Sediment Assessment at the Mouths of Chollas Creek and Paleta Creek

Phase II Results

Temporal Patterns

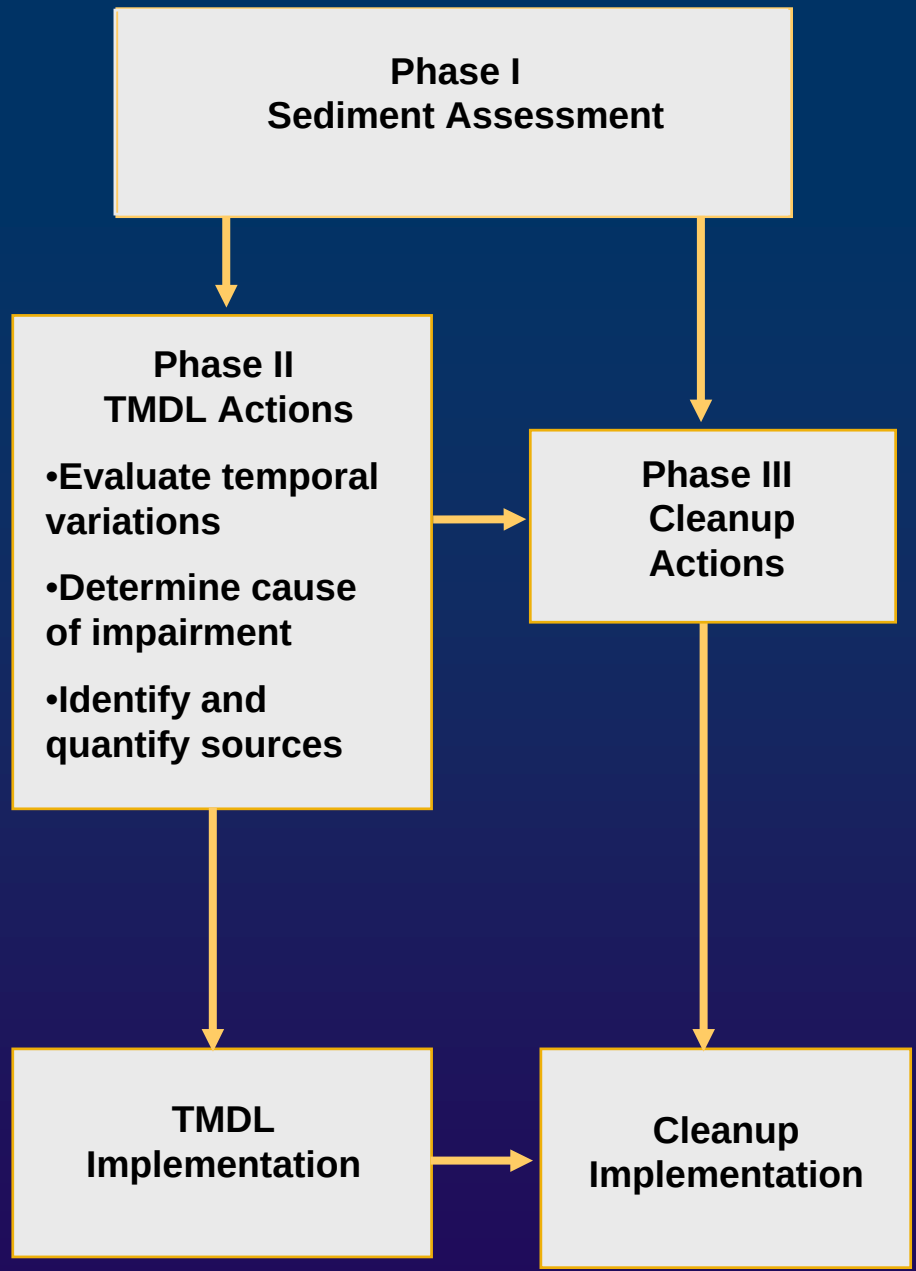
Toxicity Identification Evaluation

January 18, 2005

San Diego RWQCB

Program Framework

- Phase II actions provide information needed to develop TMDL and plan cleanup



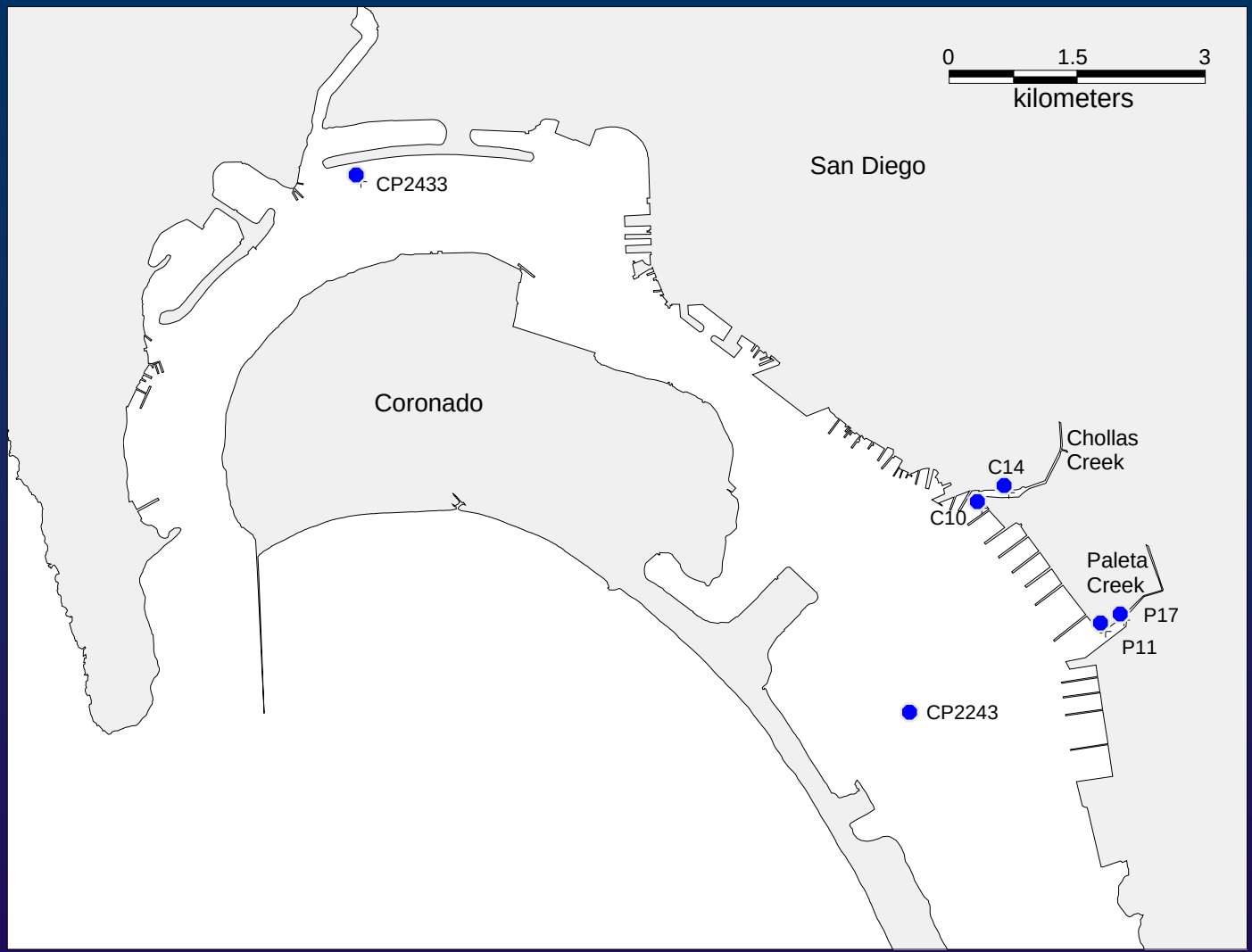
Temporal Study: Objectives

- Describe variability in sediment assessment indicators
  - Effect of wet vs. dry conditions
  - Reliability of indicators
- Confirm station assessment results
  - Are Phase I results representative?

Temporal Study: Methods

- Five sampling events
  - July/August 2001(Phase I samples)
  - Nov. 2001
  - Feb., June, Oct. 2002
- Six stations
  - 2 each from reference, Chollas, and Paleta areas
- Sediment quality triad indicators
  - Sed. Chemistry, toxicity, benthos

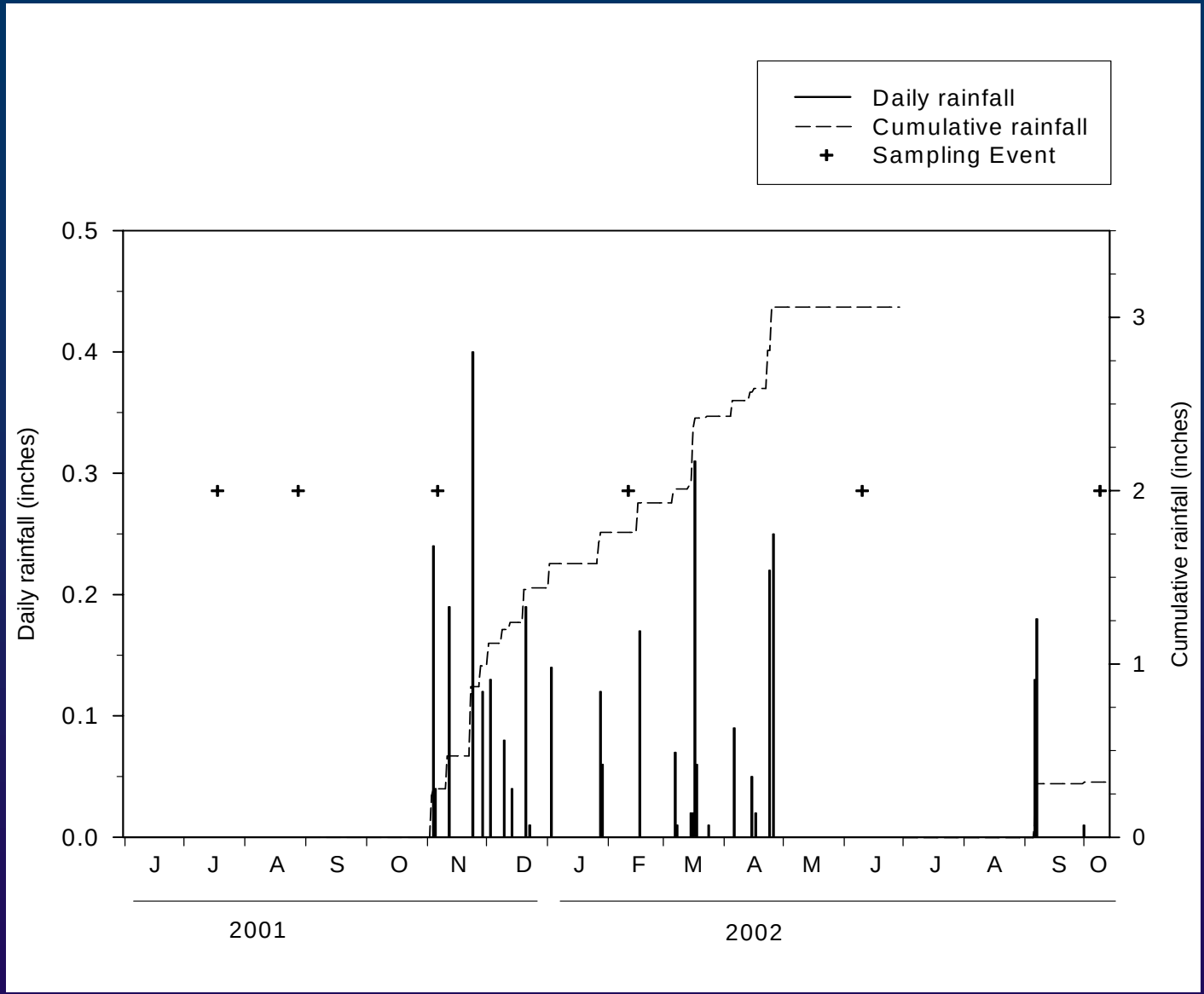
Stations


0
1.5
3
kilometers
San Diego
CP2433
Coronado
Chollas
Creek
C14
C10
Paleta
Creek
P17
P11
CP2243

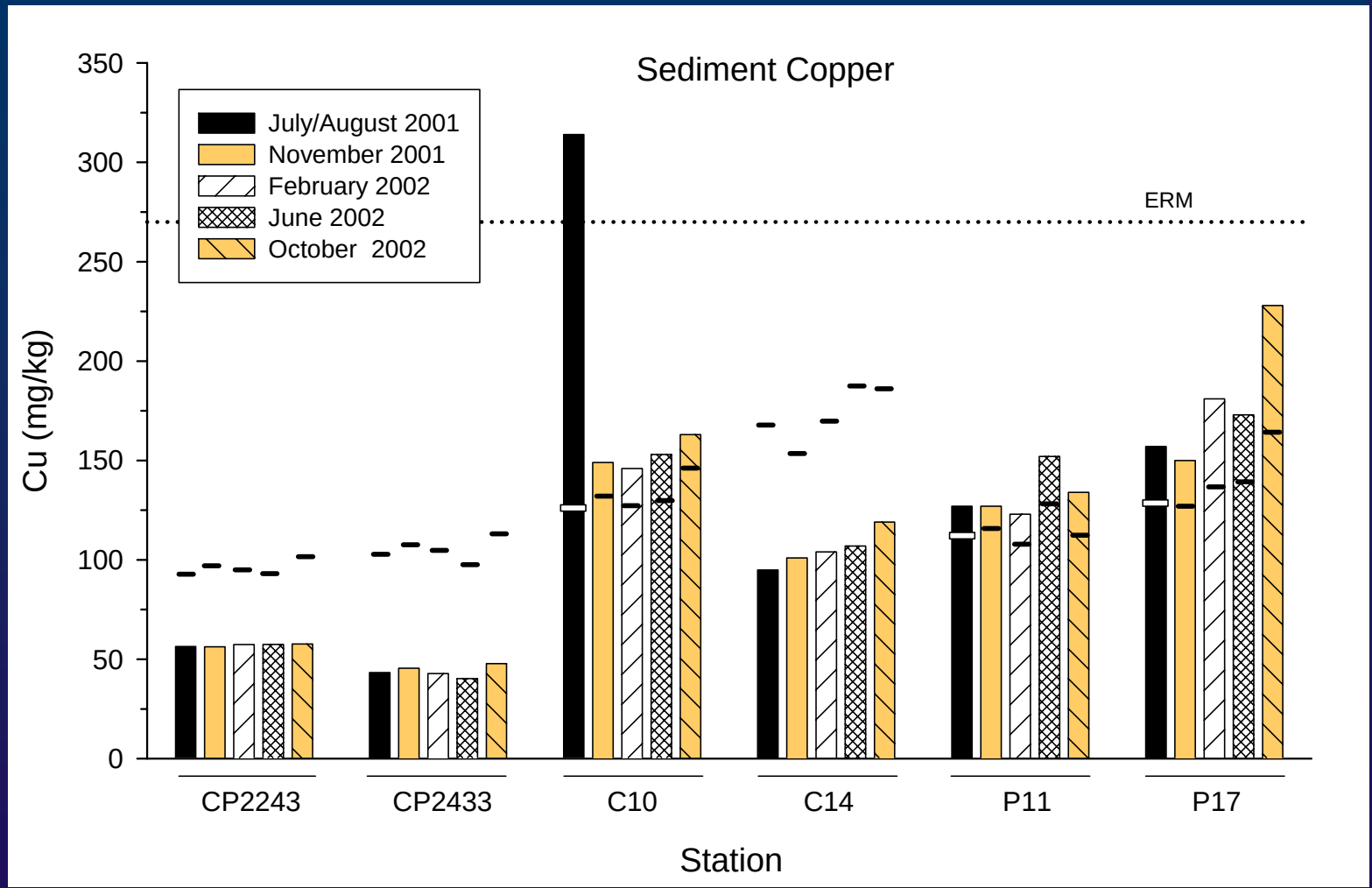
Temporal Study: Analytes

- Sediment chemistry
  - Metals, grain size
  - PAHs, DDTs, Chlordanes, PCBs
- Toxicity
  - Amphipod survival, sea urchin development (interface), sea urchin fertilization (pore water)
- Benthic community
  - Abundance, taxa, diversity, benthic response index

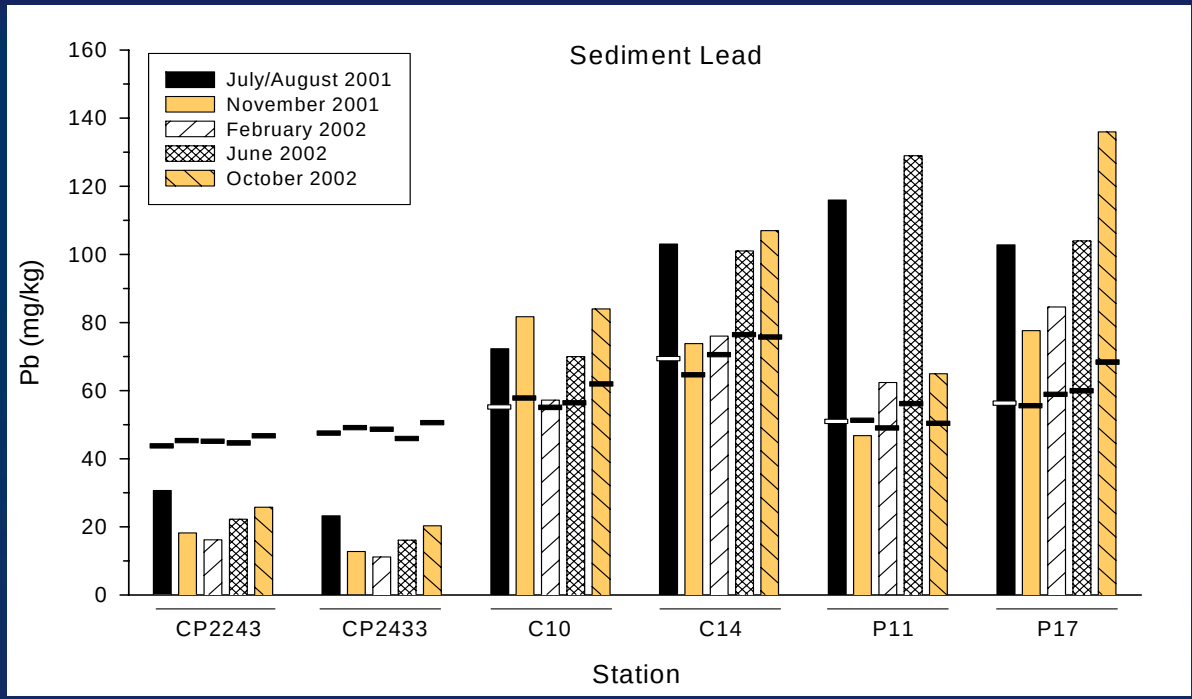
Rainfall


Daily rainfall
Cumulative rainfall
Sampling Event
Daily rainfall (inches)
Cumulative rainfall (inches)
0.0
0.1
0.2
0.3
0.4
0.5
0
1
2
3
J J A S O N D J F M A M J J A S O
2001
2002

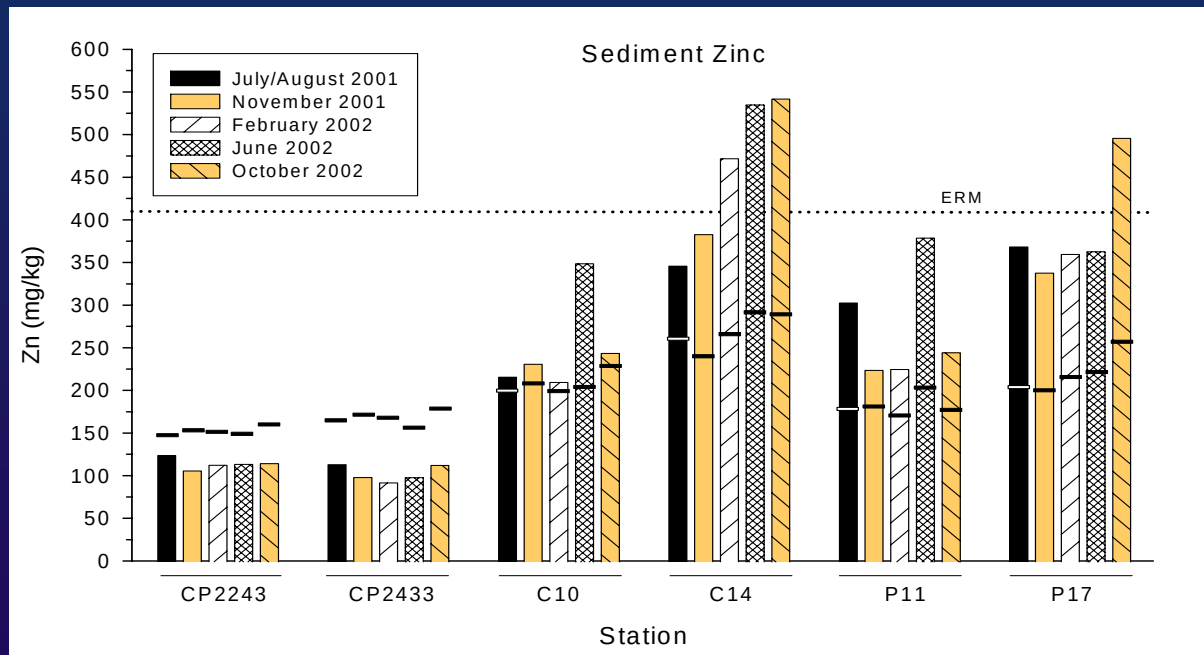
Sediment Chemistry



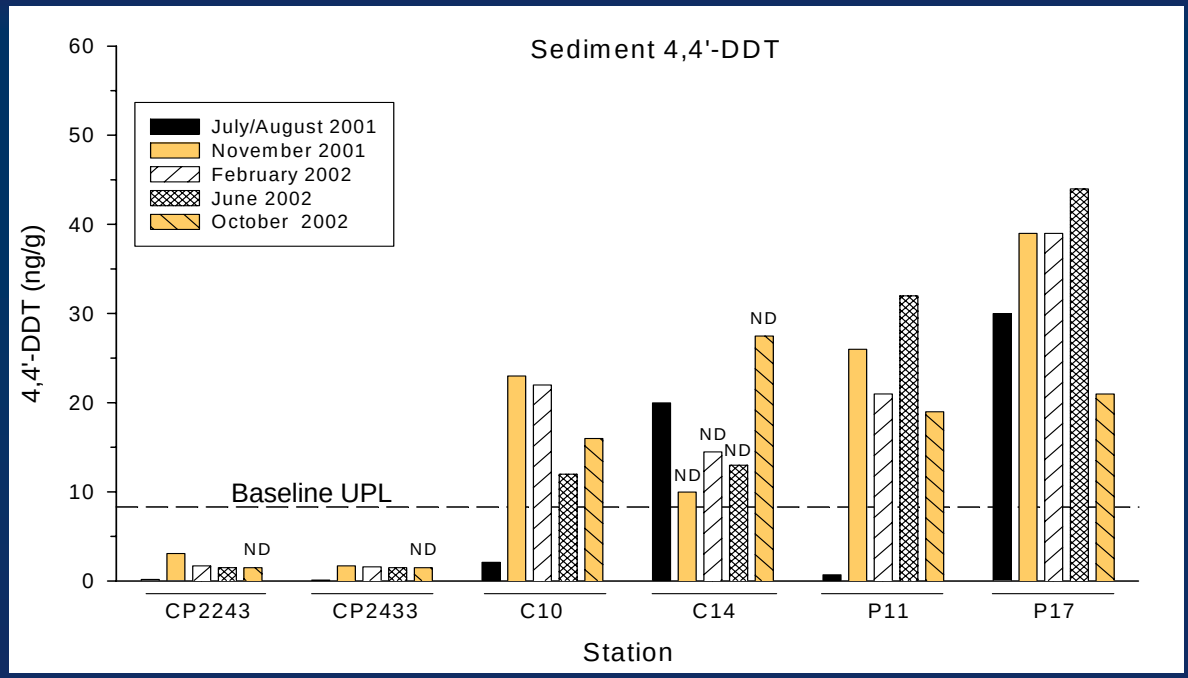
Lead


Sediment Lead
July/August 2001
November 2001
February 2002
June 2002
October 2002
Pb (mg/kg)
0
20
40
60
80
100
120
140
160
CP2243
CP2433
C10
C14
P11
P17
Station

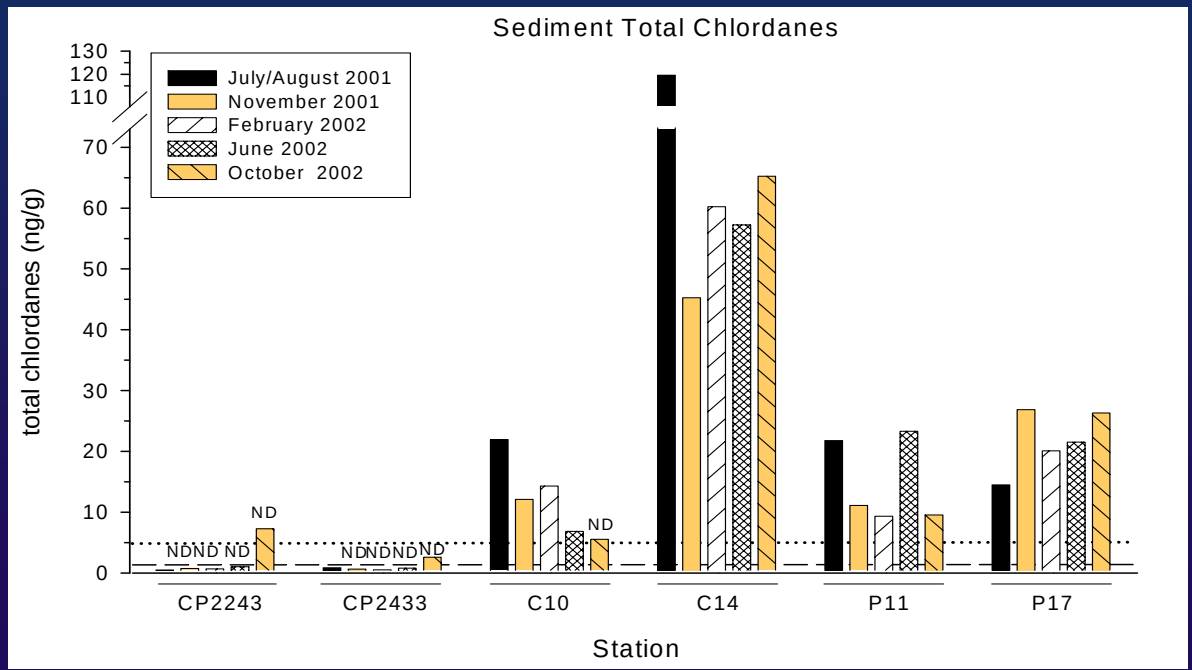
Zinc


Sediment Zinc
July/August 2001
November 2001
February 2002
June 2002
October 2002
ERM
Zn (mg/kg)
0
50
100
150
200
250
300
350
400
450
500
550
600
CP2243
CP2433
C10
C14
P11
P17
Station

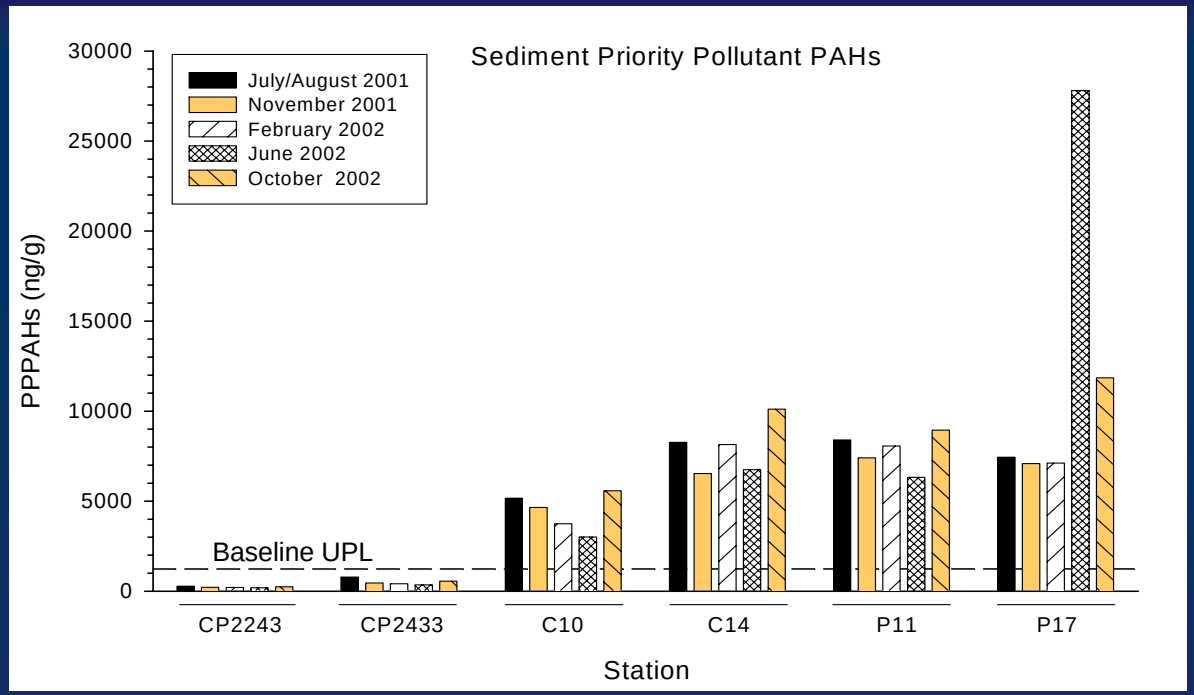
DDT



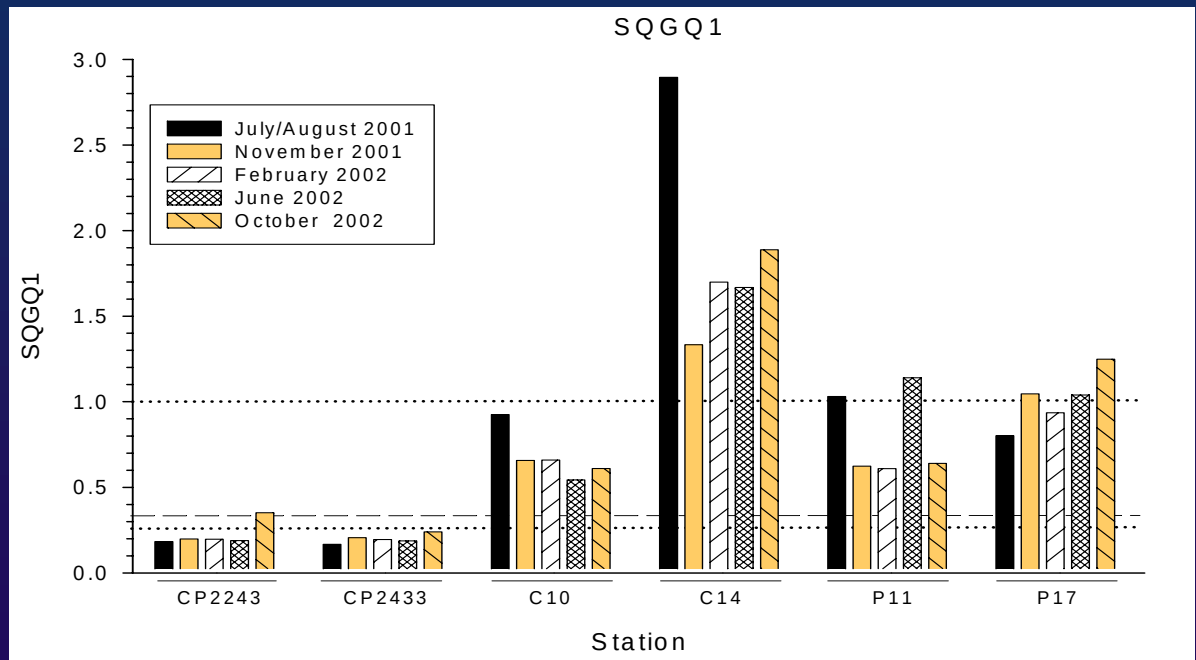
Chlordane



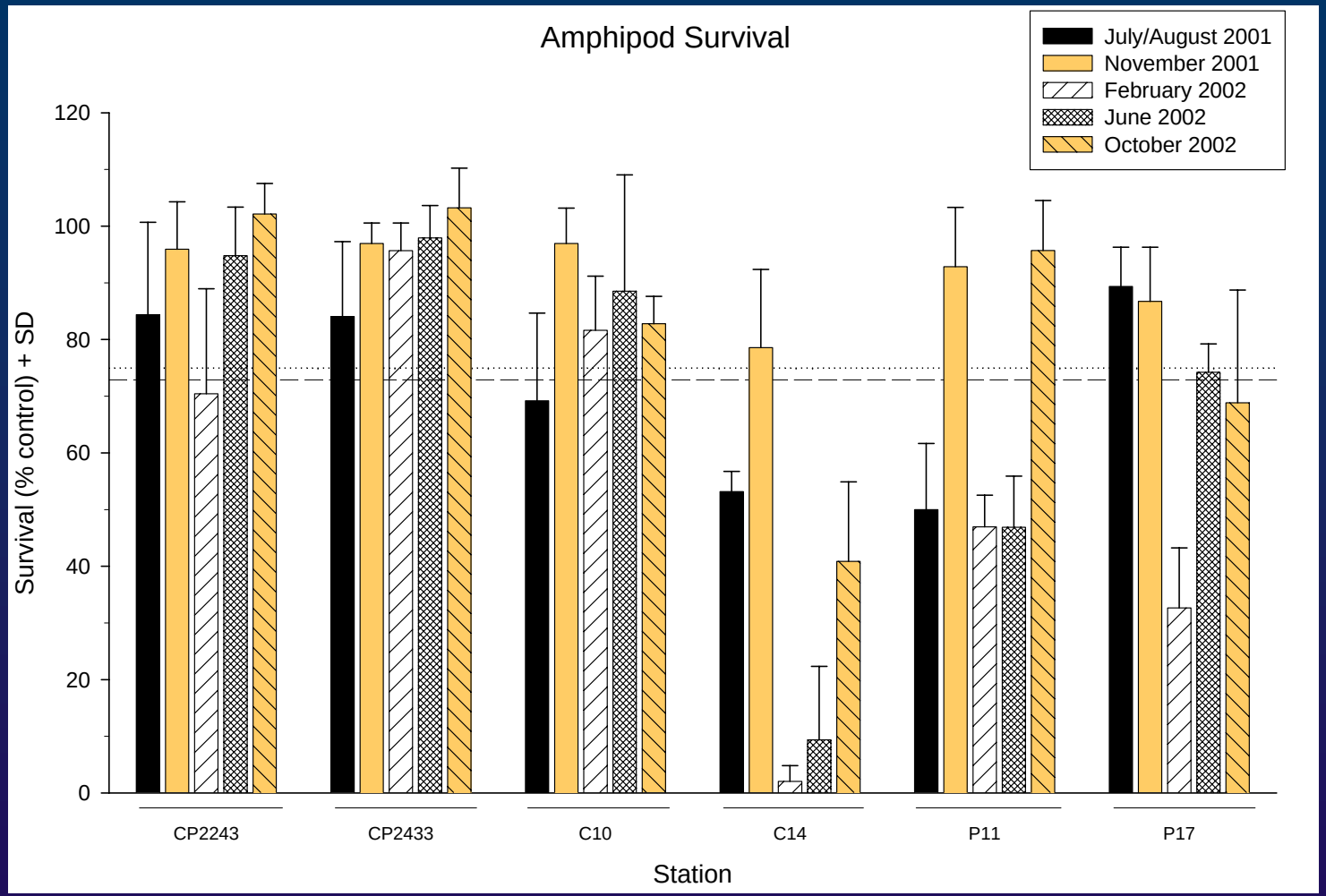
PAHs



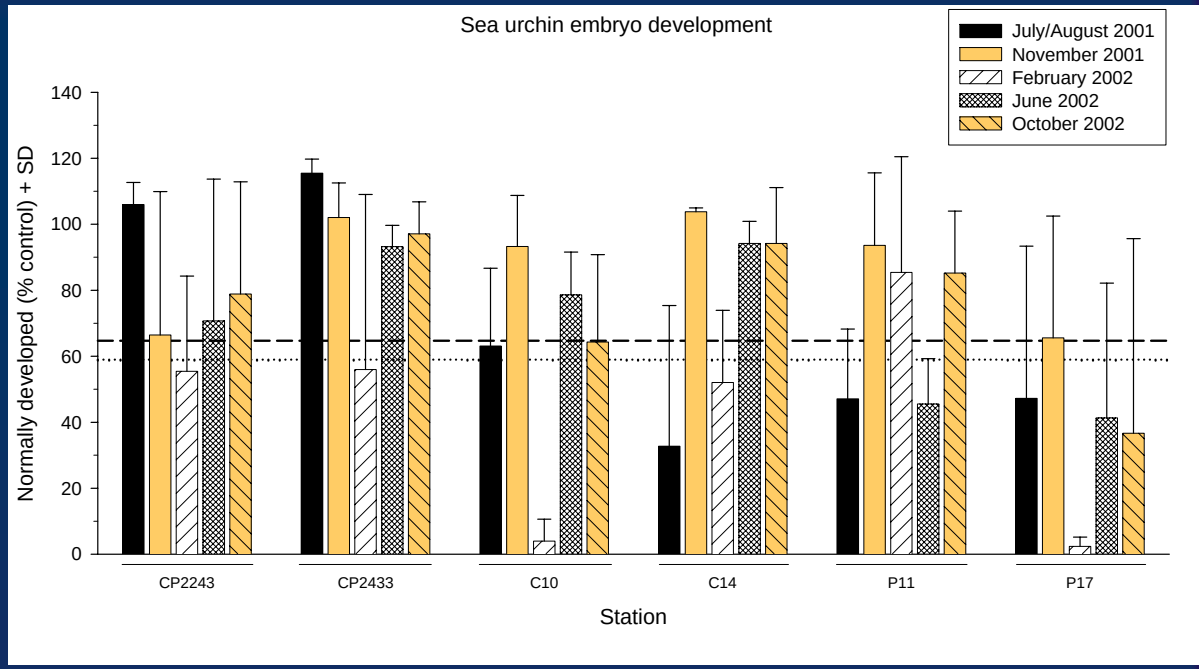
SQG Quotient



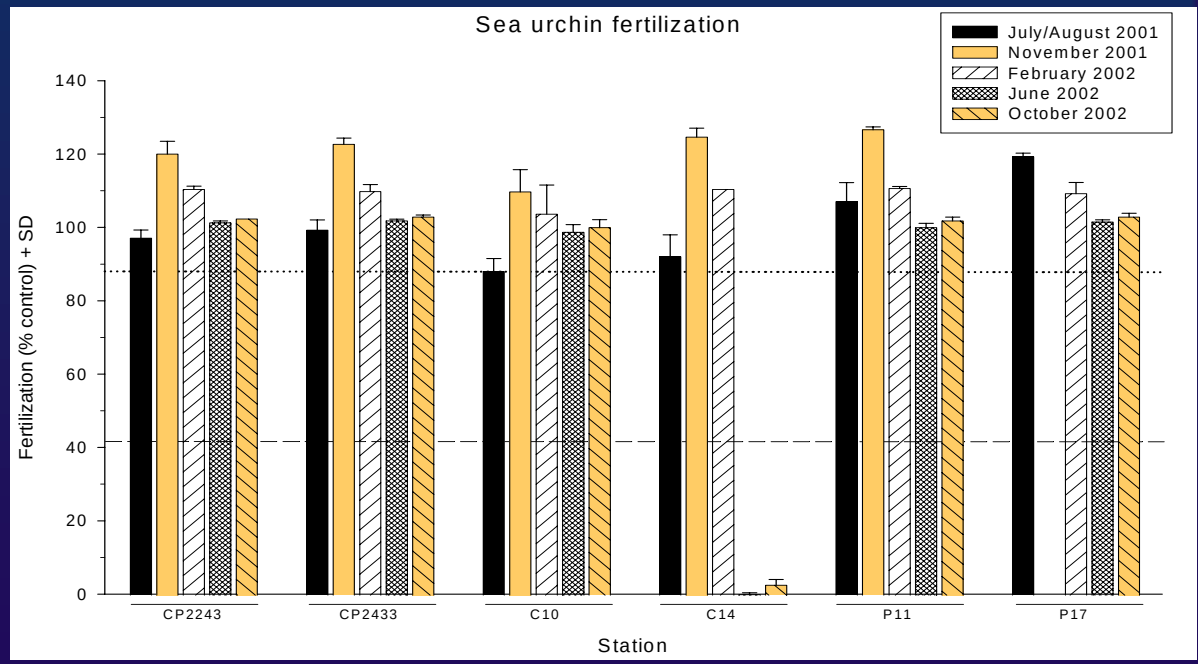
Sediment Toxicity



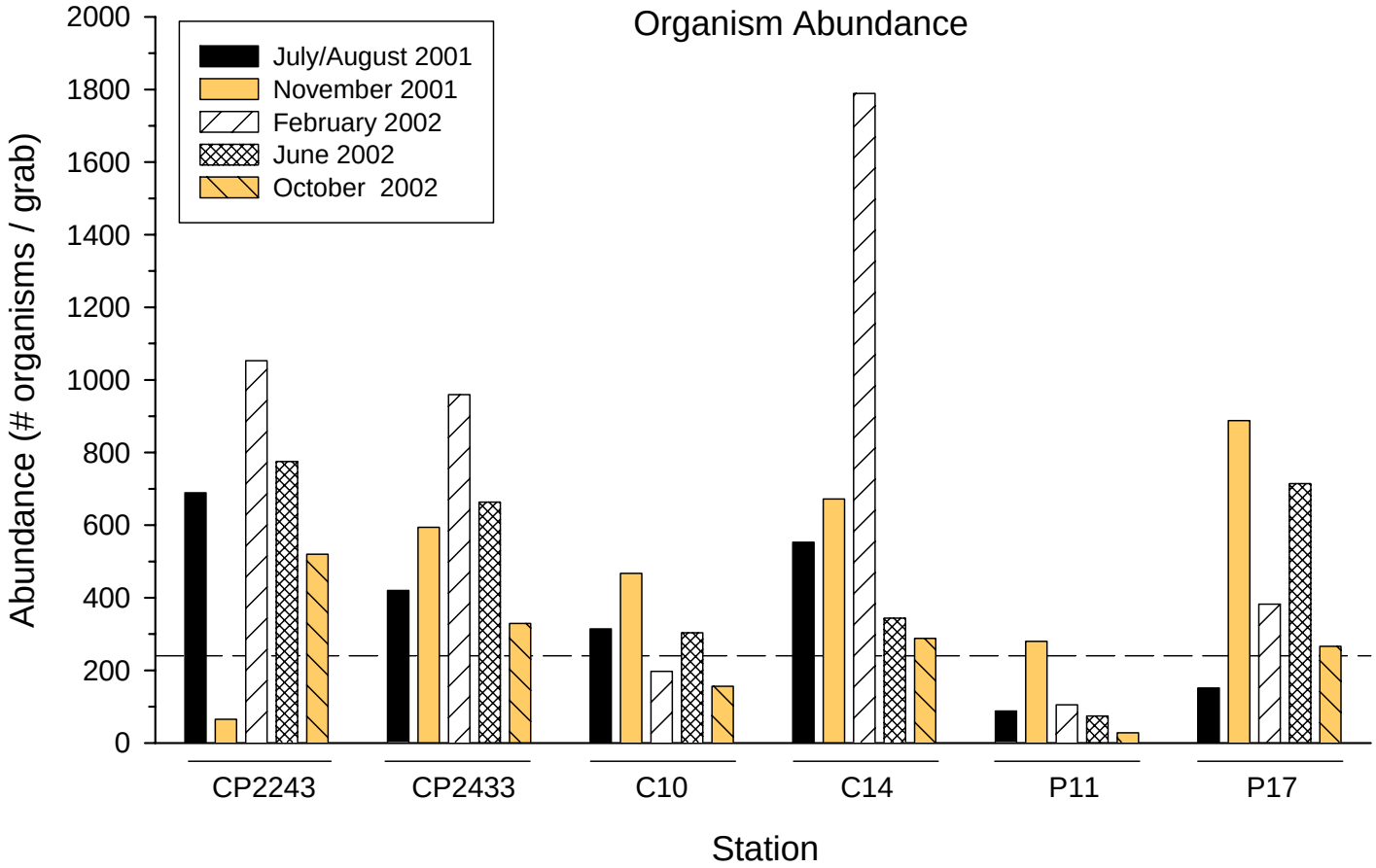
Sed.-Water Interface



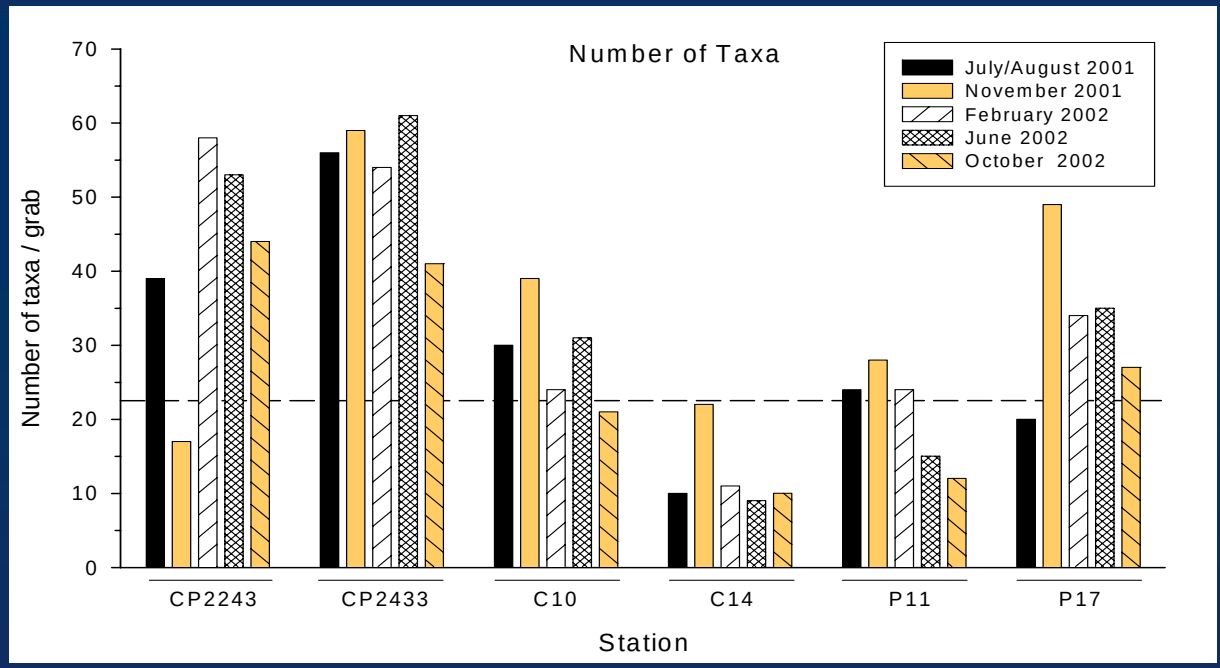
Pore Water



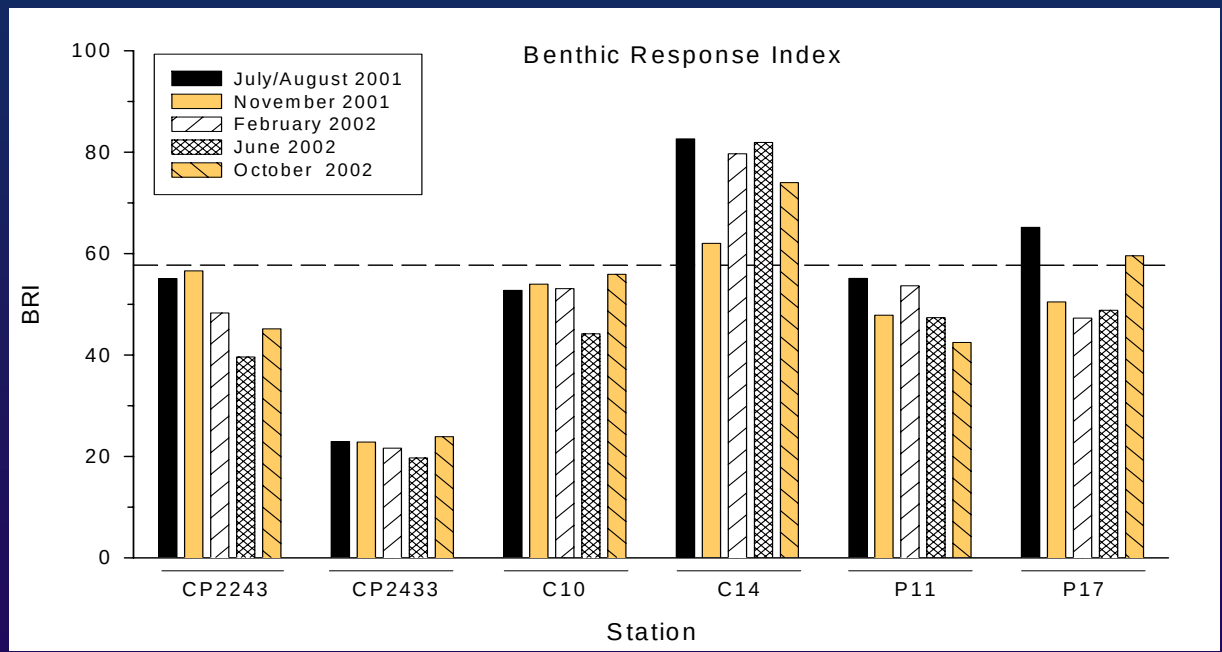
Benthic Community



Taxa


Number of Taxa
July/August 2001
November 2001
February 2002
June 2002
October 2002
Number of taxa / grab
0
10
20
30
40
50
60
70
CP2243
CP2433
C10
C14
P11
P17
Station

BRI


Benthic Response Index
July/August 2001
November 2001
February 2002
June 2002
October 2002
BRI
0
20
40
60
80
100
CP2243
CP2433
C10
C14
P11
P17
Station

Weight of Evidence Results: Reference

Station	Sampling Event	Chemistry	Toxicity	Benthos	Impairment?
CP2243	July/August 2001	○	○	○	Unlikely
CP2243	November 2001	○	○	◉	Unlikely
CP2243	February 2002	○	●	○	Unlikely
CP2243	June 2002	○	○	○	Unlikely
CP2243	October 2002	◉	○	○	Unlikely
CP2433	July/August 2001	○	○	○	Unlikely
CP2433	November 2001	○	○	○	Unlikely
CP2433	February 2002	○	○	○	Unlikely
CP2433	June 2002	○	○	○	Unlikely
CP2433	October 2002	○	○	○	Unlikely

Weight of Evidence Results: Chollas

Station	Sampling Event	Chemistry	Toxicity	Benthos	Impairment?
C10	July/August 2001	⊙	⊙	O	Possible
C10	November 2001	⊙	O	O	Unlikely
C10	February 2002	⊙	⊙	⊙	Likely
C10	June 2002	⊙	O	O	Unlikely
C10	October 2002	⊙	O	⊙	Possible
C14	July/August 2001	●	●	●	Likely
C14	November 2001	●	O	●	Likely
C14	February 2002	●	●	●	Likely
C14	June 2002	●	●	●	Likely
C14	October 2002	●	●	●	Likely

Weight of Evidence Results: Paleta

Station	Sampling Event	Chemistry	Toxicity	Benthos	Impairment?
P11	July/August 2001	●	●	⊙	Likely
P11	November 2001	⊙	O	O	Unlikely
P11	February 2002	⊙	●	⊙	Likely
P11	June 2002	●	●	⊙	Likely
P11	October 2002	⊙	O	⊙	Possible
P17	July/August 2001	⊙	⊙	●	Likely
P17	November 2001	●	⊙	O	Likely
P17	February 2002	⊙	●	O	Possible
P17	June 2002	●	⊙	O	Likely
P17	October 2002	●	⊙	⊙	Likely

Temporal Study Summary

- Variability among sampling events is present for most indicators
  - Chemistry more consistent than toxicity or benthos
  - Less variation for metals
  - BRI less variable than abundance or # taxa
- A seasonal pattern was not evident
  - Suggests current creek inputs not the driving factor
  - Low rainfall is a confounding factor
- Variability can influence station assessment
  - Stations with intermediate impairment show most variabilility
  - Assessment results more reliable when based on multiple samples/stations

Toxicity Identification Evaluation (TIE)

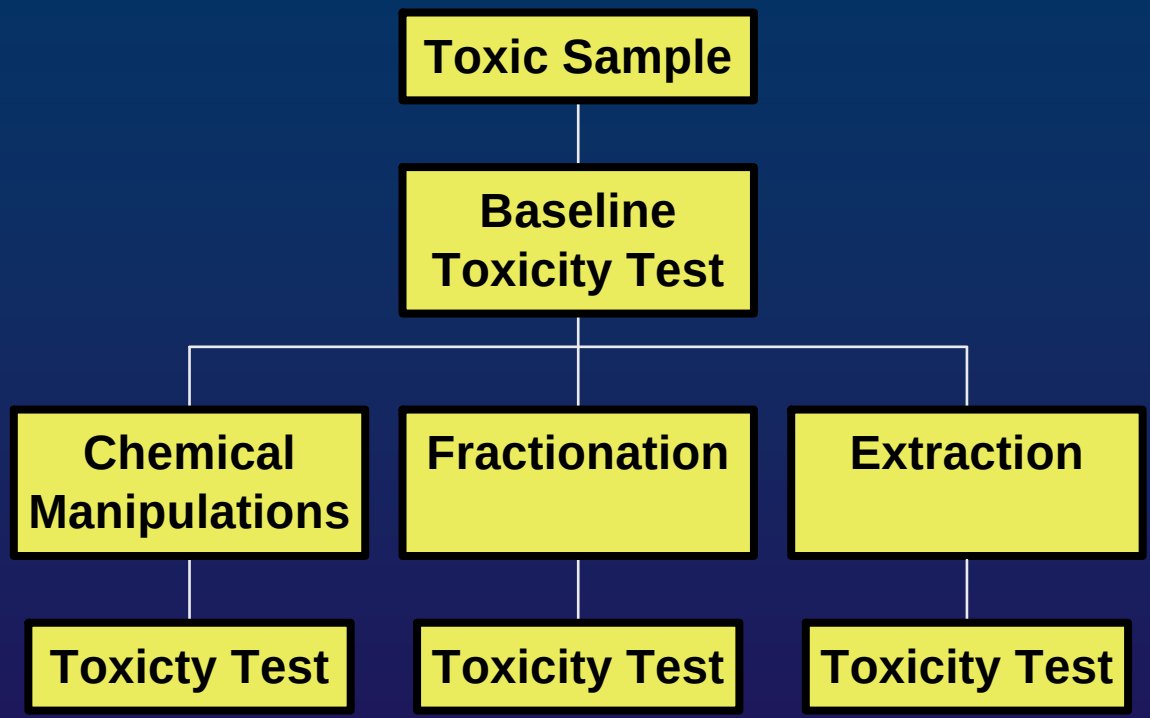
TIE: Objectives

- Determine if toxicity is due to sediment contaminants
  - Evaluate confounding factors
- Characterize likely contaminants
  - Metals vs. organics

TIE: Methods

- Two approaches
  - Whole sediment/amphipod survival
  - Pore water/amphipod survival
- Multiple stations
  - High toxicity stations from Chollas and Paleta sites
- Three sampling times
  - July 2001, October 2002, April 2004

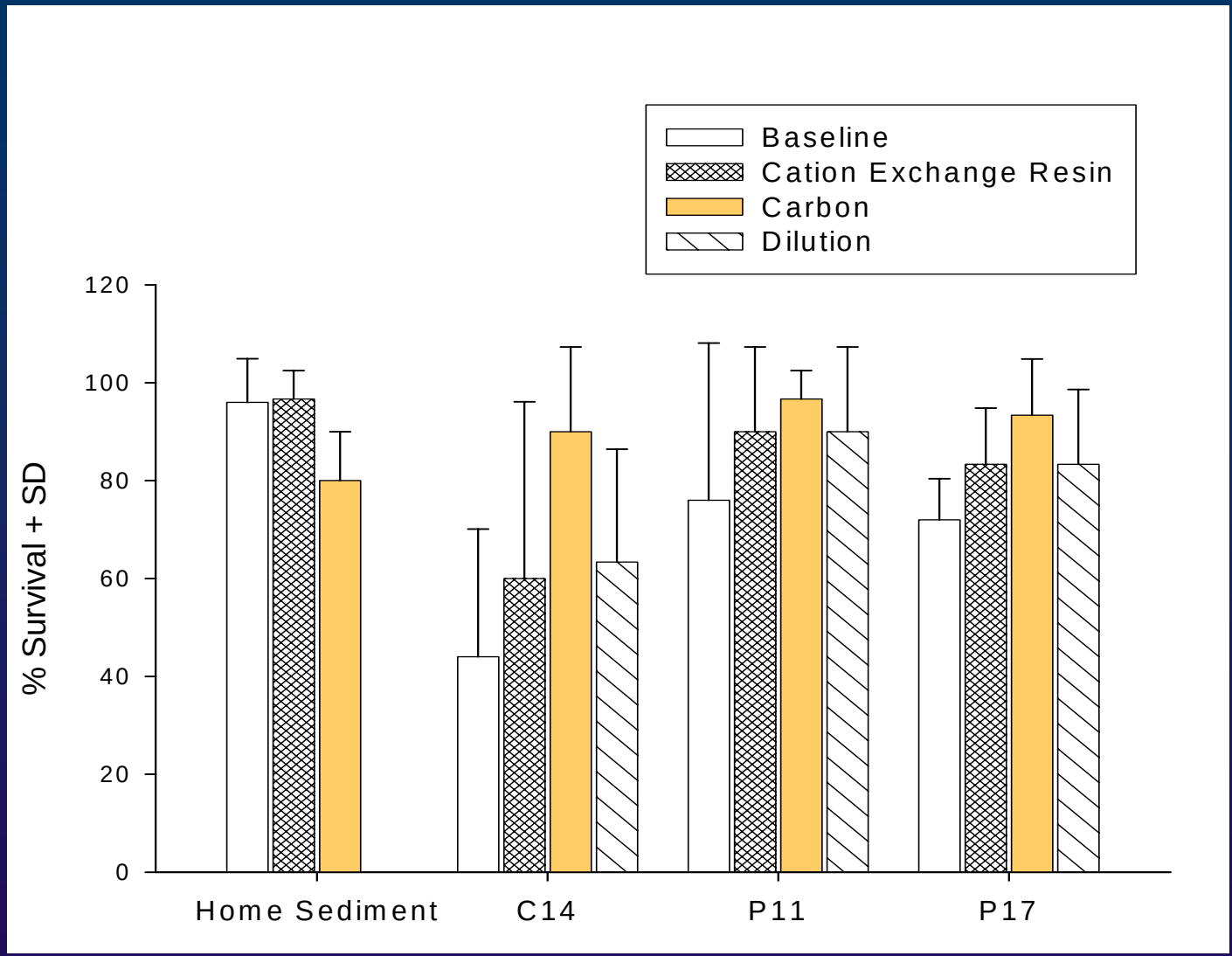
Toxicant Characterization Approach



Toxicant Characterization Treatments

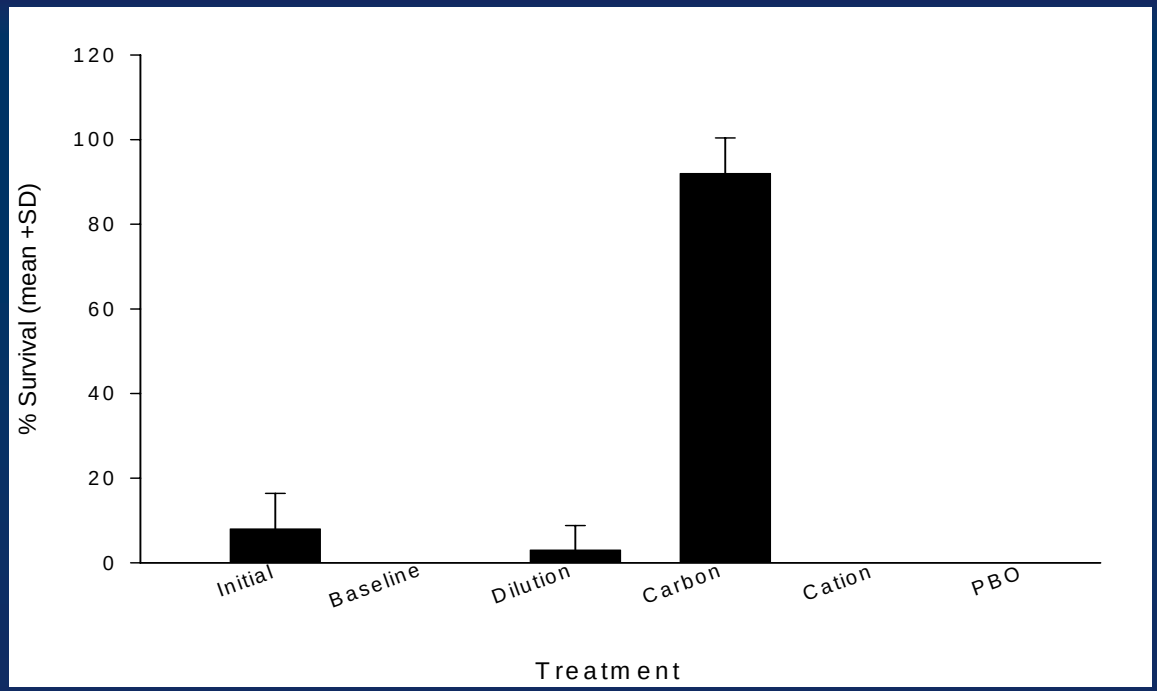
Sediment Treatment	Pore Water Treatment	Purpose
Baseline Toxicity	Baseline Toxicity	Evaluate treatment effectiveness
Cation exchange resin	EDTA	Complexes metals
Activated carbon	Extraction (C18)	Removes nonpolar organics
Piperonyl Butoxide (PBO)	Piperonyl Butoxide (PBO)	Metabolic inhibitor Blocks op pesticide toxicity
	Sodium Thiosulfate (STS)	Neutralizes oxidants Complexes some metals
Reference Sediment		Control for dilution and mixing effects

October 2002: Whole Sediment

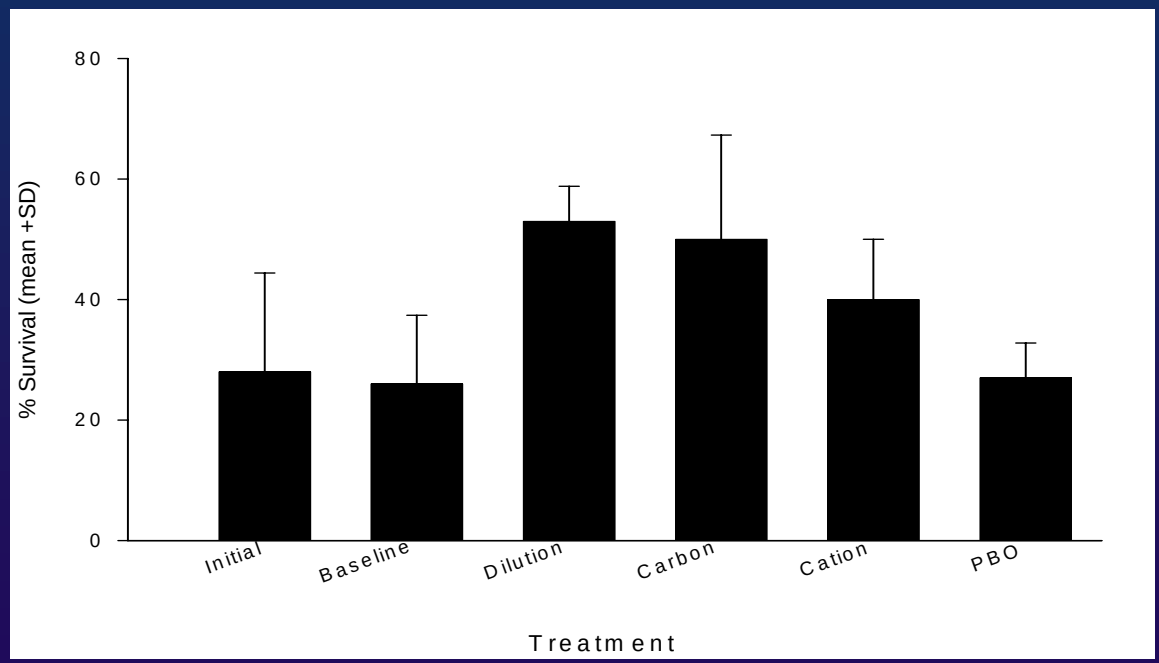


April 2004 Whole Sediment

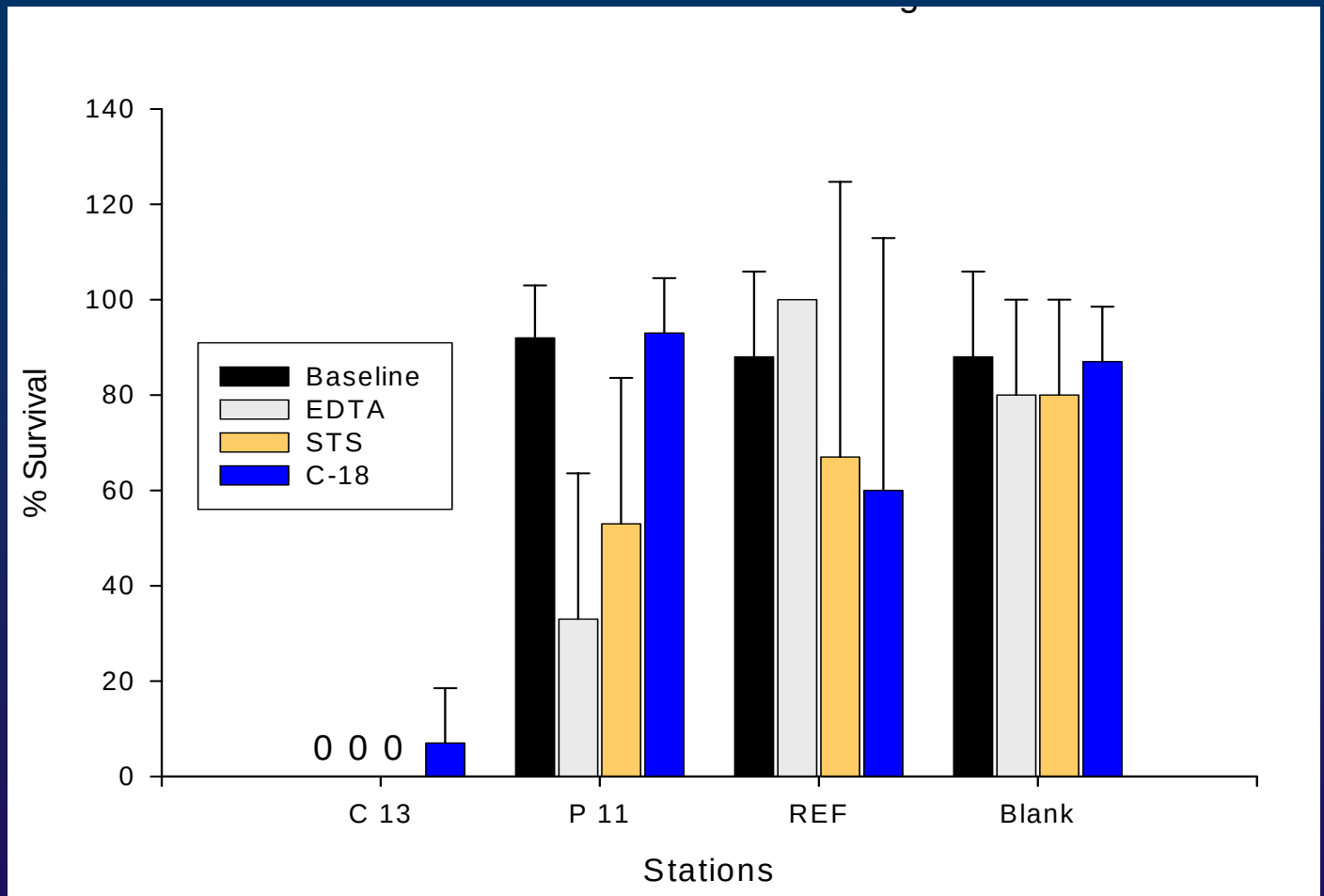
C13



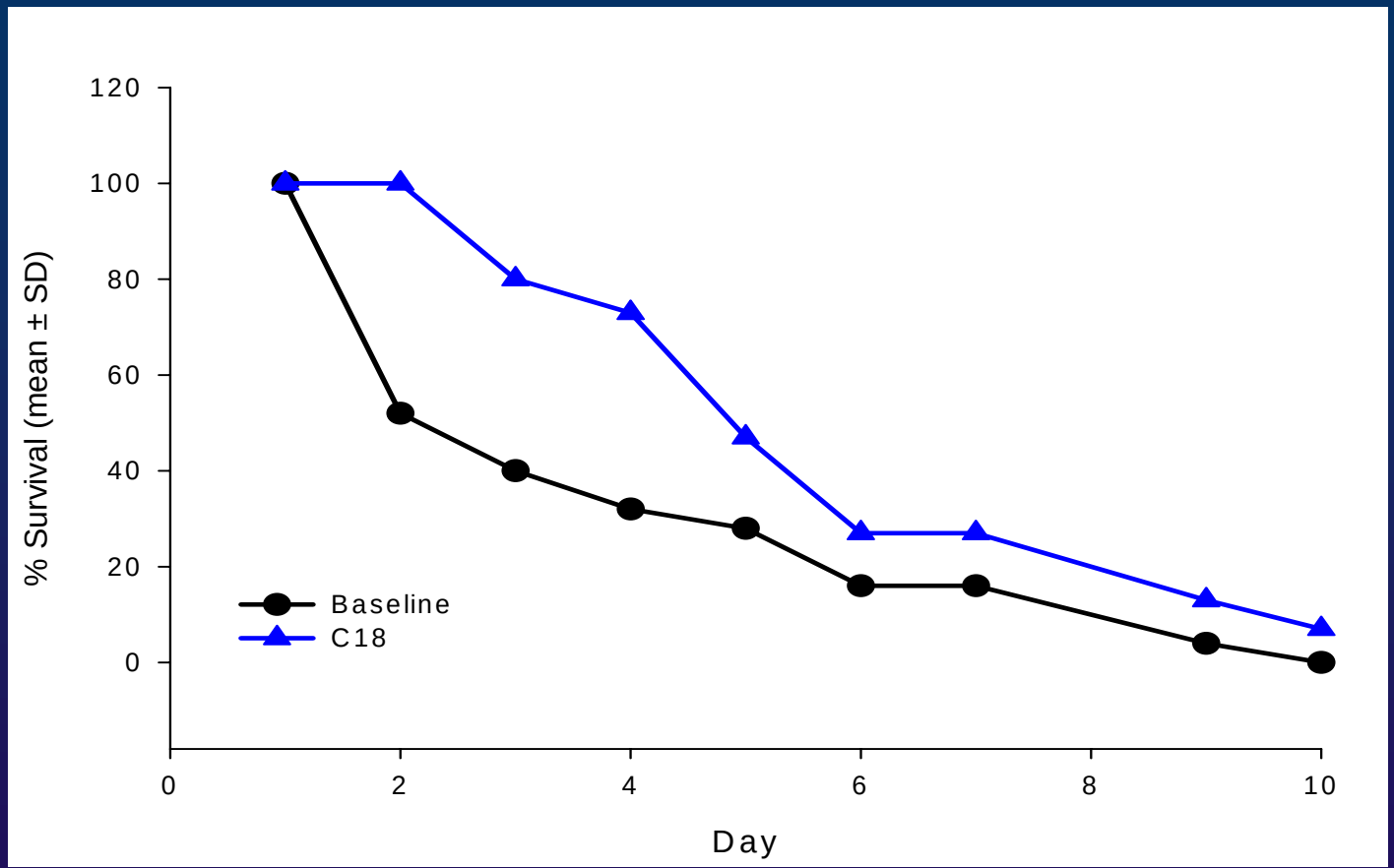
P11



April 2004: Pore Water



C13 Pore Water Daily Survival



TIE Results
Whole Sediment

Station	Date	Site	Carbon	Cation	Dilution
C14	July 2001	Chollas	+	0	NA
C14	Oct. 2002	Chollas	+	0	+0
P11	Oct. 2002	Paleta	+	0	+0
P17	Oct. 2002	Paleta	+	0	+0
C13	April 2004	Chollas	+	0	0
P11	April 2004	Paleta	0	0	+0

0 = Not effective **+0 = Slightly effective** **+ = Highly effective**

> = Enhanced **NA=Not analyzed**

TIE Results
Pore Water

Station	Date	Site	EDTA	STS	C-18
C01	July 2001	Chollas	Not toxic		
C14	July 2001	Chollas	+	NA	+
C13	April 2004	Chollas	0	NA	+0
P11	April 2004	Paleta	Not toxic		

0 = Not effective **+0 = Slightly effective** **+ = Highly effective**

> = Enhanced **NA=Not analyzed**

Toxicity:Sediment Chemistry Correlation Spatial Study Data

	Chollas		Paleta	
	Amphipod Survival	Sea Urchin Development	Amphipod Survival	Sea Urchin Development
Fines	-0.62	-0.20	0.04	-0.08
TOC	-0.76	-0.43	-0.07	-0.37
Ag (fn)	0.40	-0.06	-0.07	-0.10
As (fn)	0.35	-0.04	-0.05	0.20
Cd (fn)	0.28	-0.16	-0.51	-0.50
Cr (fn)	0.55	0.11	-0.04	0.04
Cu (fn)	0.19	-0.31	0.14	-0.14
Hg (fn)	0.34	0.08	-0.09	-0.11
Ni (fn)	0.44	-0.05	0.01	-0.10
Pb (fn)	0.23	-0.26	-0.27	-0.56
Zn (fn)	0.24	-0.18	-0.15	-0.38
LMWPAH	-0.43	-0.77	0.07	-0.57
HMWPAH	-0.44	-0.77	-0.15	-0.61
TPCB	-0.56	-0.59	-0.03	-0.60
TCHLOR	-0.53	-0.64	-0.13	-0.64
TDDT	-0.59	-0.65	-0.14	-0.67
Mean SQGQ1	-0.48	-0.71	-0.04	-0.68

TIE Study Summary

- Toxicity at Chollas and Paleta sites caused by sediment contaminants
  - Grain size and ammonia not primary factors
  - TIE treatments reduce toxicity
  - Correlations between chemistry and toxicity
- Multiple causes may be present
  - Variable results for whole sediment and pore water
  - Available TIE methods are not specific
  - Lab tests may not detect some toxicants
- Organic contaminants are most likely cause
  - Carbon usually only effective sediment treatment
- Additional investigation needed to identify specific contaminants