

Southern California Bight 1998 Regional Monitoring

Steven Bay
Southern California
Coastal Water Research Project

Background

- **Most monitoring is spatially limited**
 - Less than 5% of Bight is monitored
 - Focus is on discharges
- **Existing data can't be easily integrated**
 - Different parameters and methods
 - Inaccessible data
- **These shortcomings prevent regional-scale evaluation of condition and assessment of cumulative impacts**

1998 Bight Regional Monitoring Survey

- **Assessed the spatial extent of chemical contamination and effects in sediment and fish in southern California**
 - What is the areal extent of impact?
- **Provides perspective on local conditions**
 - Reference conditions
 - Hot spot identification
 - Identify large-scale events
- **Focus on San Diego Bay**
 - 46 stations

Bight'98 Regional Survey

361 Stations

**Standardized
methods**

**Statistically
rigorous sampling
design**

Chemistry

Toxicity

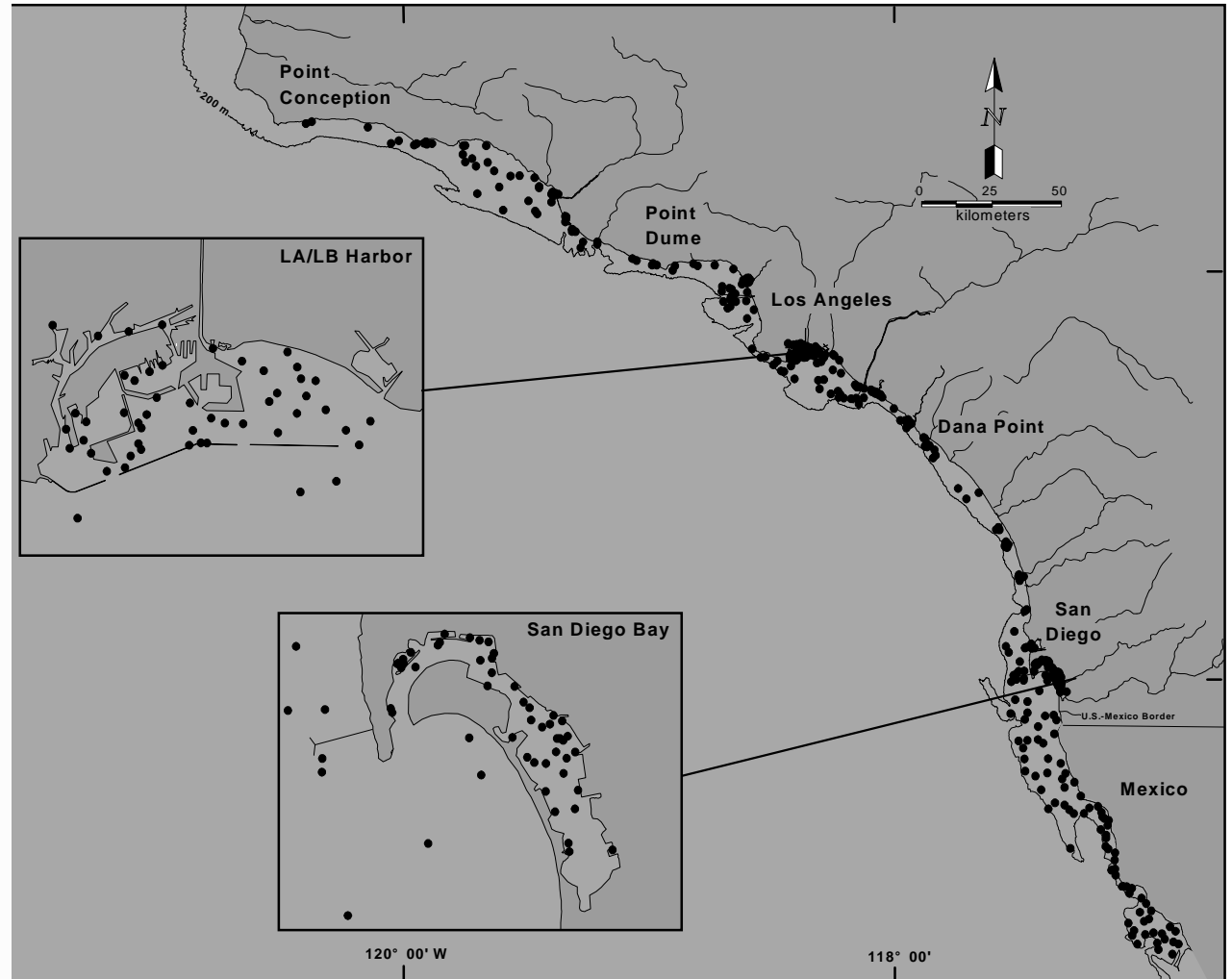
Benthos

Fish

Populations

Bioaccumulation

Biomarkers



Sediment Chemistry

- **Average concentration**
 - Area weighted mean
- **Relative contaminant loading**
 - Percent of mass in bight
- **Sediment quality guidelines**
 - Mean SQG quotient

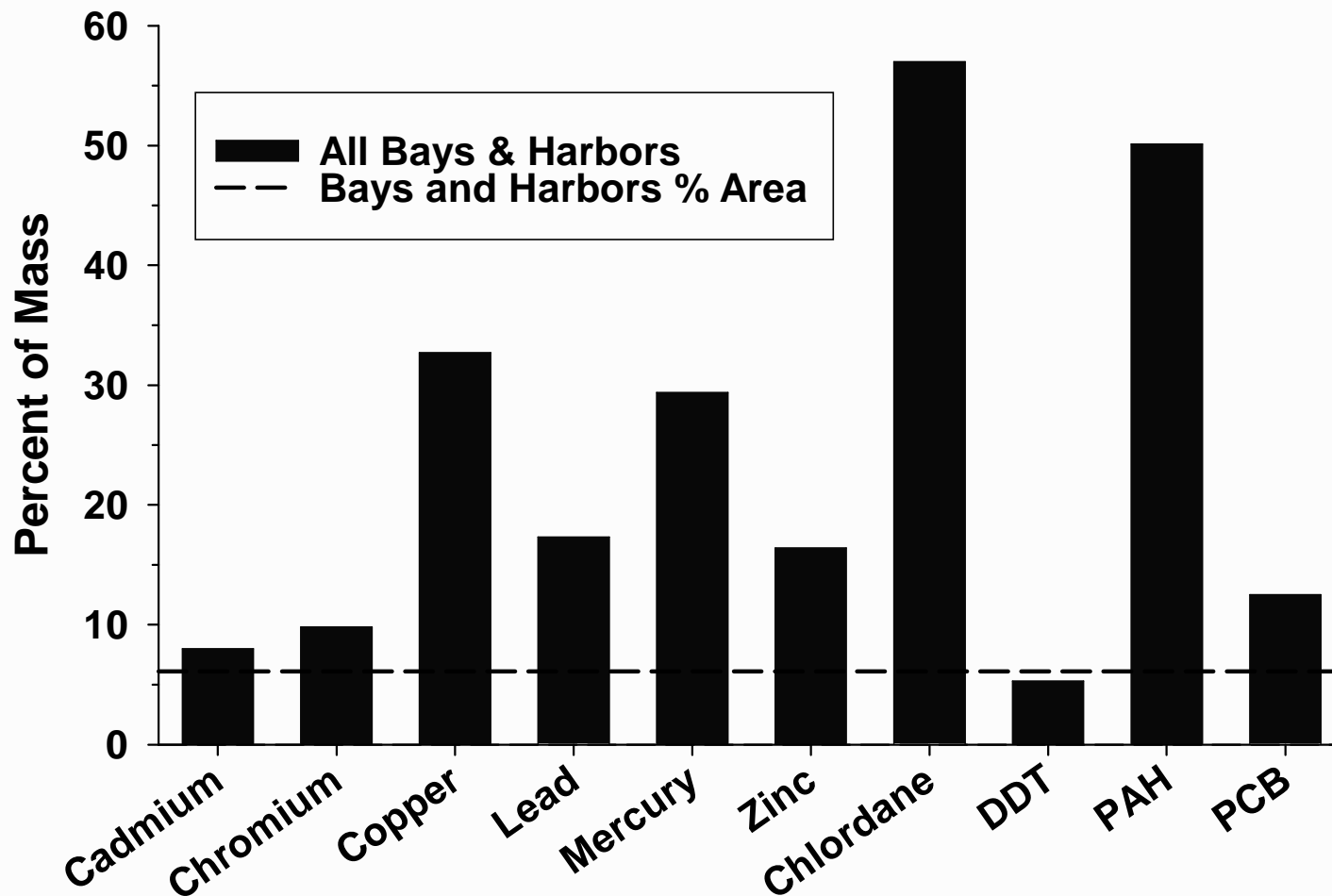
Average Contaminant Concentration

	San Diego	Other Bays	Bight
Cadmium (mg/kg)	0.13	0.68	0.37
Chromium (mg/kg)	40.0	47.6	27.6
Copper (mg/kg)	103.7	68.2	14.9
Lead (mg/kg)	36.2	36.9	12.8
Mercury (mg/kg)	0.47	0.22	0.06
Zinc (mg/kg)	154.2	153.1	56.8
Chlordane (ug/kg)	0.0	3.2	0.2
DDT (ug/kg)	0.4	66.6	46.8
PAH (ug/kg)	1,232	1,027	134
PCB (ug/kg)	6.9	37.2	12.5

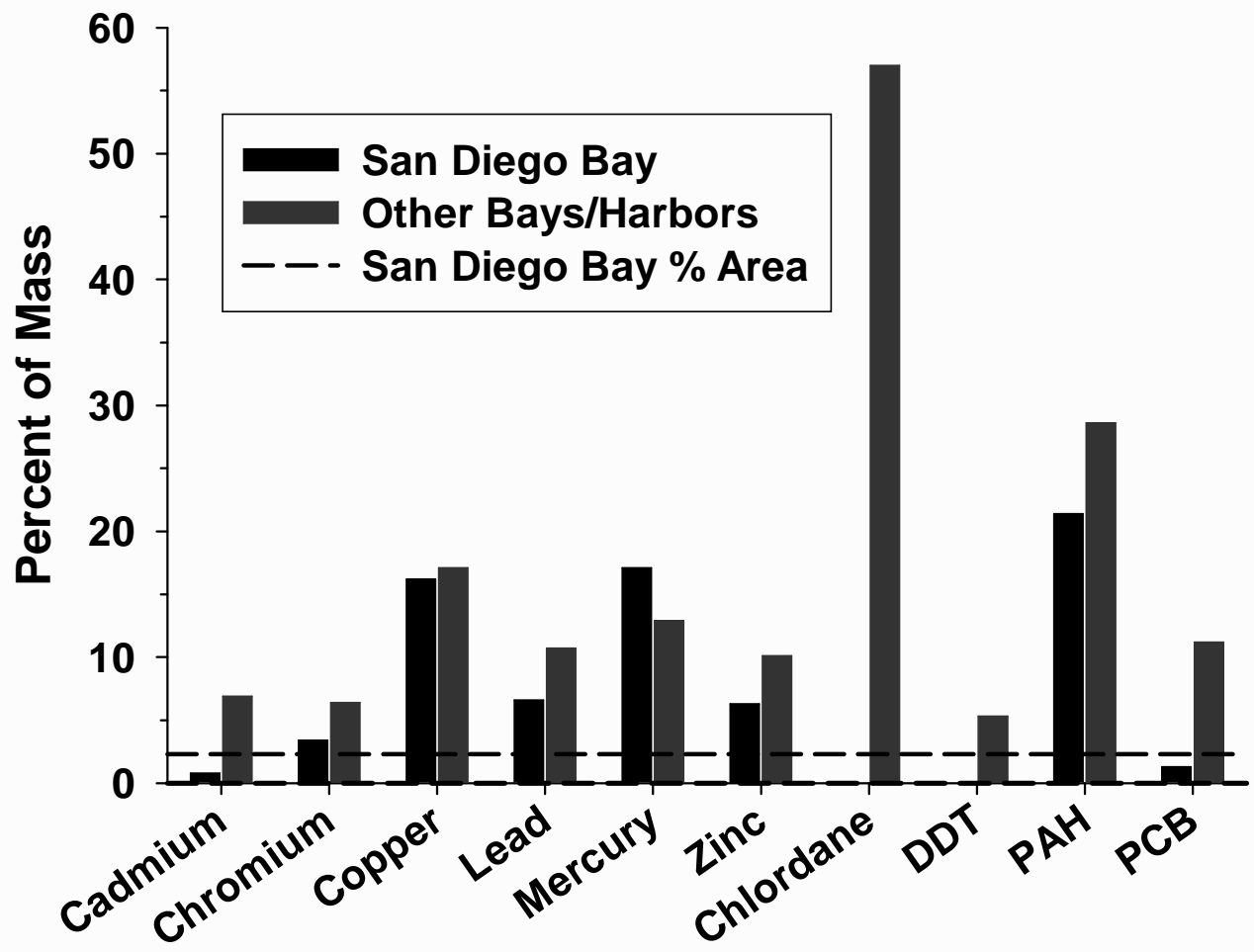
Contamination Load

- **Surface sediment (top 2 cm)**
 - Concentration per unit volume
- **Load per station**
 - = Concentration X volume represented
- **Load per area**
 - = Sum of station loadings

Bays and Harbors Contamination Load



San Diego Bay Contamination Load

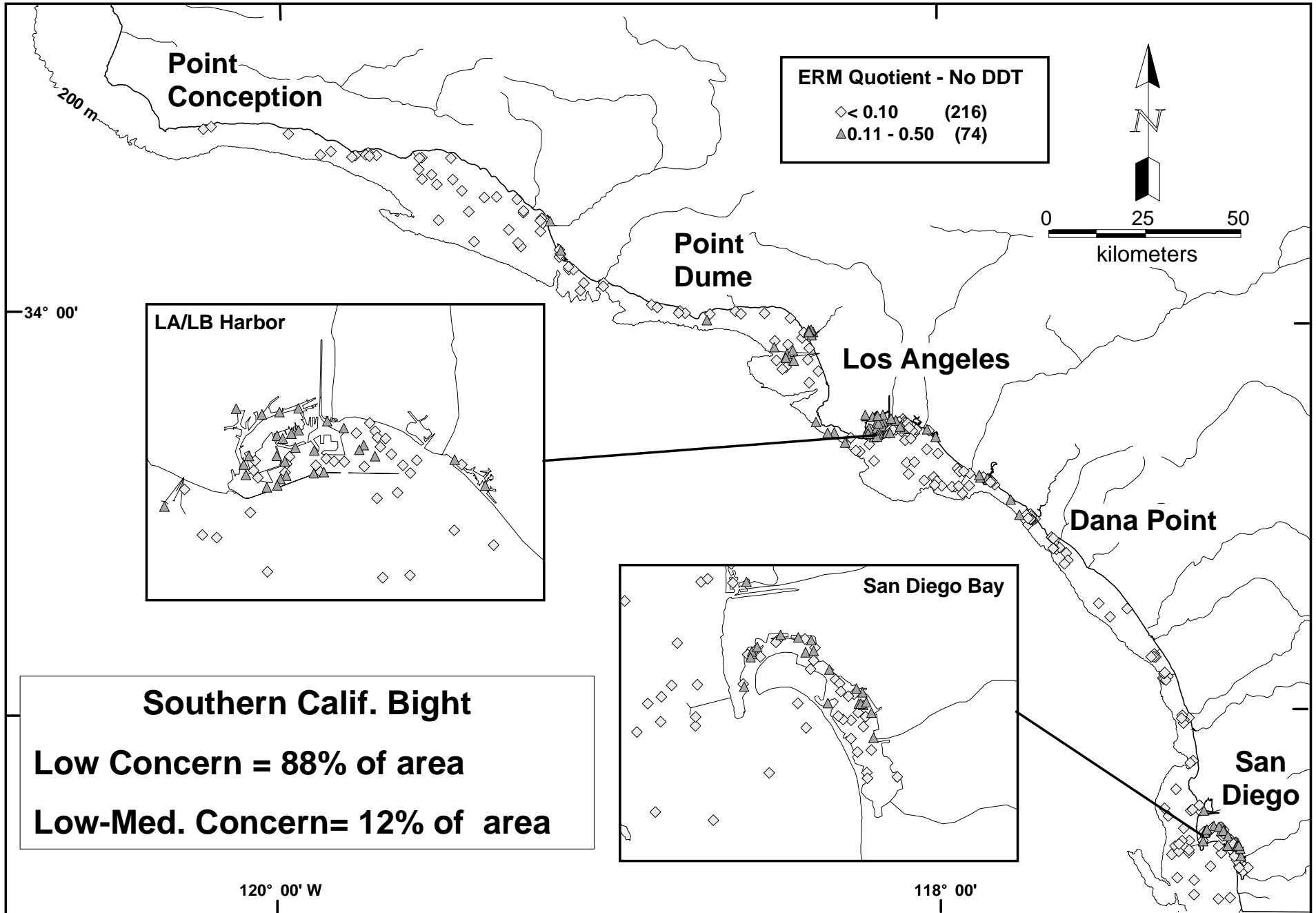


Sediment Quality Guidelines

- **Estimate potential for adverse biological effects from sediment contamination**
 - **Apparent Effects Threshold (AET)**
Toxicity always present
 - **NOAA Effects Range Median (ERM)**
Biological effects probable (>50%)
- **SQGs primarily intended for screening**
 - Usually don't indicate cause
 - Poor reliability for some contaminants
 - False negatives and positives unavoidable
- **No consistent policy for SQG use in CA**

ERM Quotient Approach

- **Sediment toxicity more likely when:**
 - Large exceedence of SQG value present
 - Multiple SQG exceedences present
- **Mean ERM quotient more reliable predictor of sediment quality**
 - = $\text{mean} (C_1/ERM_1 + C_2/ERM_2 \dots C_n/ERM_n)$
- **Sediment toxicity classification**
 - <0.1: Low concern
 - 0.11-0.5: Low-medium concern
 - 0.51-1.5: Medium-high concern
 - >1.5: High concern



**Point
Conception**

ERM Quotient - No DDT

- ◇ < 0.10 (216)
- ▲ 0.11 - 0.50 (74)



0 25 50
kilometers

**Point
Dume**

Los Angeles

Dana Point

LA/LB Harbor

San Diego Bay

**San
Diego**

34° 00'

Southern Calif. Bight
Low Concern = 88% of area
Low-Med. Concern = 12% of area

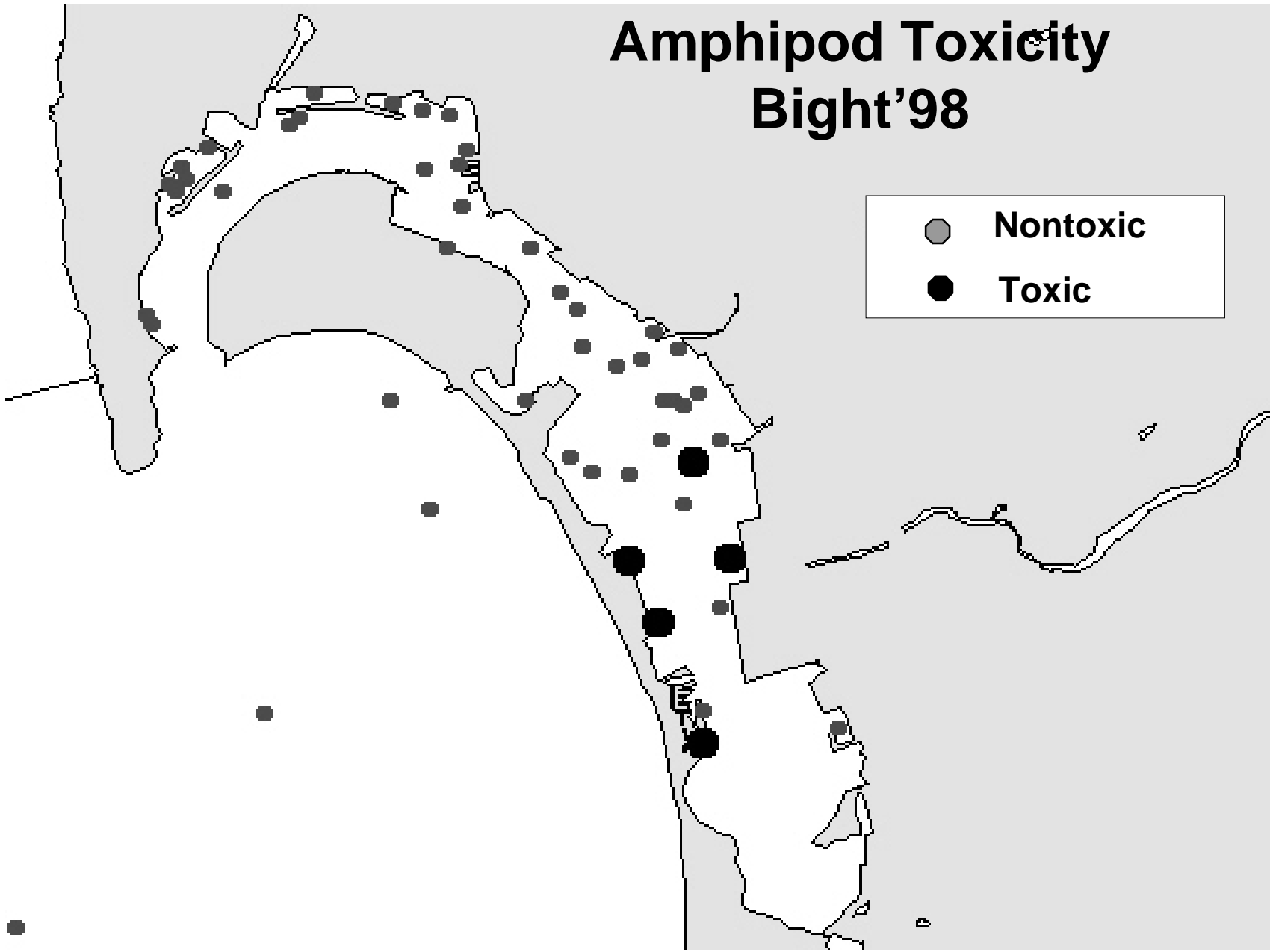
120° 00' W

118° 00'

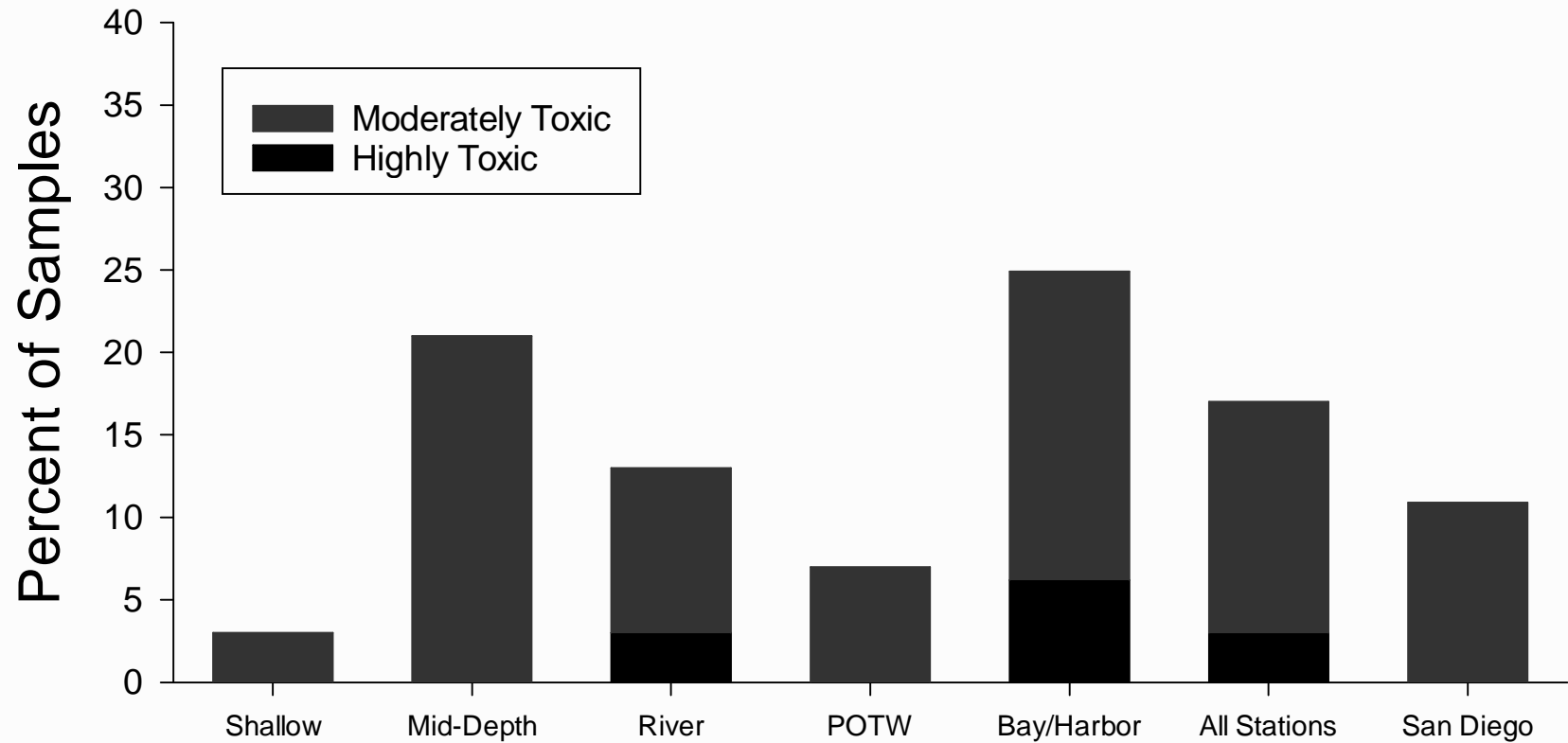
Sediment Toxicity

- **Amphipod survival**
 - Sediment, 10 days
- **Phytoplankton Luminescence (QwikSed)**
 - Elutriate, 24 hours
- **Enzyme induction (P450 HRGS)**
 - Solvent extract, 16 hours

Amphipod Toxicity Bight'98



Amphipod Toxicity San Diego Bay

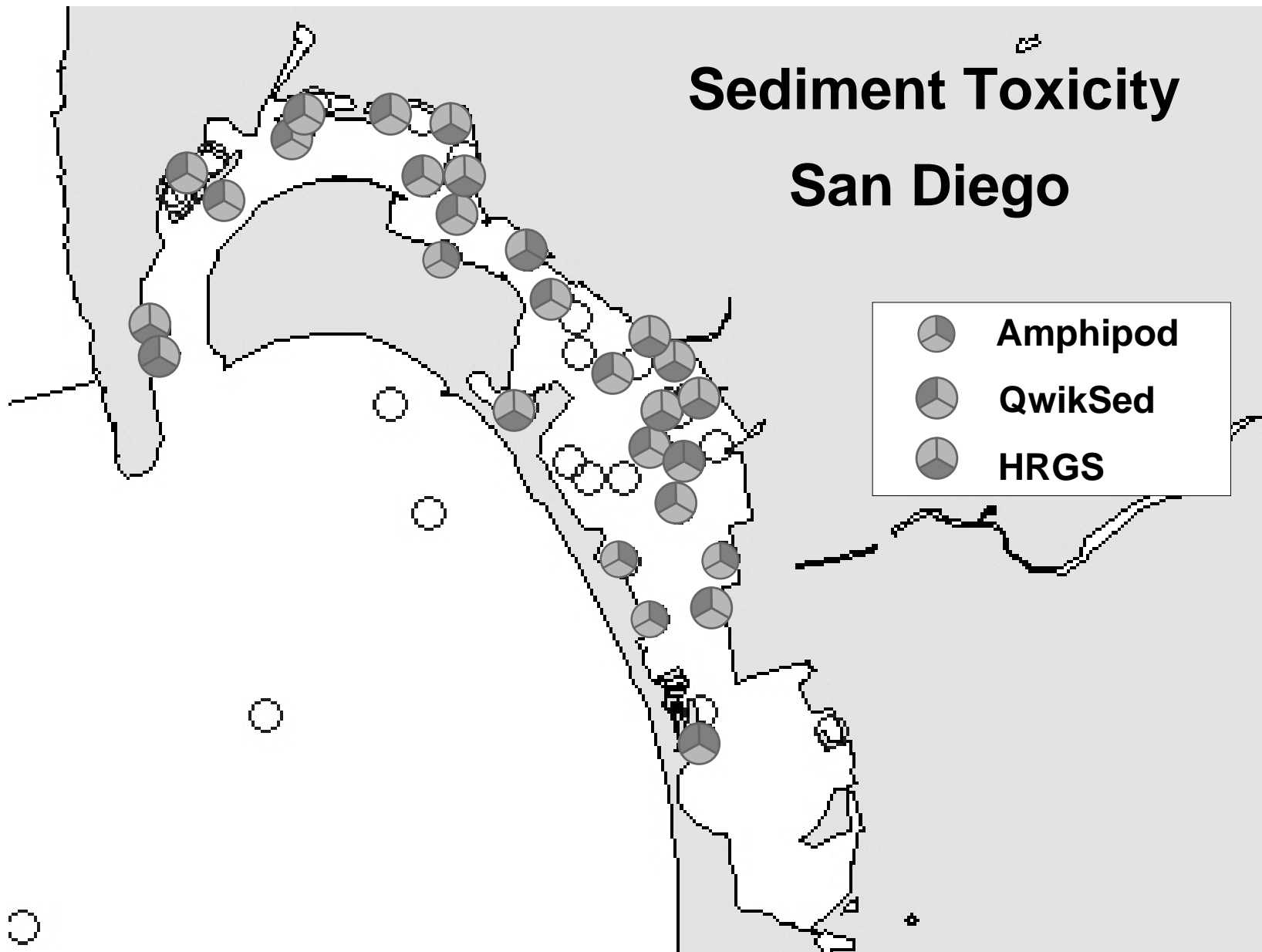


Frequency of Toxicity to Amphipods

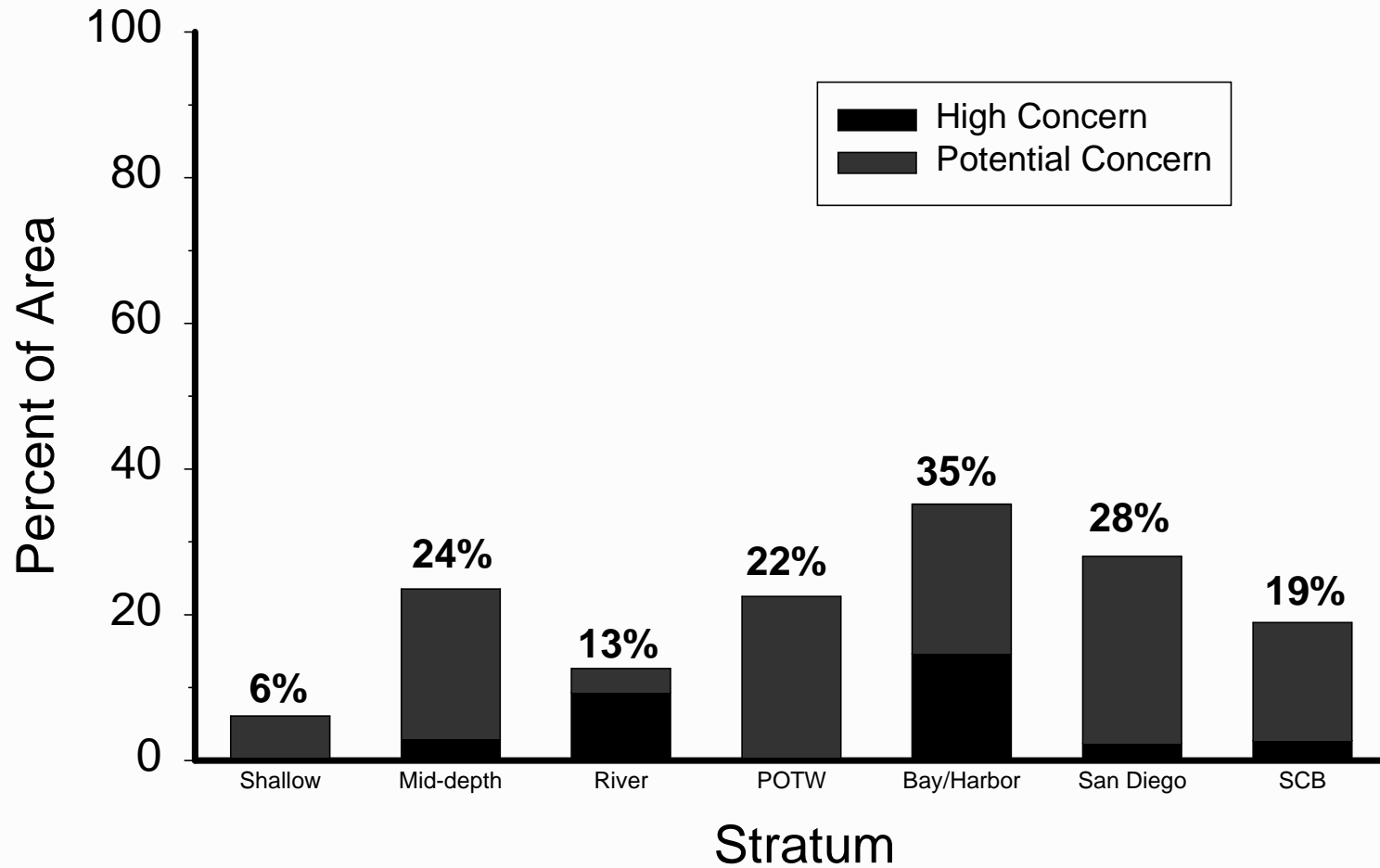
Area	#Toxic/Total	% Samples Toxic
Ventura H.	0/1	0
Channel Is. H.	2/3	67
Marina del Rey	4/7	43
San Pedro Bay	11/45	24
Anaheim Bay	1/3	33
Newport Bay	9/11	82
Dana Point H.	0/3	0
Mission Bay	0/3	0
San Diego Bay	5/46	11

Sediment Toxicity

San Diego

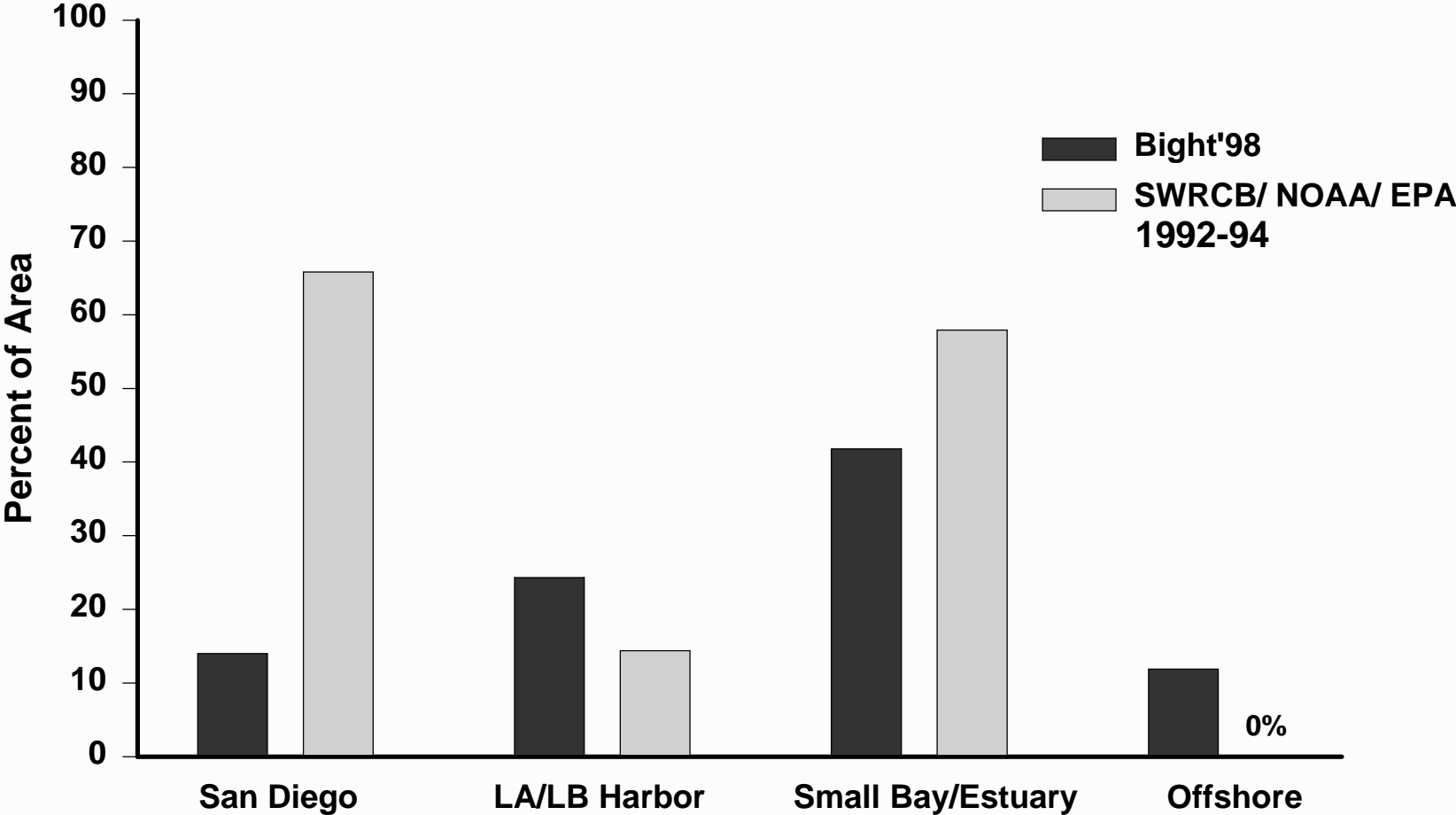


Combined Classification



Amphipod Survival

Temporal Changes in % Area Toxic



Summary

- **Bays and harbors contain most of the contamination in southern California**
- **San Diego Bay has similar levels of contamination as other harbors**
- **Greatest prevalence of sediment toxicity in bays and harbors**
- **28% of San Diego Bay of potential concern for toxicity**
- **Reductions in San Diego Bay sediment toxicity have occurred in recent years**