# Water Quality Concerns With Synthetic Pyrethroids

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# Overview

- Background on OPs and water quality.
- Approaches used by Regional Boards and DPR to address OPs in surface water.
- Recent concern about pyrethroids and potential toxicity to aquatic organisms.
- Monitoring of pyrethroids in aquatic environments.
- Regulatory options for pyrethroids.

# Organophosphate Insecticides
## *A Key Water Quality Concern in the 1990s*

- Diazinon and chlorpyrifos were found in the Sacramento and San Joaquin Rivers, their tributaries, and urban creeks.
- Source:  Irrigation and rain runoff agricultural and urban sites.
- Concentrations exceeded water quality criteria developed by DFG.

# Organophosphate Insecticides
## *A Key Water Quality Concern in the 1990s*

Concentrations of diazinon were high enough to explain results of bioassays with sensitive arthropods.

# Organophosphate Insecticides
## *A Key Water Quality Concern in the 1990s*

- Regional Boards determined diazinon and chlorpyrifos caused violations of water quality standards in rivers, the Delta, and urban creeks.
- California's 2002 list of impaired water bodies (required by CWA section 303[d]) included 144 water body/ pesticide-specific combinations.
- 94 listings are related to diazinon; 28 to chlorpyrifos.

# Organophosphate Insecticides
## *A Key Water Quality Concern in the 1990s*

CWA section 303(d) also requires states to:

- For water bodies on the list, establish TMDLs, which must account for pollution from point sources (permitted discharges) and non-point sources (e.g., runoff).
- Incorporate TMDLs into water quality control plans (i.e., basin plans).

# Organophosphate Insecticides
## *Total Maximum Daily Loads*

- San Francisco Bay Region:  Diazinon and pesticide-related toxicity in urban creeks
- Los Angeles Region:  Toxicity, chlorpyrifos, and diazinon in Calleguas Creek, its tributaries, and Mugu Lagoon
- Central Valley Region:
  - Diazinon in Sacramento and Feather Rivers
  - Diazinon and chlorypyrifos in San Joaquin River
  - Diazinon and chlorpyrifos in urban creeks in Sacramento County
  - Diazinon and chlorpyrifos in the Delta

# Organophosphate Insecticides
## *Total Maximum Daily Loads*

- Santa Ana Region:  Diazinon and chlorpyrifos in the Upper Newport Bay Watershed
- San Diego Region:  Diazinon in Chollas Creek

# Organophosphate Insecticides
## *DPR's Response*

DPR's staff analysis of 1991-2001 data

- 22 studies
- 7,862 concentration measurements of diazinon and chlorpyrifos
- 488 *Ceriodaphnia dubia* toxicity tests
- Conclusion: diazinon from dormant spray runoff continued to exceed DFG water quality criteria.

# Organophosphate Insecticides
## *DPR's Response*

- DPR reviewed chlorpyrifos data available after the previous review.
- Conclusion:  chlorpyrifos was frequently found in waters of the San Joaquin and Salinas Valleys and in the Delta concentrations that exceeded DFG water quality criteria.

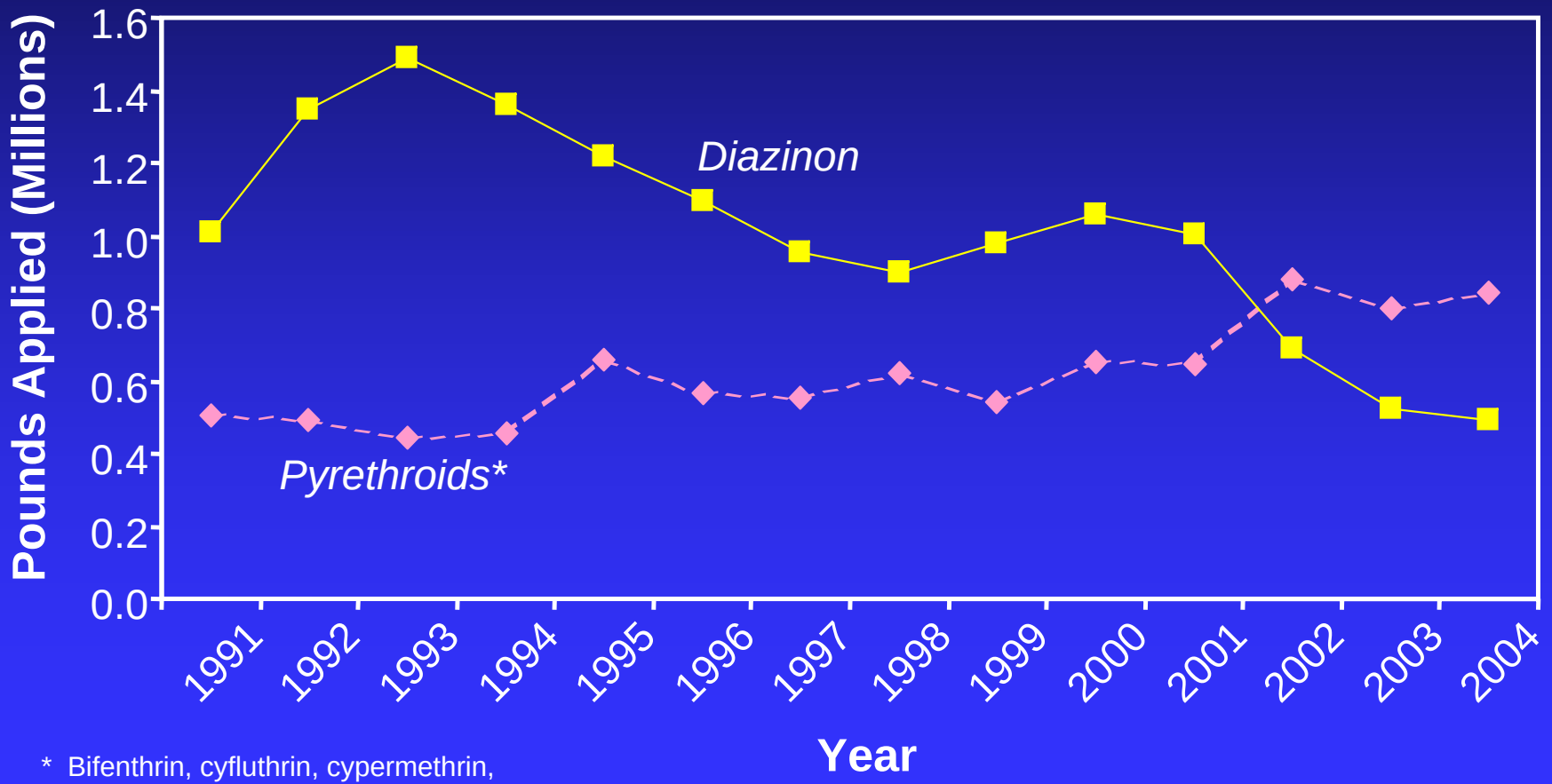
# Organophosphate Insecticides
## *DPR's Response*

- DPR put diazinon (dormant spray products) and chlorpyrifos (agricultural use products) into reevaluation.
- Reevaluations emphasize demonstration of management practices that reduce or eliminate runoff to surface waters.

# DPR's Response: Proposed Dormant Spray Regulations

- Need to reduce offsite movement of dormant sprays in a comprehensive way, reducing opportunities for movement into surface waters.
- Not limited to OPs, in recognition of increasing concern about environmental effects of OP "replacements" (e.g., synthetic pyrethroids).
- Use drift management and other means to prevent pesticide movement off the site of application.

# Diazinon and Pyrethroid Use




* Bifenthrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin, permethrin

# Pyrethroid Insecticides
## *General Characteristics*

- Broad spectrum insecticide.
- Low toxicity to mammals and birds.
- Applied at low rates.
- They are typically inexpensive to use.

# Pyrethroid Insecticides
## *General Characteristics*

- Highly toxic to aquatic invertebrates and fish.
- High affinity for particles and surfaces.
- Difficult to sample and analyze.
- Toxic levels are near or below detection limits.

# Pyrethroids in California Waters
## *Monitoring prior to 2003*

- 941 pyrethroid/location/date specific samples were analyzed. (Not an exhaustive review)
- No pyrethroids were detected *except* 40 detections of bifenthrin in Orange County; almost all were associated with discharges from a major nursery.

# Pyrethroids in Stanislaus County Waters
## *2003 (17 sample dates, prelim. results)*

| *Location* | *Whole water* | *Bed sediment* |
|---|---|---|
| Pomelo Drain | 2 bifenthrin<br>1 esfenvalerate | 3 esfenvalerate<br>1 permethrin |
| Westport Drain | 1 esfenvalerate | 1 permethrin |
| Orestimba Creek | 2 bifenthrin | 8 esfenvalerate |
| Del Puerto Creek | 11 bifenthrin<br>2 esfenvalerate<br>1 permethrin | 6 esfenvalerate<br>3 permethrin |

# Pyrethroids in Monterey County Waters *2003 (16 sample dates, prelim. results)*

| *Location* | *Whole water* | *Bed sediment* |
|---|---|---|
| Alisal Creek | 2 bifenthrin<br>1 esfenvalerate<br>2 permethrin | 15 permethrin |
| Blanco Drain | None detected | 3 permethrin |
| Chualar Creek | None detected | 3 permethrin |
| Quail Creek | 11 permethrin<br>1 esfenvalerate<br>1 cypermethrin | 15 permethrin<br>6 cypermethrin |

# Pyrethroid Insecticides
## *Investigations in Agricultural Waters*

- Don Weston, UC Berkeley
- 70 sediment samples from water bodies dominated by agricultural runoff
- 42 locations in 10 Central Valley counties
- Analyzed for
  - 5 pyrethroids
  - 18 “legacy” organochlorines
  - 2 currently-used organochlorines

# Pyrethroid Insecticides
## *Investigations in Agricultural Waters*

Sediment bioassays were performed using a sediment-dwelling arthropod, *Hyalella azteca*

# Pyrethroid Insecticides
## *Investigations in Agricultural Waters*

- Significant toxicity to *H. azteca* at 42% of sites.
- High correlation between toxicity and pyrethroid concentrations.
- Pyrethroid concentrations were near of above concentrations toxic to *H. azteca* in 70% of the toxic samples.
- Organochlorine concentrations were generally far below those toxic to *H. azteca*.

# Pyrethroid Insecticides
## *Investigations in Urban Waters*

- Don Weston, UC Berkeley.
- Several urban creeks in Roseville, CA.

# Pyrethroid Insecticides
## *Investigations in Urban Waters*

- 9 of 21 sites had >90% mortality of *H. azteca*.
- High correlation between mortality and pyrethroid concentrations. Both were highest near storm drain outfalls.
- Native populations of *H. azteca* were low or zero in areas with high pyrethroid concentrations.
- OP and organochlorine concentrations could not account for mortality.

# Pyrethroid Insecticides
## *Investigations in Ag and Urban Waters*

- Link between pyrethroid concentrations and sediment toxicity consists of:
  - Consistent correlations between predicted toxicity (toxic units based on sediment concentrations and LC50 values) and observed toxicity.
  - No alternatives could explain the toxicity.

# Pyrethroid Insecticides
## *DPR's Regulatory Options*

- DPR announced intent to put pyrethroid insecticides into reevaluation.
- Reevaluation would be consistent with application of reevaluation authorities used with diazinon and chlorpyrifos (toxicity in receiving waters).
- Seeking input from Regional Water Boards on most significant informational needs.
- DPR's overall regulatory goal is to help assure attainment and maintenance of Regional Boards' water and sediment quality objectives.

# Pyrethroid Insecticides
## *Regional Boards' Regulatory Options*

- Del Puerto and Ingram Creeks (San Joaquin Valley) are proposed for inclusion in the next CWA section 303(d) list. TMDLs would presumably follow.
- San Francisco Bay Regional Board's recent basin plan amendments includes a "water quality attainment strategy" for pesticides. It includes provisions that promote interagency cooperation to prevent 303(d) listings and TMDL development for pesticides. DPR pledged support.

# DPR's Surface Water Program on the World Wide Web

http://www.cdpr.ca.gov >

Programs and Services >

Surface Water Protection Program