RIFA Insecticides and Other Organophosphates: Use Pattern, Concentration and Toxicity in Runoff Water, Source Identification, and Mitigation Measures

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el modeno Gardens

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Santa Ana RWQCB, Costa Mesa

dpr

Outline

- Introduction
- Monitoring
- Runoff
- Sources
- Mitigation
- Conclusions

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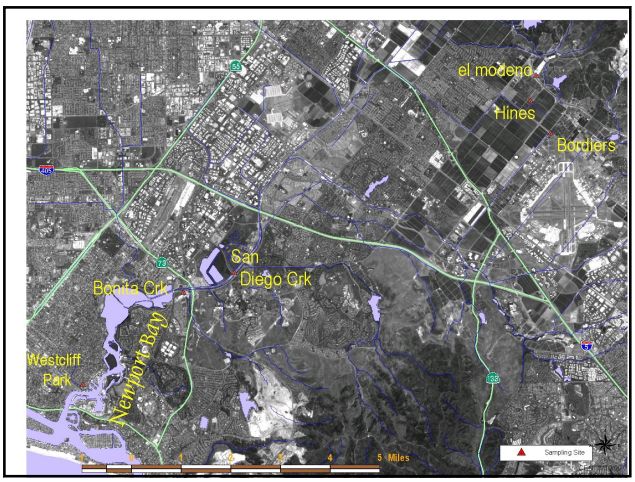
The Insecticides: RIFA

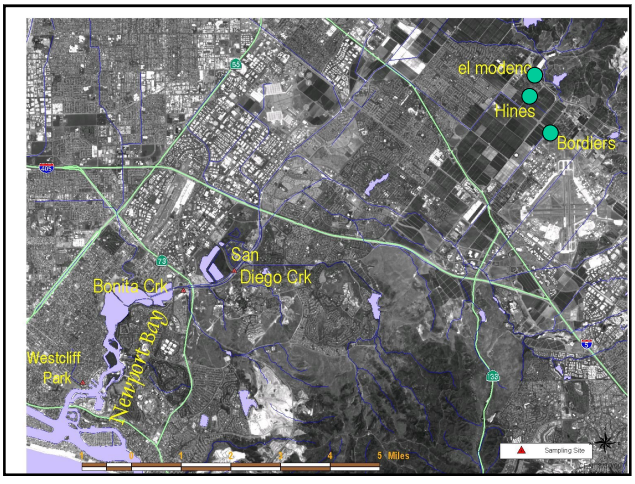
- Bifenthrin (Talstar®)
- Chlorpyrifos (Dursban®)
- Fenoxycarb (Award®)
- Hydramethylnon (Amdro®)
- Pyriproxyfen (Distance®)
- Diazinon

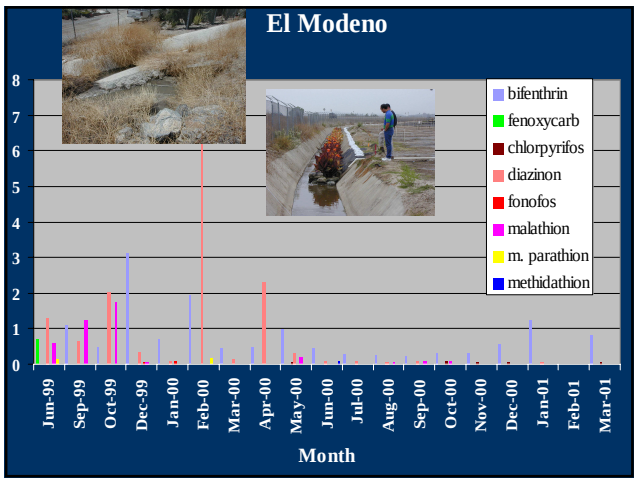
Aquatic Toxicity (LC50 ppb)

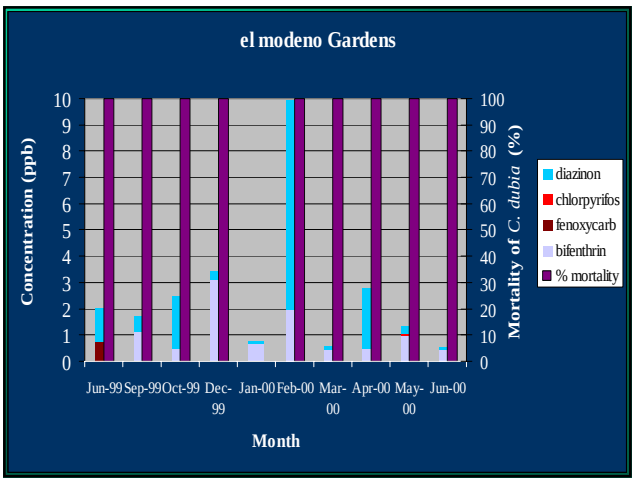
Chemical	R. Trout	D. magna	C. dubia
Bifenthrin	0.15	0.16	0.078
Chlorpyrifos	3	1.7	0.13
Diazinon	2600	0.96	0.51
Fenoxycarb	1600	400	na
Hydramethylnon	160	1140	na
Malathion	170	1.8	1.14
Pyriproxyfen	>325	400	na

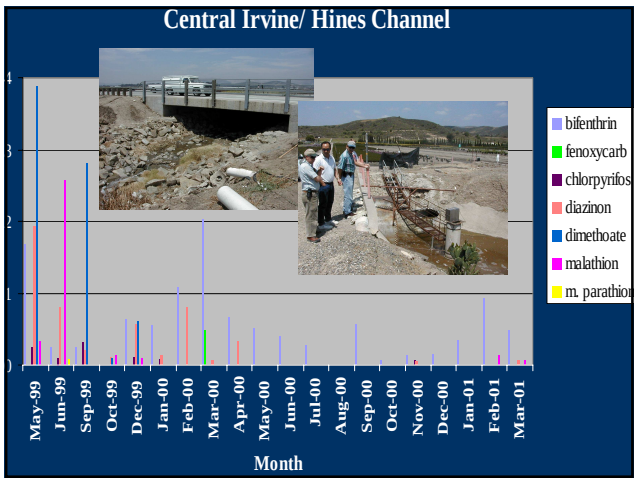


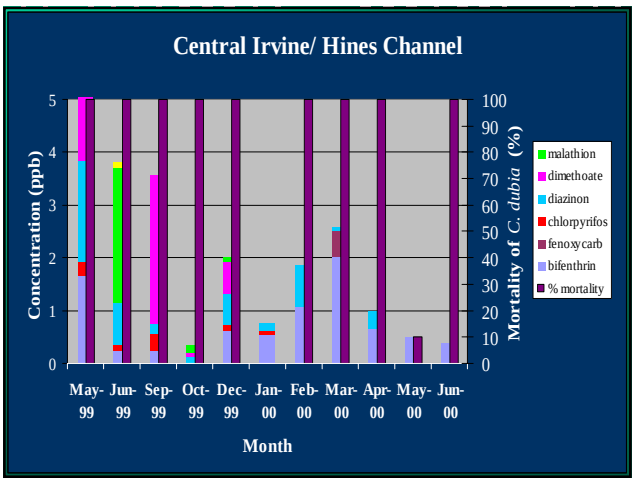
Irrigation Runoff: base flow

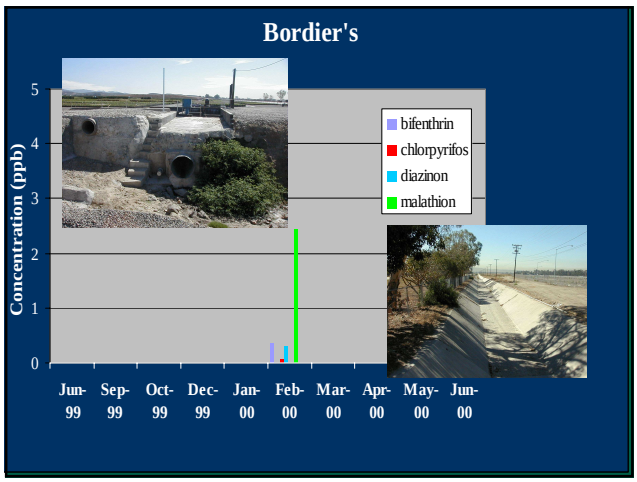


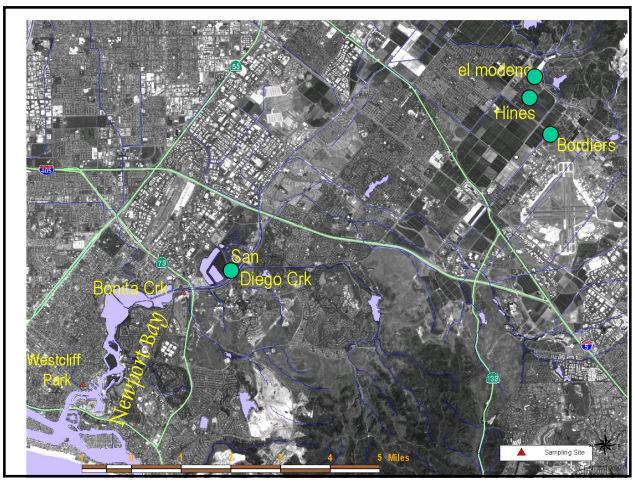

El Modeno
bifenthrin
fenoxycarb
chlorpyrifos
diazinon
fonofos
malathion
m. parathion
methidathion
Month

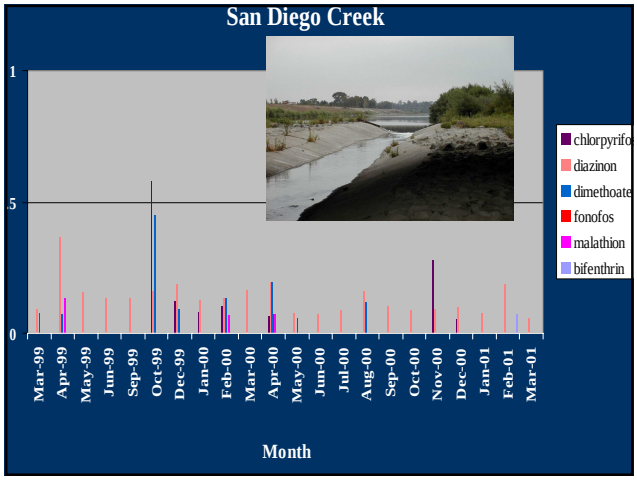

el modeno Gardens
Concentration (ppb)
Mortality of C. dubia (%)
diazinon
chlorpyrifos
fenoxycarb
bifenthrin
% mortality
Month

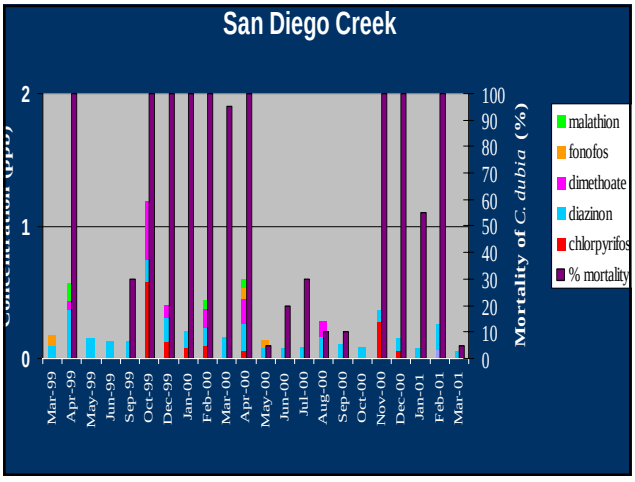

Central Irvine/ Hines Channel
bifenthrin
fenoxycarb
chlorpyrifos
diazinon
dimethoate
malathion
Month

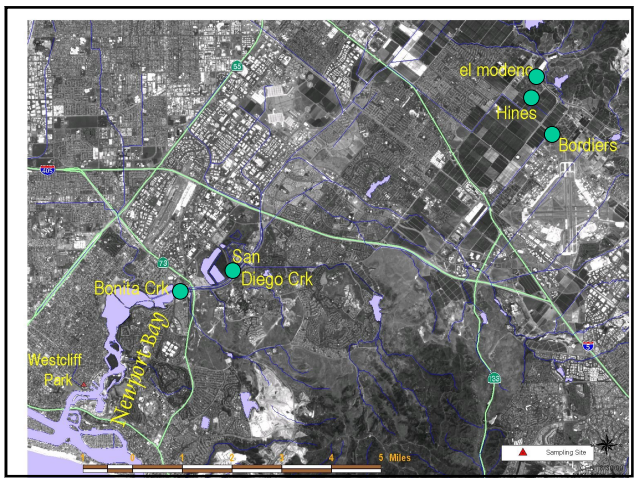

Central Irvine/ Hines Channel
Concentration (ppb)
Mortality of C. dubia (%)
malathion
dimethoate
diazinon
chlorpyrifos
fenoxycarb
bifenthrin
% mortality
Month

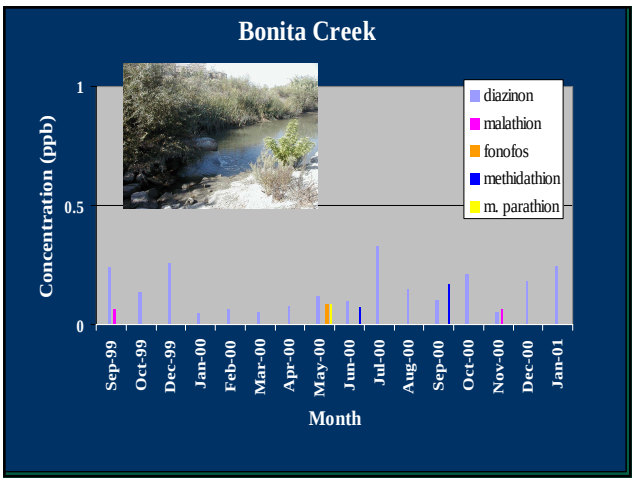

Bordier's
Concentration (ppb)
0
1
2
3
4
5
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
bifenthrin
chlorpyrifos
diazinon
malathion

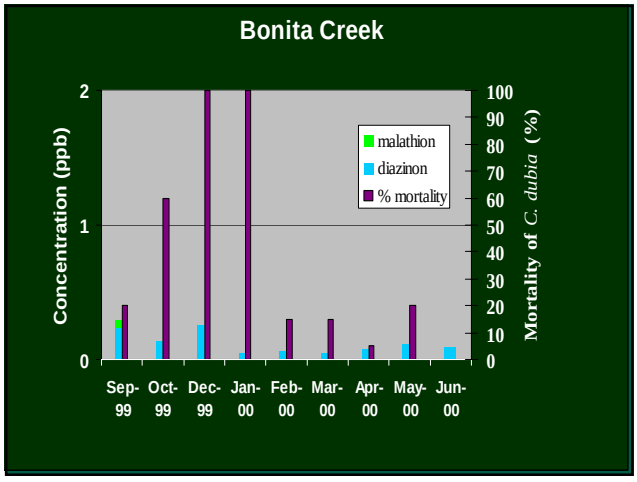

el modeno
Hines
Bordiers
San
Diego Crk
Bonita Crk
Newport Bay
Westcliff
Park
5 Miles
Sampling Site

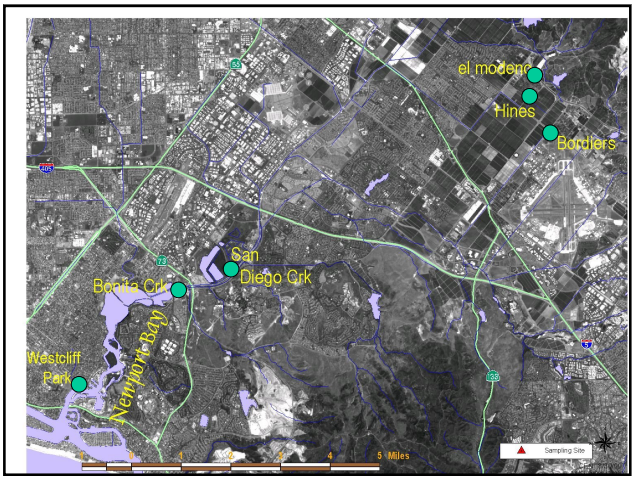

San Diego Creek
0
5
1
Mar-99
Apr-99
May-99
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Feb-01
Mar-01
Month
chlorpyrifos
diazinon
dimethoate
fonofos
malathion
bifenthrin

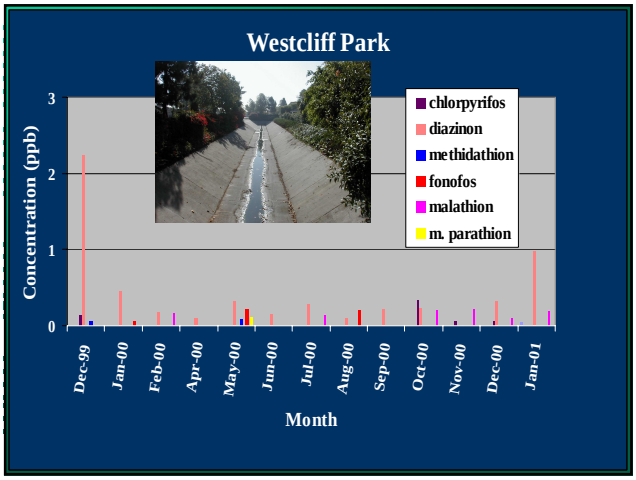

San Diego Creek
0
1
2
0
10
20
30
40
50
60
70
80
90
100
Mortality of C. dubia (%)
malathion
fonofos
dimethoate
diazinon
chlorpyrifos
% mortality

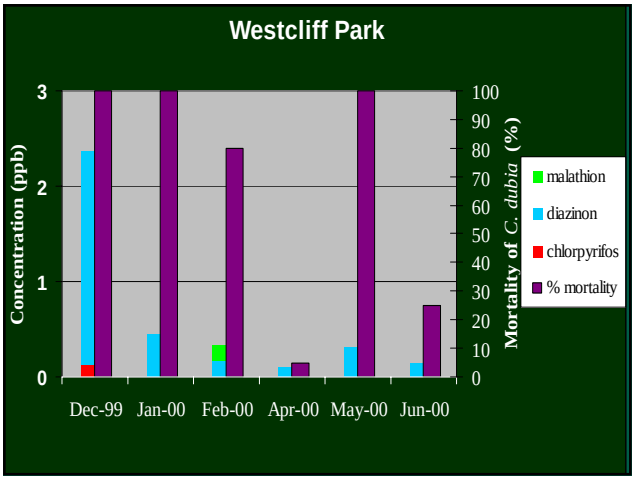

el modeno
Hines
Borders
San
Diego Crk
Bonita Crk
Newport Bay
Westcliff
Park
5 Miles
Sampling Site


Bonita Creek
Concentration (ppb)
1
0.5
0
diazinon
malathion
fonofos
methidathion
m. parathion
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Month

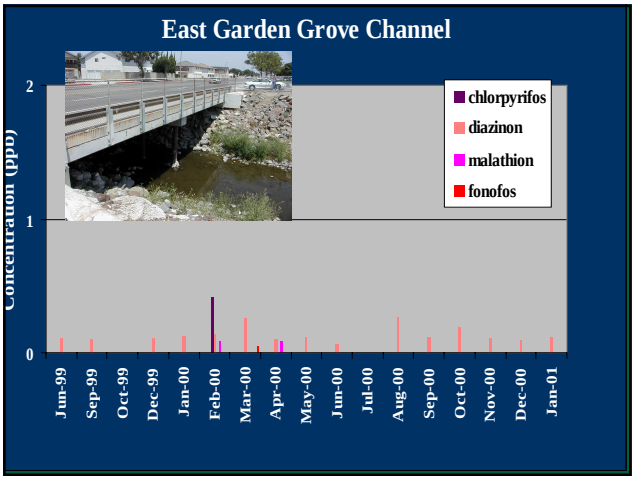

Bonita Creek
Concentration (ppb)
2
1
0
100
90
80
70
60
50
40
30
20
10
0
Mortality of C. dubia (%)
malathion
diazinon
% mortality
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00

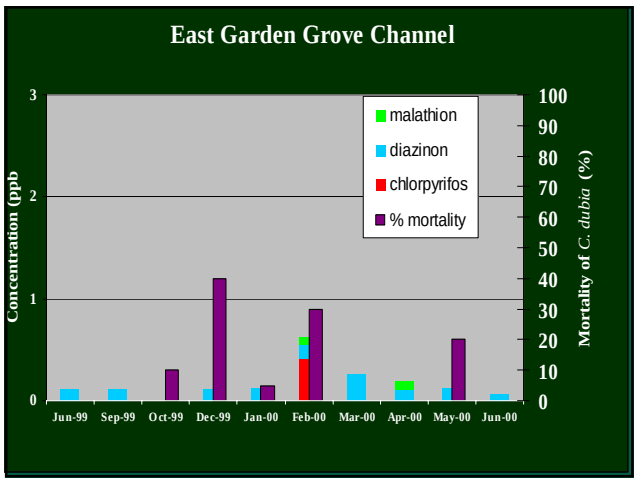

el modeno
Hines
Borders
San
Diego Crk
Bonita Crk
Newport Bay
Westcliff
Park
5 Miles
Sampling Site

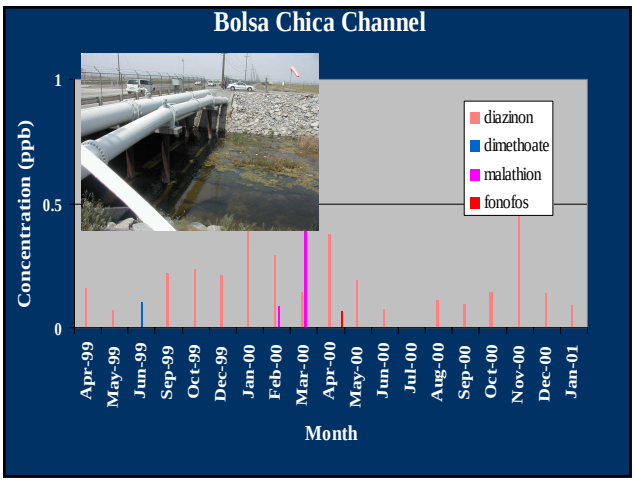

Westcliff Park
Concentration (ppb)
0
1
2
3
Dec-99
Jan-00
Feb-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Month
chlorpyrifos
diazinon
methidathion
fonofos
malathion
m. parathion

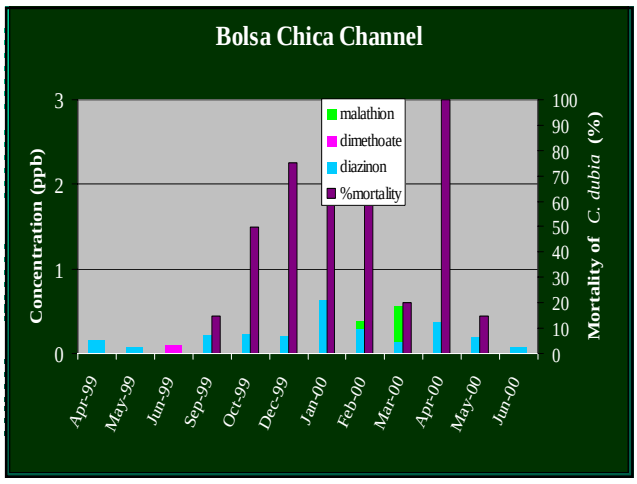

Westcliff Park
Concentration (ppb)
0
1
2
3
Mortality of C. dubia (%)
0
10
20
30
40
50
60
70
80
90
100
Dec-99
Jan-00
Feb-00
Apr-00
May-00
Jun-00
malathion
diazinon
chlorpyrifos
% mortality

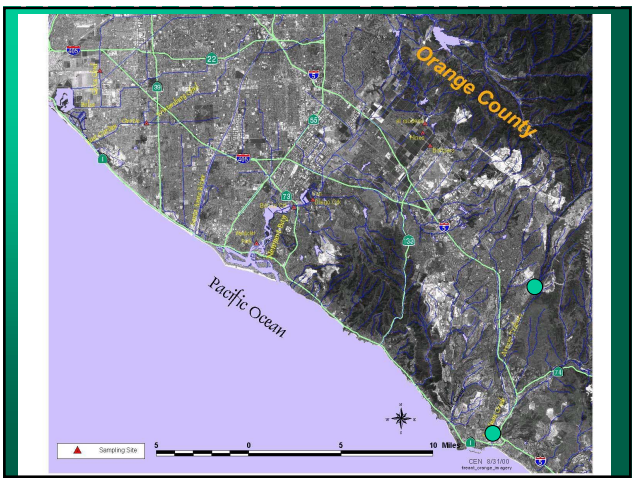
Orange County
Pacific Ocean
Sampling Site
5
0
5
10 Miles

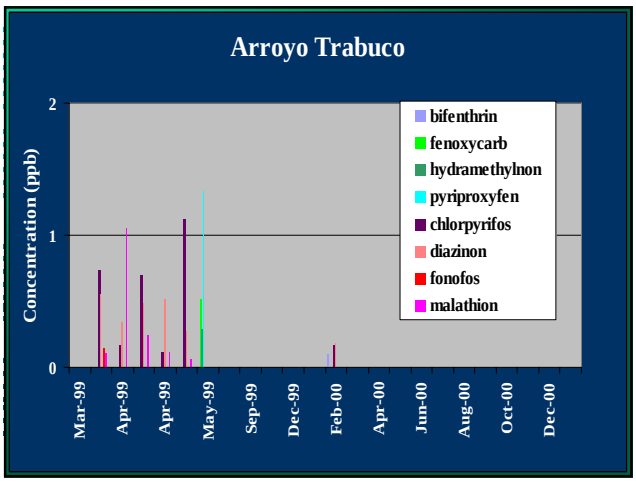

East Garden Grove Channel
Concentration (ppb)
0
1
2
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
chlorpyrifos
diazinon
malathion
fonofos

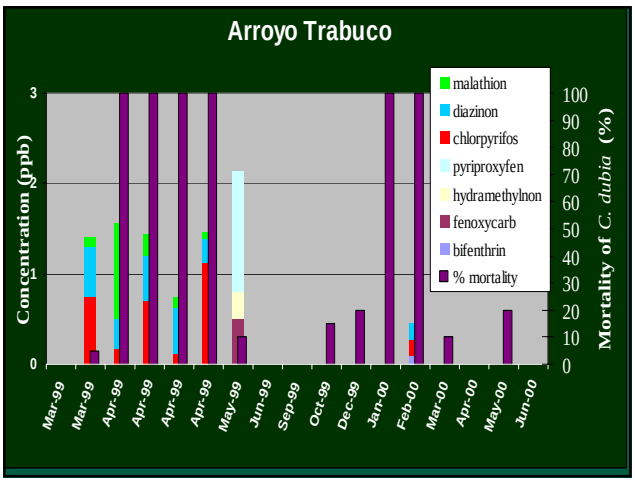

East Garden Grove Channel
Concentration (ppb)
Mortality of C. dubia (%)
malathion
diazinon
chlorpyrifos
% mortality
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00

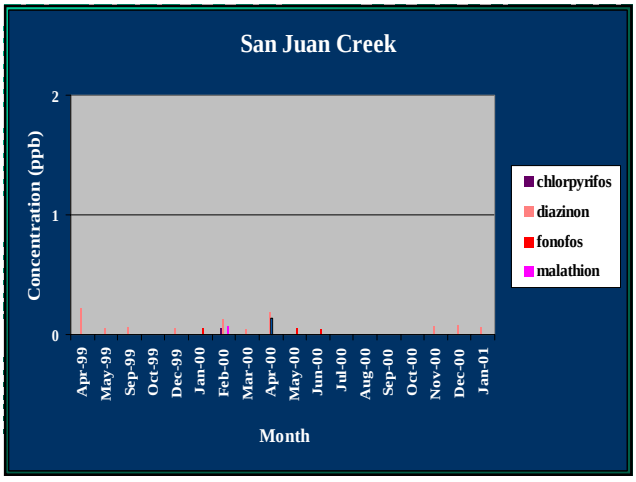

Bolsa Chica Channel
Concentration (ppb)
diazinon
dimethoate
malathion
fonofos
Apr-99
May-99
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Month

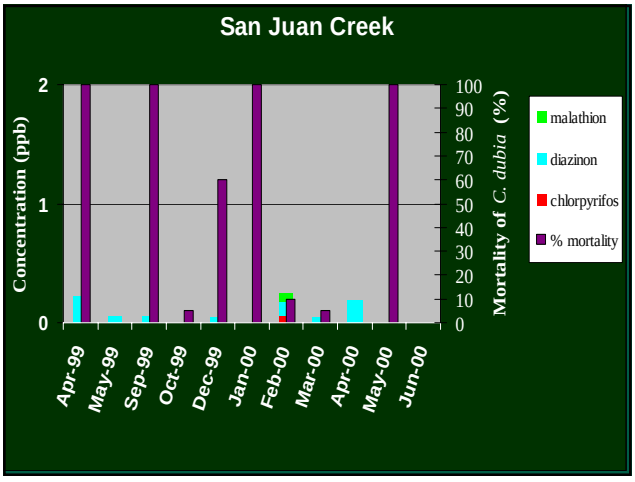

Bolsa Chica Channel
Concentration (ppb)
Mortality of C. dubia (%)
malathion
dimethoate
diazinon
%mortality
Apr-99
May-99
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00


Orange County
Pacific Ocean
Sampling Site
10 Miles

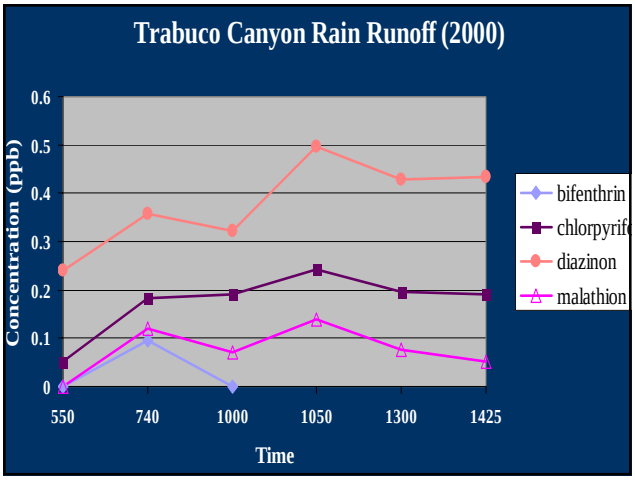

Arroyo Trabuco
Concentration (ppb)
2
1
0
bifenthrin
fenoxycarb
hydramethylnon
pyriproxyfen
chlorpyrifos
diazinon
fonofos
malathion
Mar-99
Apr-99
Apr-99
May-99
Sep-99
Dec-99
Feb-00
Apr-00
Jun-00
Aug-00
Oct-00
Dec-00

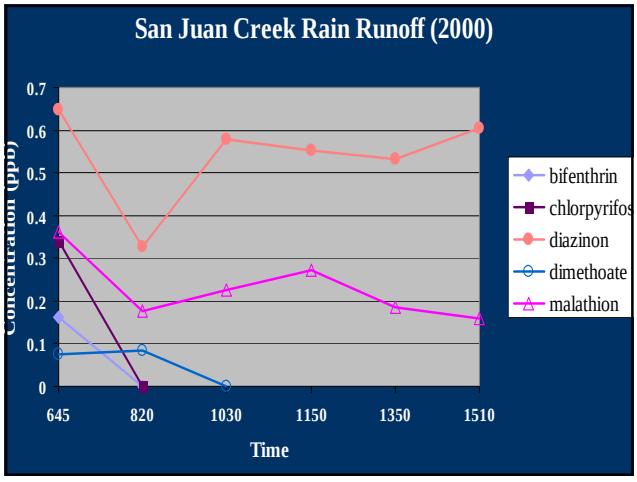

Arroyo Trabuco
Concentration (ppb)
3
2
1
0
Mortality of C. dubia (%)
100
90
80
70
60
50
40
30
20
10
0
malathion
diazinon
chlorpyrifos
pyriproxyfen
hydramethylnon
fenoxycarb
bifenthrin
% mortality
Mar-99
Mar-99
Apr-99
Apr-99
Apr-99
Apr-99
May-99
Jun-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00


San Juan Creek
Concentration (ppb)
2
1
0
chlorpyrifos
diazinon
fonofos
malathion
Apr-99
May-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Month

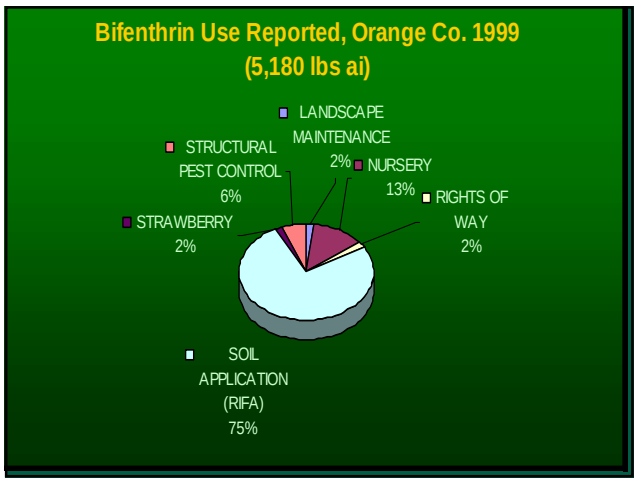

San Juan Creek
Concentration (ppb)
2
1
0
Mortality of C. dubia (%)
100
90
80
70
60
50
40
30
20
10
0
malathion
diazinon
chlorpyrifos
% mortality
Apr-99
May-99
Sep-99
Oct-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00

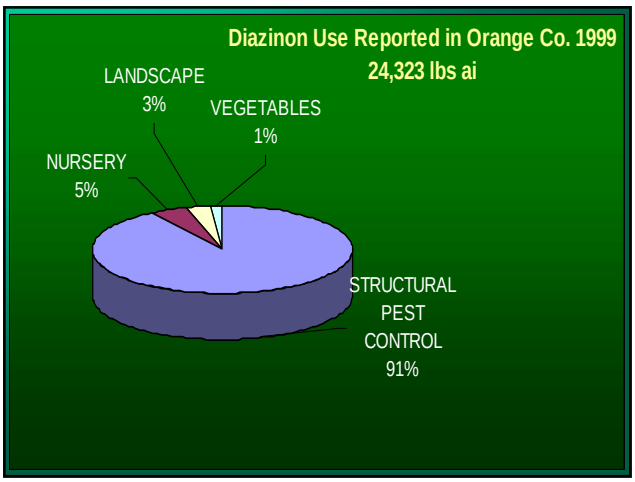
Storm Runoff

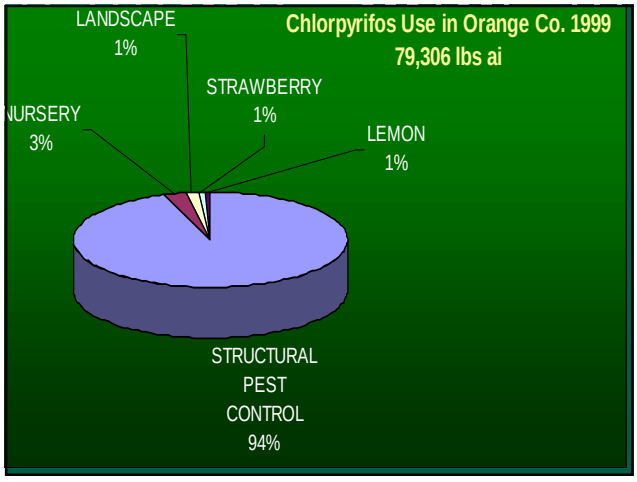


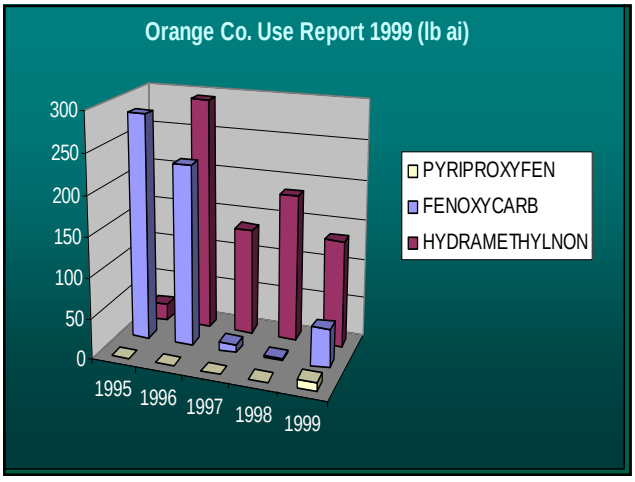


Insecticide Use Pattern

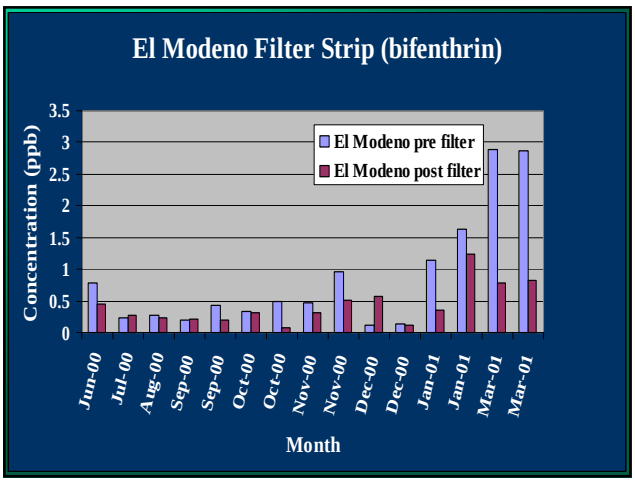

Bifenthrin Use Reported, Orange Co. 1999
(5,180 lbs ai)
LANDSCAPE MAINTENANCE 2%
NURSERY 13%
RIGHTS OF WAY 2%
STRUCTURAL PEST CONTROL 6%
STRAWBERRY 2%
SOIL APPLICATION (RIFA) 75%

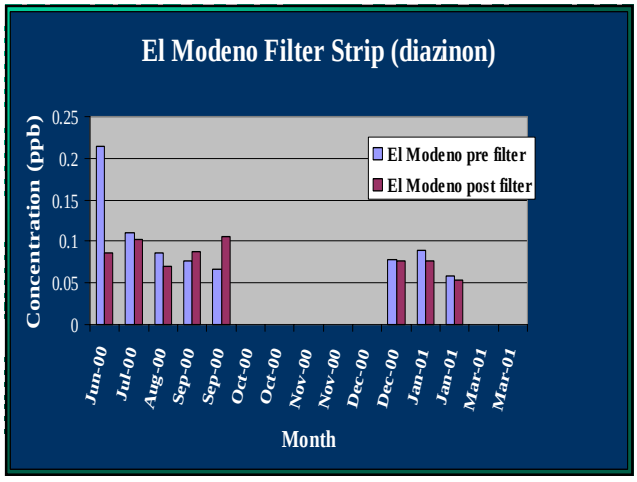

Diazinon Use Reported in Orange Co. 1999
24,323 lbs ai
LANDSCAPE 3%
VEGETABLES 1%
NURSERY 5%
STRUCTURAL PEST CONTROL 91%


Chlorpyrifos Use in Orange Co. 1999
79,306 lbs ai
LANDSCAPE 1%
STRAWBERRY 1%
LEMON 1%
NURSERY 3%
STRUCTURAL PEST CONTROL 94%


Orange Co. Use Report 1999 (lb ai)
300
250
200
150
100
50
0
1995
1996
1997
1998
1999
PYRIPROXYFEN
FENOXYCARB
HYDRAMETHYLNON

Mitigation





Conclusions

Detections

- Single detect: hydramethylnon, pyriproxyfen
- Nursery: Bifenthrin, Fenoxycarb, Diazinon, Chlorpyrifos, Malathion, Dimethoate
- Urban: Diazinon, Chlorpyrifos Malathion, Dimethoate

Toxicity

- **Nursery sites:**
  - **85%** Bifenthrin, Diazinon, Chlorpyrifos, Malathion
  - 8% unknown
  - 7% non toxic
- **Urban and integrated sites:**
  - **36% Diazinon, Malathion, Chlorpyrifos**
  - **36% Unknown Toxicity**
  - **28% Non Toxic**

Prevention & Mitigation

Insecticide Application
Irrigation Management
Water Recovery
Sediment Pond
Buffer Strip