Pollutants of Emerging Concern in Orange County Stormwater

Synthetic Pyrethroid Pesticides

Fipronil Pesticide

Urban Runoff Carries Pesticides to Creeks

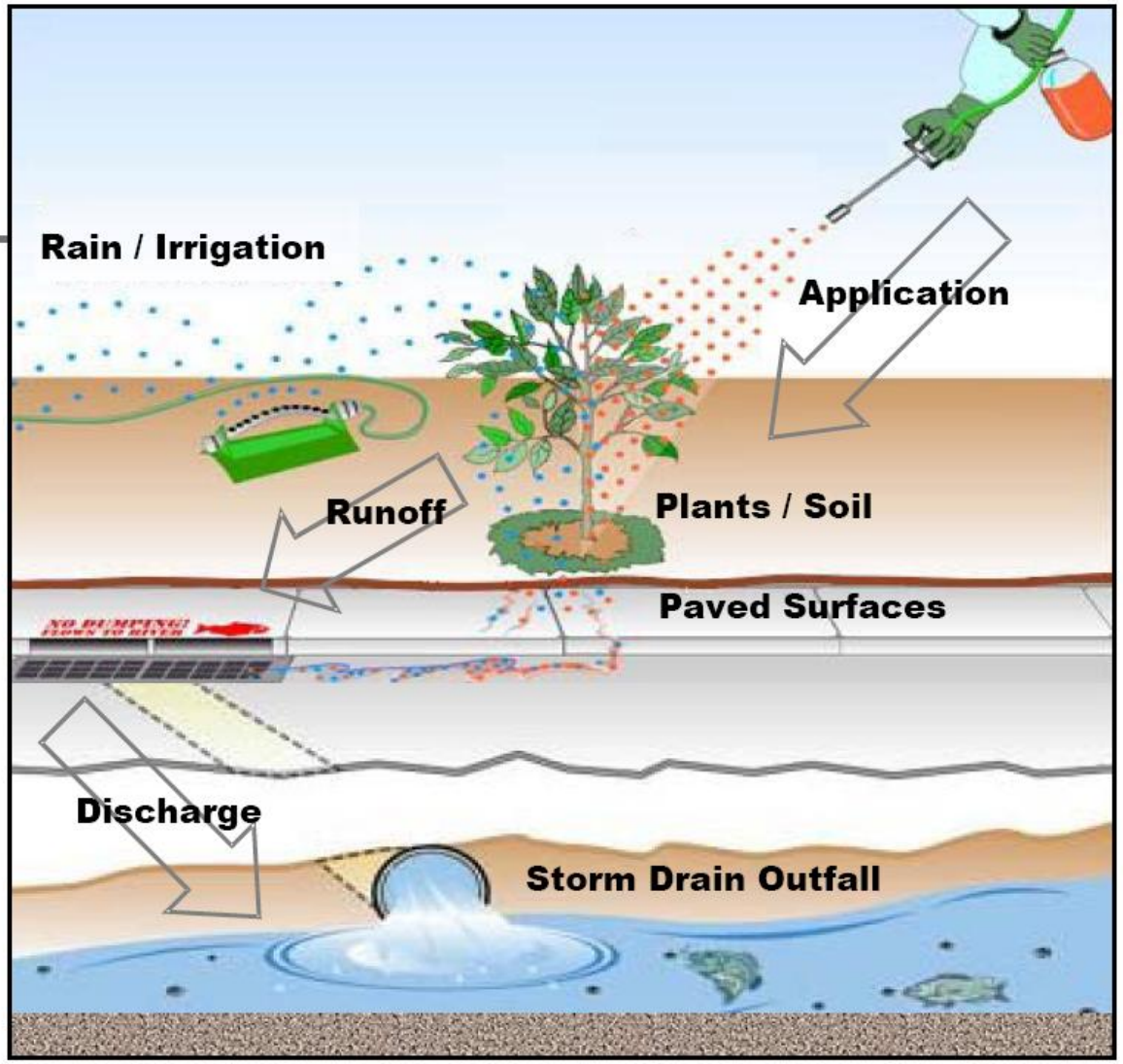


Figure courtesy SF Bay Regional Water Board, based on U.C. IPM Project drawing

Regulatory Drivers

- Basin Plan narrative objective

  "The concentration of toxic pollutants in the water column, sediments or biota shall not adversely affect beneficial uses" Region 8
- Pesticide toxicity has been identified as a pollutant of concern in stormwater and a number of waterbodies have been listed as impaired due to unknown toxicity or sediment toxicity
- A TMDL for toxic pollutants has been promulgated in San Diego Creek and Newport Bay
- TMDL requirements are being implemented into municipal stormwater permits

Synthetic Pyrethroid Pesticides

- Light-stable synthetic derivatives of pyrethrin, natural insecticidal extracts of the chrysanthemum flower.
- Sodium channel toxin
- Includes Bifenthrin, Permethrin, Cyfluthrin, Cypermethrin, Deltamethrin, Cyhalothrin, etc.
- In animals, toxicity enhanced by simultaneous high-dose exposure to organophosphates

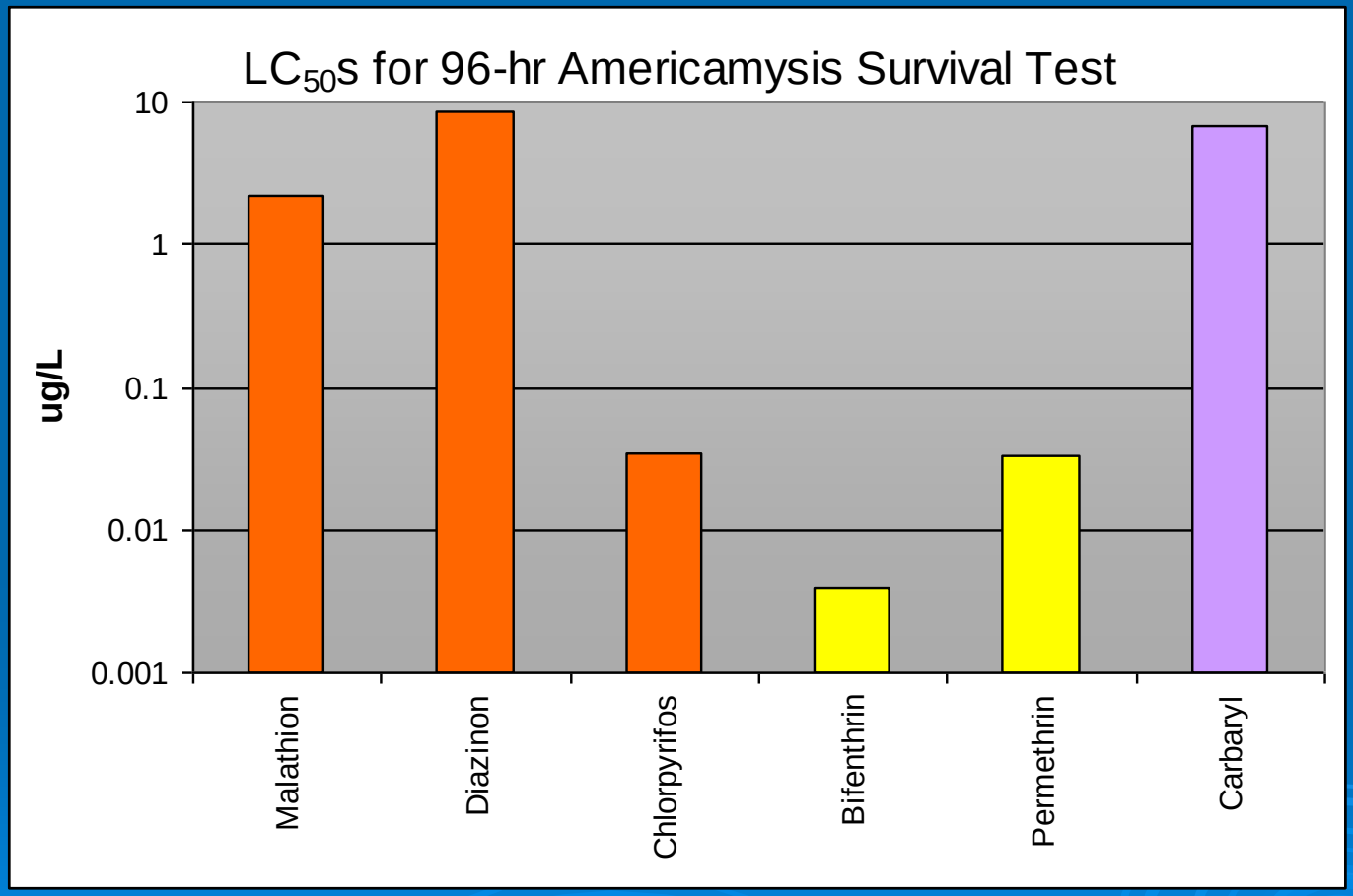
Synthetic Pyrethroid Pesticides (cont.)

- Bifenthrin used extensively in the San Diego Creek watershed (ornamental nurseries) for Red Imported Fire Ant (RIFA) control
- Binds to soil particulates

Half-life (days) in soils

	Aerobic	Anaerobic
Bifenthrin	96.3	425
Cyfluthrin	11.5	33.6
Permethrin	39.5	197

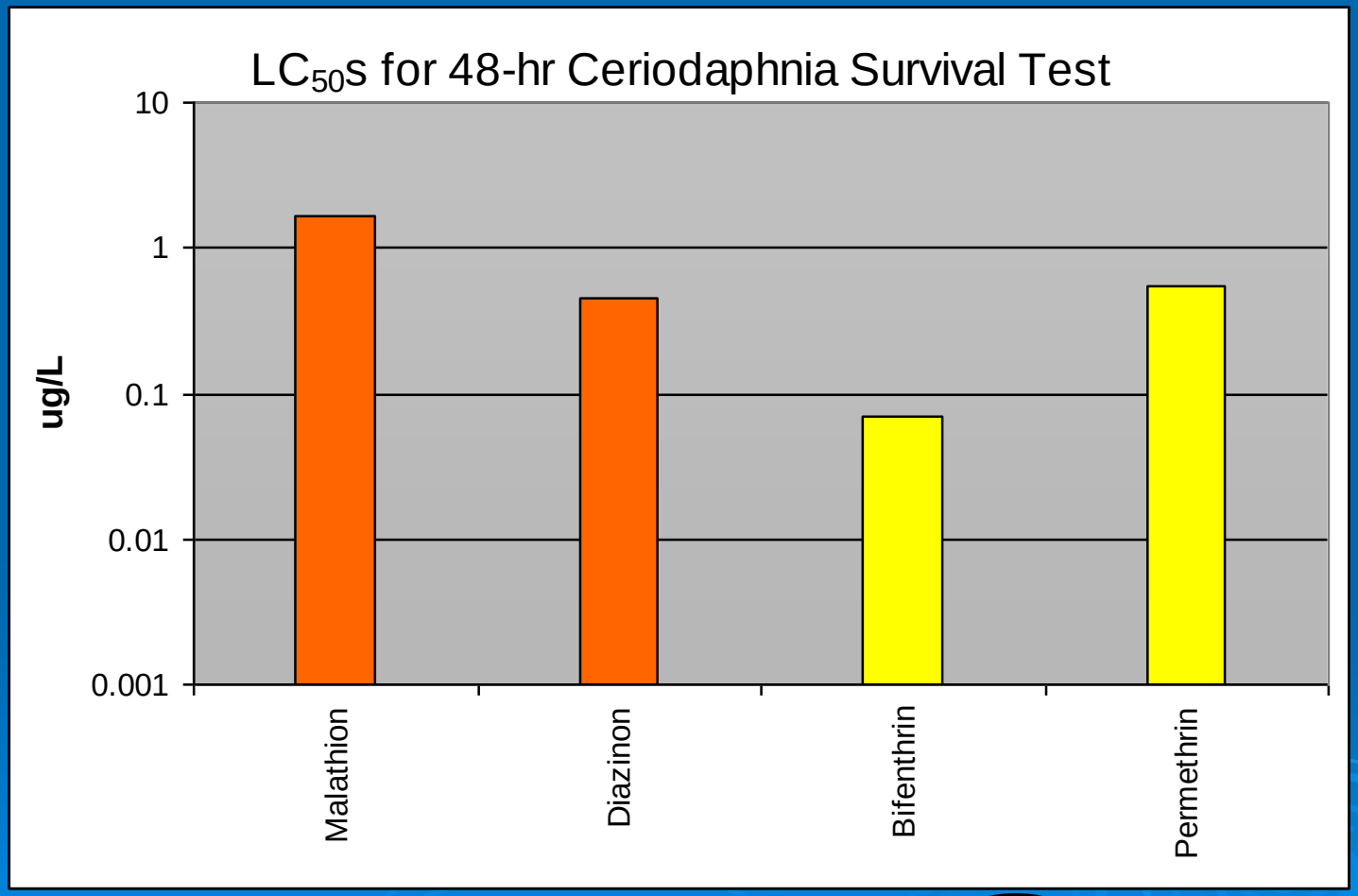
Relative Aquatic Toxicities of Pesticides Analyzed in the OC Program



Organophosphates - Synthetic Pyrethroids - Carbamates

Source: Average values from USEPA Ecotox database

Relative Aquatic Toxicities of Pesticides Analyzed in the OC Program



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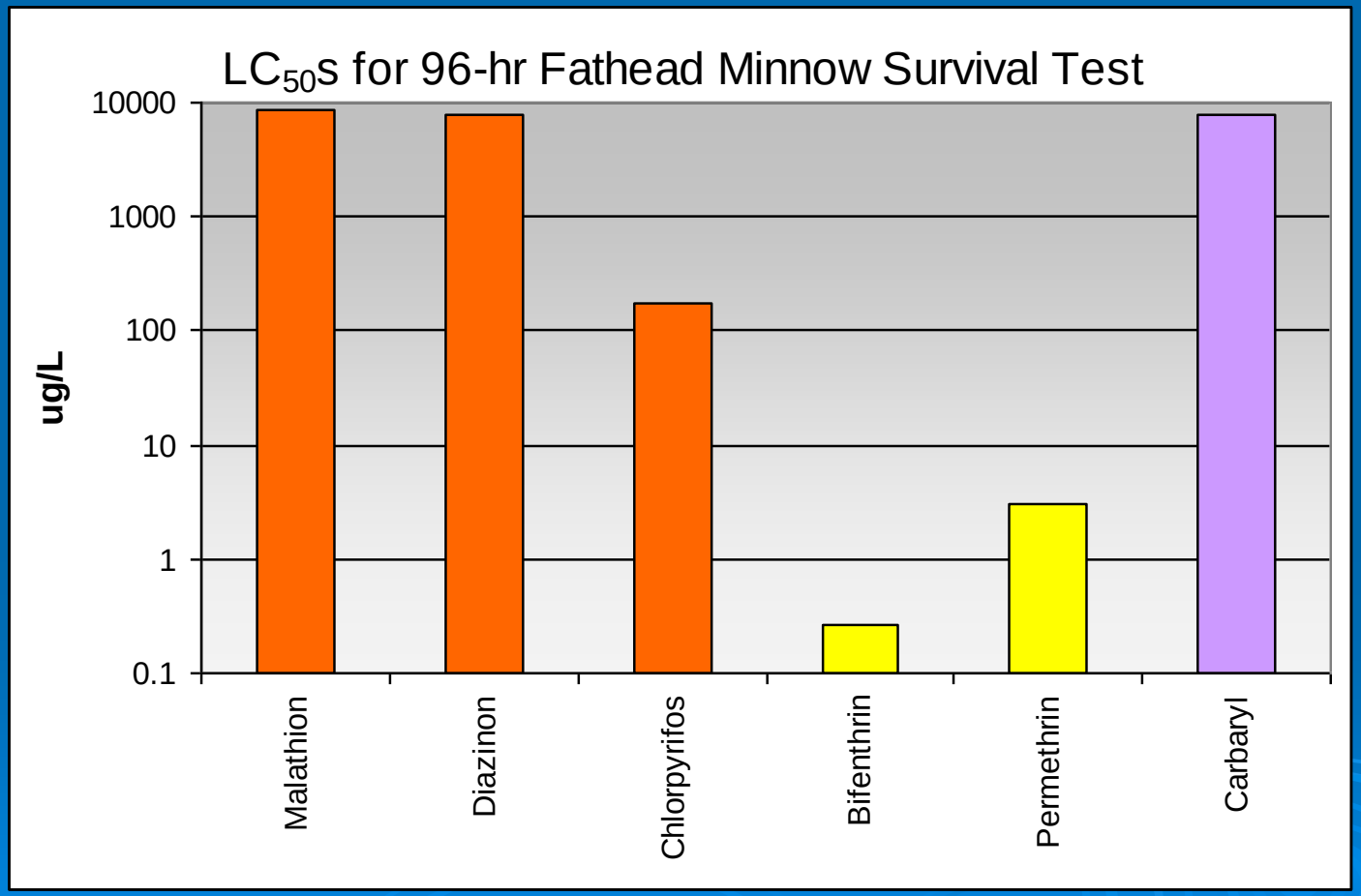


Fipronil Pesticide

- Not yet analyzed in OC Program
- Neurotoxin in the phenyl pyrazole class of pesticides
- Registered for use in CA in late 1990s
- Popular usage for flea control (Frontline- topically applied to dogs and cats); termite, roach, and ant control (Combat - baits)
- Only slightly soluble in water; binds to soil particulates

Fipronil Pesticide (cont.)

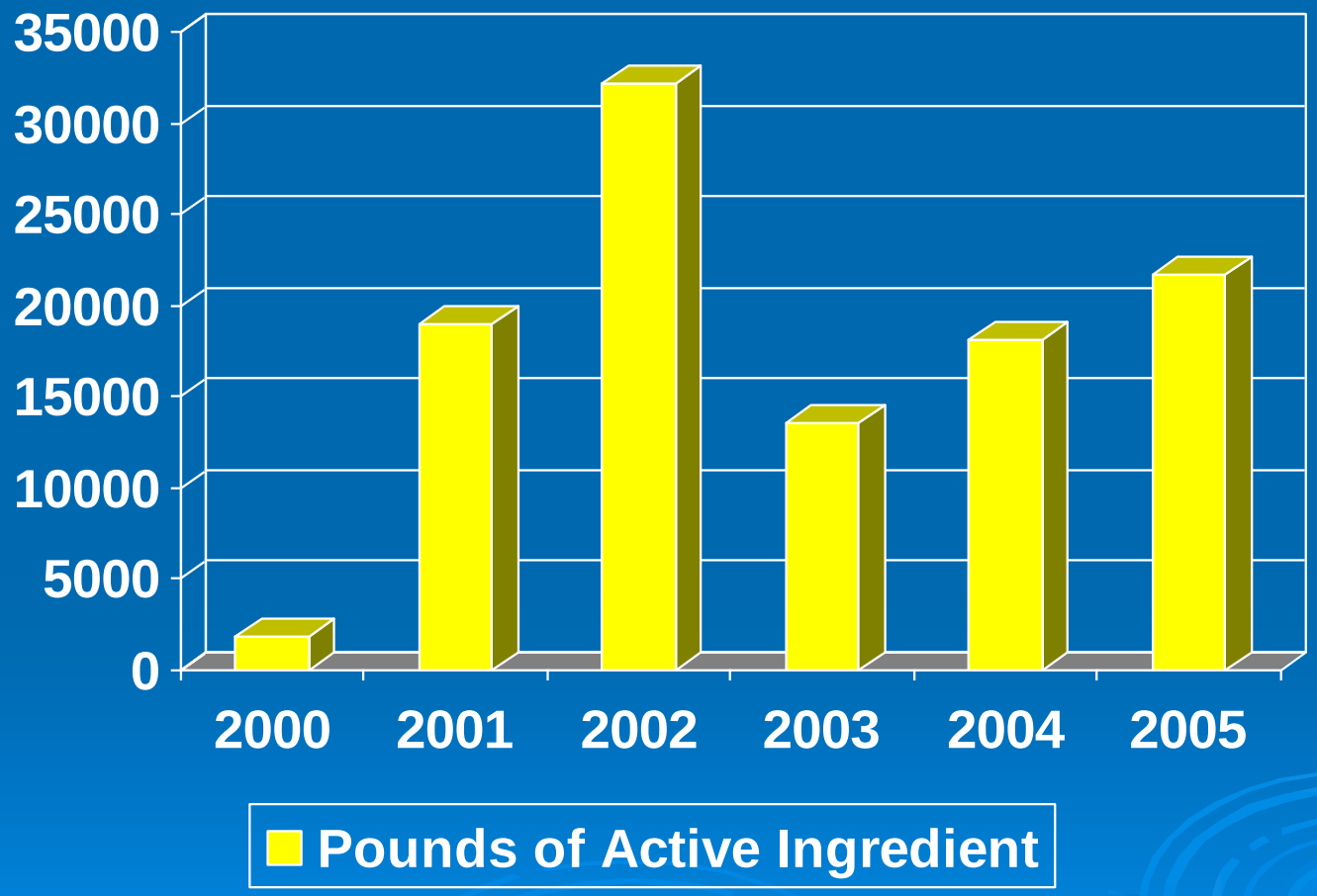
- Half-life in oxygenated soils = 188 days; 18-22 days in anaerobic soils; 1-5 days in aerobic aquatic conditions
- Forms metabolites much more toxic (to fish) than the parent compound Fipronil:
  - Degrades in anaerobic soils to Fipronil Sulfide
  - Degrades in aerobic soils to Fipronil Sulfone
  - Photodegrades in water quickly to Fipronil Disulfinyl (1/2 life - 0.33 days)

Aquatic Toxicity of Fipronil and Metabolites (μg/L)

Organism	Test	Fipronil	Fipronil Desulfinyl	Fipronil Sulfone	Fipronil Sulfide
Ceriodaphnia dubia	48-hr LC_{50}	17.7	355		
Americamysis bahia	96-hr LC_{50}	0.14	1.5		
Rainbow Trout	96-hr LC_{50}	250	31	39	
Bluegill	96-hr LC_{50}	83	20	25	

Source - DPR

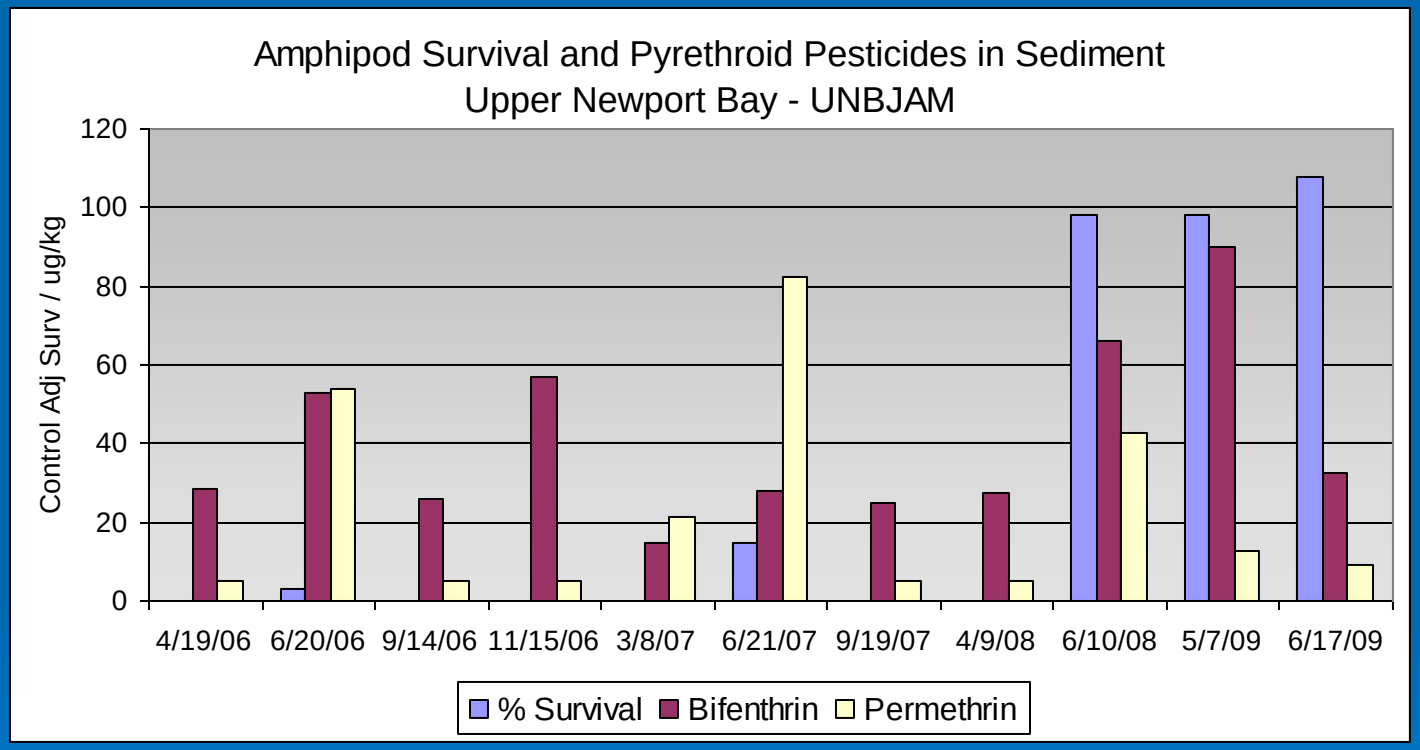
Fipronil Sales in California



Current Issues

- Finding a laboratory which can analyze Fipronil in stormwater at a **reasonable** price
- Attaining laboratory reporting limits for synthetic pyrethroids below literature values of LC_{50}s for common toxicity testing organisms
- Finding consistency between toxicity testing results and concentrations of pyrethroid pesticides in water and sediment

Example of Inconsistency between Toxicity Testing and Chemistry



LC_{50}s for *Eohaustorius estuarius* - Source: Dr. Brian Anderson UC Davis

Bifenthrin - 7.9 ug/kg ; Permethrin -140.1 ug/kg

Additional Data