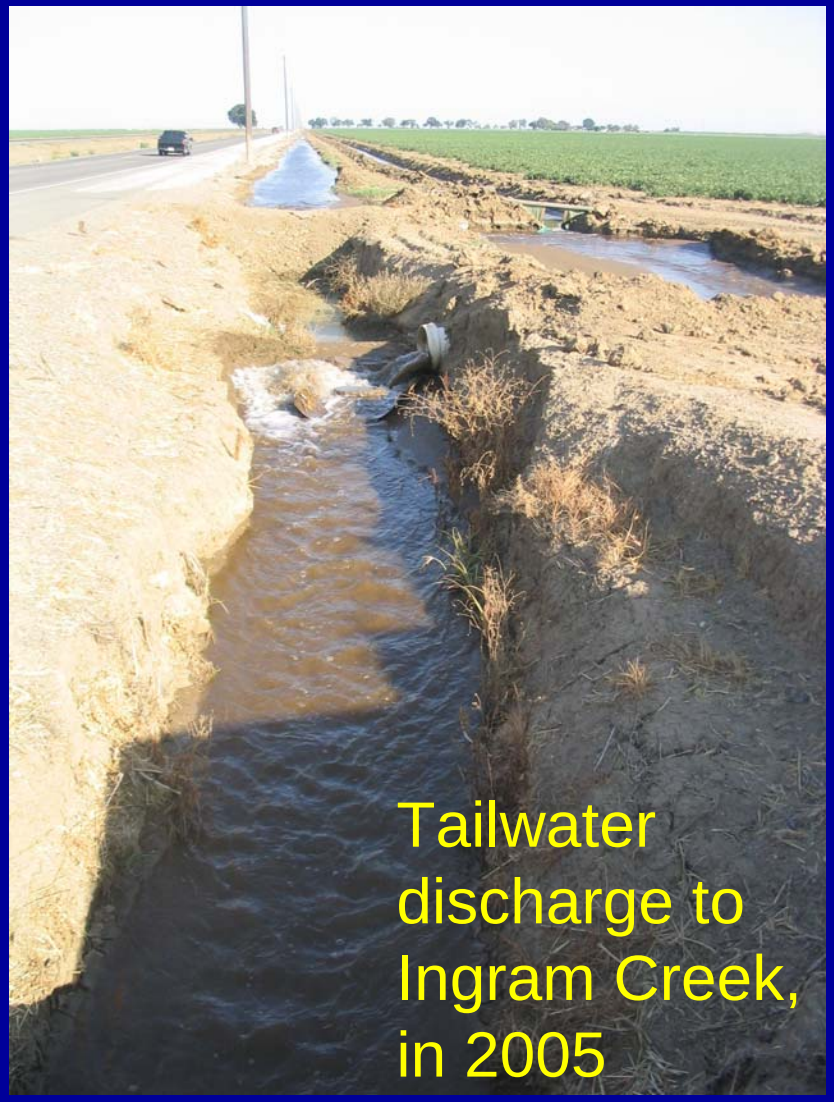
- Identify and prioritize constituent/location combinations
- General outreach/communication plans
- Focused efforts on priority sub-watersheds
- Quantify MP implementation and their effect on monitoring results (BIG challenge)
- Efficiencies: control of sediment erosion likely to control hydrophobic pesticides (pyrethroids, DDTs), sediment toxicity, turbidity, TSS, and perhaps others (nutrients, bacteria)

Effect of Polyacrylamide (PAM) on Tailwater

Treated

Not treated

Implementation example: 550 acres of row crops



Tailwater discharge to Ingram Creek, in 2005

Prop 50 Grant adds sediment ponds and TW re-circ, 2008, no discharge!

Further information:

website information at:

www.waterboards.ca.gov/centralvalley/programs/irrigated_lands/index.html

Thanks for listening….