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An Introduction to the Role of SQGs in Evaluating Ecological Effects of Contaminated Sediments.

Sediment Quality Guidelines

A collective term for values used to differentiate sediment contaminant concentrations of little concern from those predicted to have adverse biological effects

Selected SQGs

- EqP
- SEM/AVS
- ΣPAH
- AET
- ERL/ERM
- TEL/PEL
- TEC/PEC
- SQGQ
- LRM

Potential Uses of SQGs

- Screen existing data
- ID problem chemicals and areas at site
- Planning future studies
- Trigger regulatory action
- Establish target remediation objectives

Mean SQG Quotient

- **Calculated by dividing each contaminant by its respective SQG value, then summing the results for all contaminants detected and dividing through by the number of contaminants**

ERM Site Priority

- **Low**
  ERMq < 0.1
  No ERLs exceeded
  (12% & 11% amphipod tox)

- **Medium Low**
  ERMq 0.11 - 0.5
  1-5 ERMs exceeded
  (30% & 32% amphipod tox)

- **Medium High**
  ERMq 0.51 -1.5
  6-10 ERMs exceeded
  (46% & 52% amphipod tox)

- **High**
  ERMq > 1.5
  > 10 ERMs exceeded
  (74% & 85% amphipod tox)

Long and MacDonald, 1998

Sediment Chemistry Risk

Incidence of Toxicity	Risk Classification	Mean PEC-Q *Ampelisca*	Mean PEC-Q *Hyalella*
<20%	Low	<0.201	<0.188
20 – 50%	Indeterminate	0.201 – 0.458	0.188 – 0.427
>50%	High	>0.458	>0.427

Mean or ΣERM Quotient Calculation

		Site 1		Site 2	
	ER-M	Concentration	ERMq	Concentration	ERMq
Arsenic	70	11.7	0.17	6	0.09
Cadmium	9.6	0.2		0.9	0.09
Chromium	370	260	0.70	12	0.03
Copper	270	242	0.90	20	0.07
Lead	218	177	0.81	15	0.07
Mercury	0.71	1.39	1.96	6.96	9.80
Nickel	51.6	15.6	0.30	14	0.27
Silver	3.7	0.5		0.75	0.20
Zinc	410	372	0.91	40	0.10
2-Methylnaphthalene	670	650	0.97	60	0.09
Acenapthene	500	470	0.94	16	0.03
Acenaphthylene	640	750	1.17	44	0.07
Anthracene	1,100	1,990	1.81	65	0.06
Fluorene	540	870	1.61	160	0.03
Naphthalene	2,100	2,200	1.05	19	0.04
Phenanthrene	1,500	1,320	0.88	90	0.04
Benzo(a)anthracene	1,600	2,100	1.31	110	0.07
Benzo(a)pyrene	1,600	3,500	2.19	130	0.08
Chrysene	2,800	4,400	1.57	175	0.06
Dibenz(a,h)anthracene	260	1,510	5.81	25	0.10
Fluoranthene	5,100	6,300	1.24	75	0.05
Pyrene	2,600	4,200	1.62	140	0.05
Aroclor-1254	180	700	3.89	19	0.11
Sum			31.79		11.61
Count			21		23
ΣERMq			1.51		0.50

Consensus-based SQGs

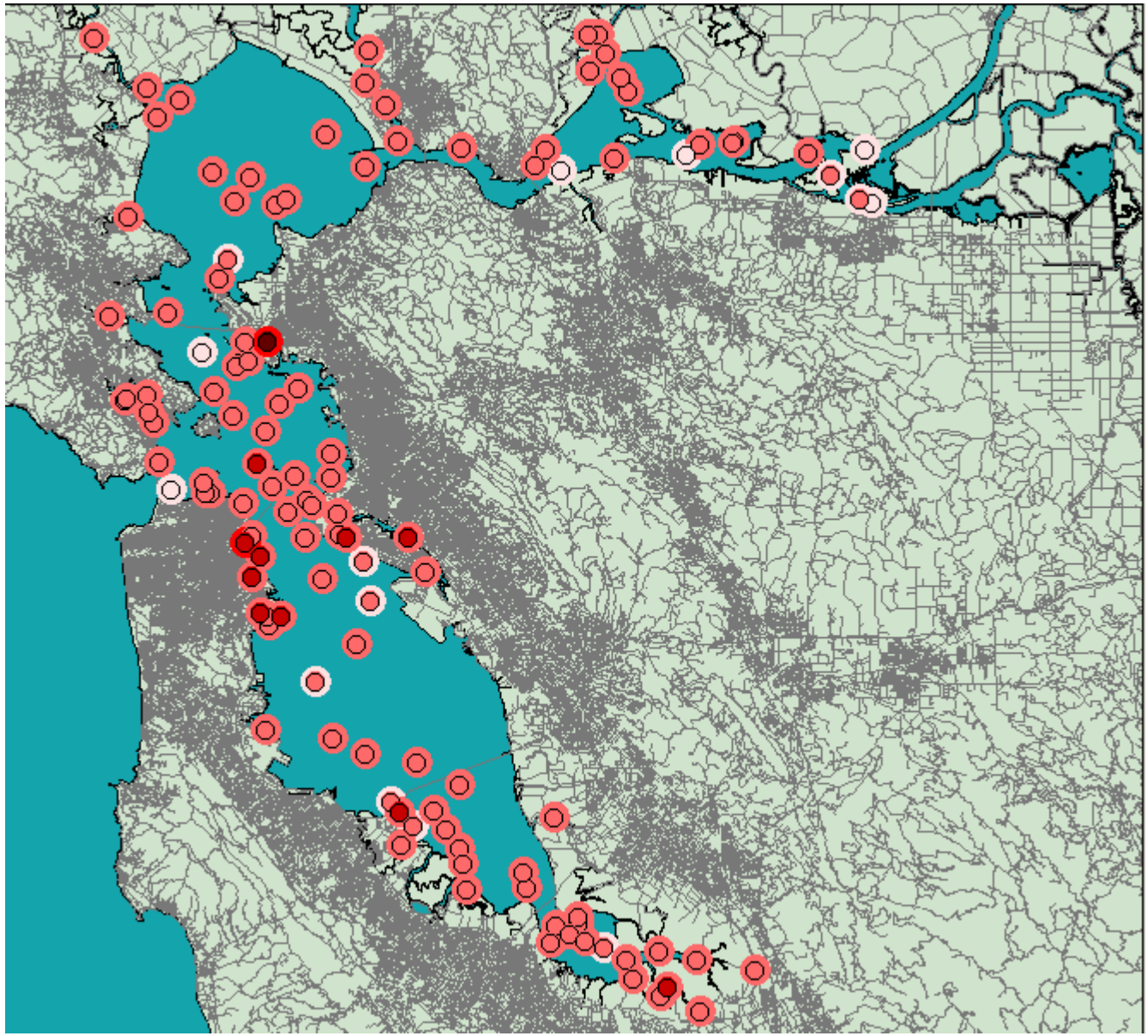
- **Threshold Effect Concentration (TEC)**

LEL	TEL
ERL	TEL-HA28
MET	SQAL

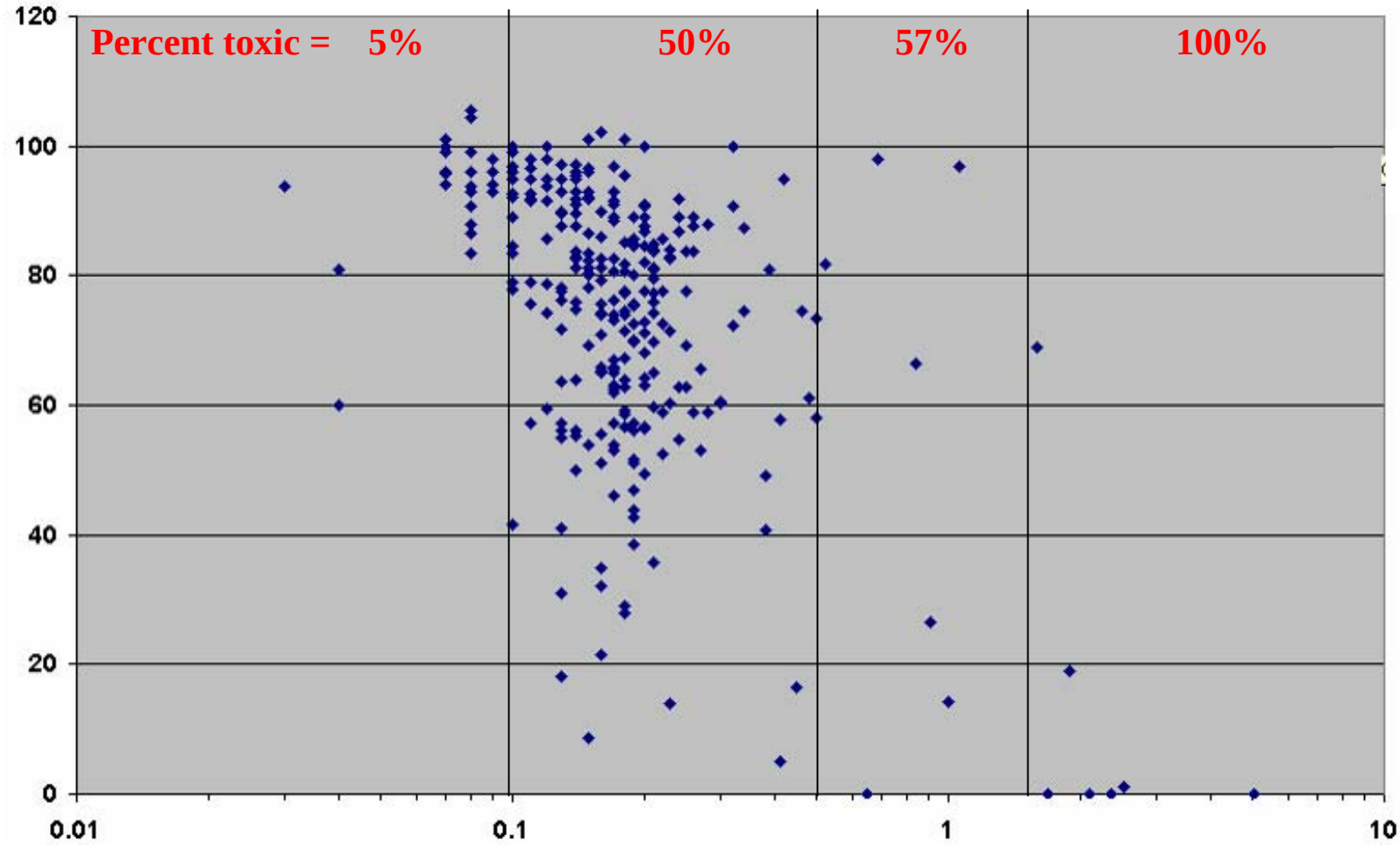
- **Probable Effect Concentration (PEC)**

SEL	PEL
ERM	PEL-HA28
TET	

Mean PELq Plotted Over Mean ERMq



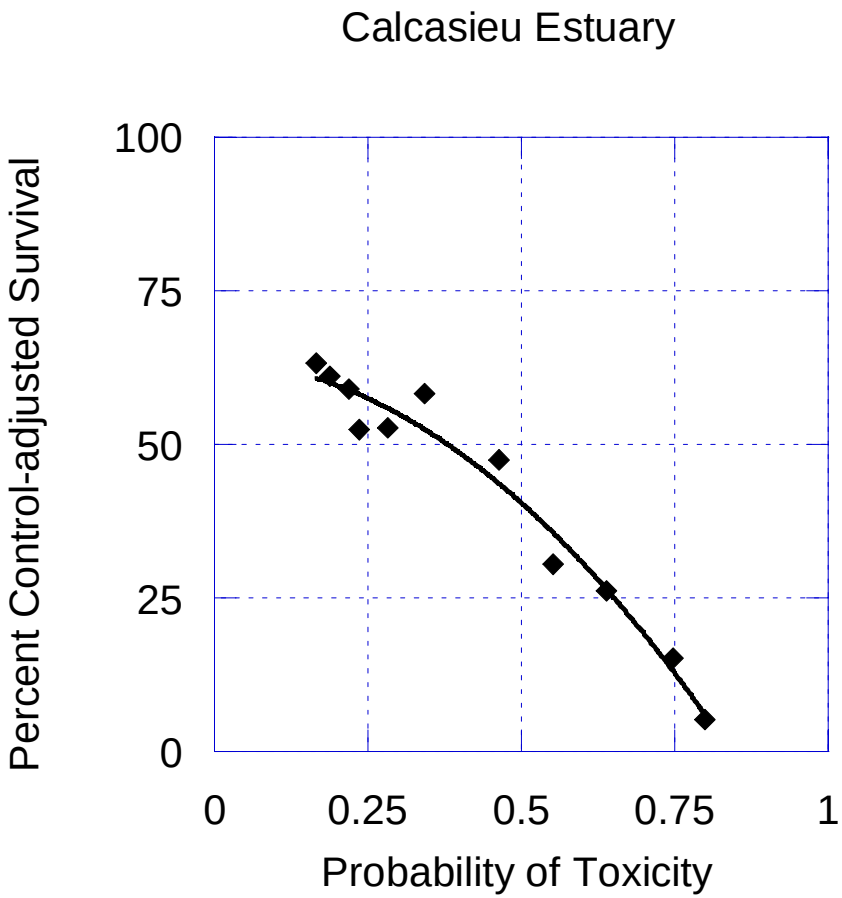
Eohaustorius Control-Adjusted Survival vs Mean ERMq



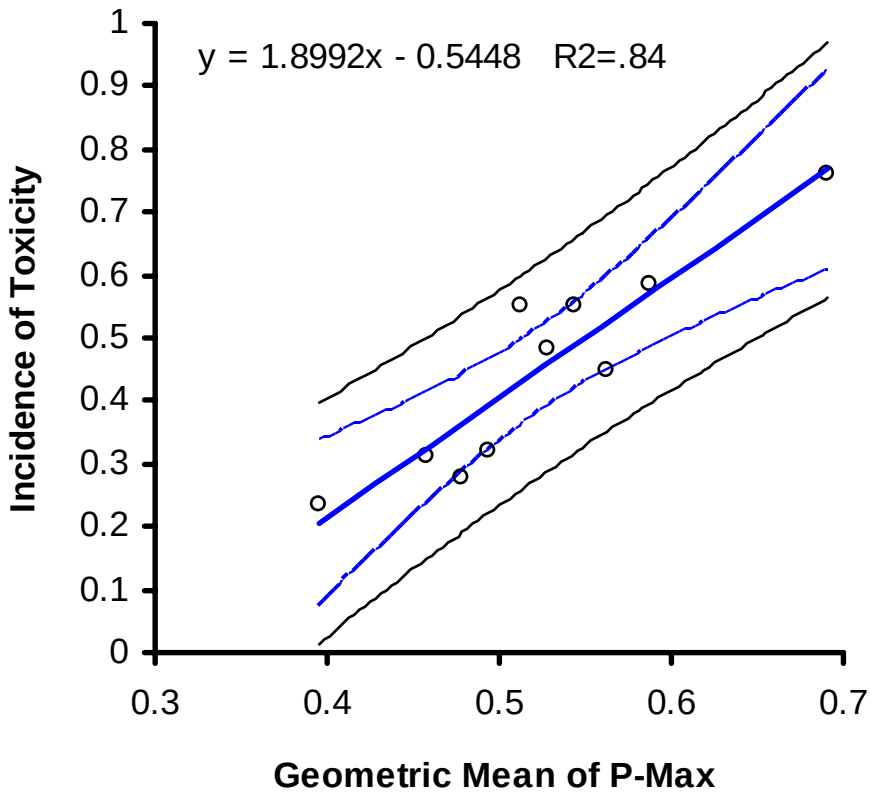
Logistic Regression Models

- LRMs provide a non-threshold approach to estimating the probability of toxicity from sediment chemistry
- LRMs were developed for 37 COPCs based on 10-day Rhepoxynius and Ampelisca survival tests
- The individual LRMs were combined into a single model (P_Avg, P_Max)

Control Adjusted Survival
vs
LRM Predicted Probability of Toxicity



Incidence of Eohaustorius Toxicity vs P-Max



Caveats

- Prediction of toxicity depends on definition of toxicity
- Prediction of toxicity based on specific test organisms and tests
  - Freshwater – Hyalella azteca
  - Marine – Rheopoxynius abronius, Ampelisca abdita
- Prediction of toxicity is generally for acute toxicity.
- SQGs do not take into account biomagnification.

Summation

- **SQGs can be used to predict toxicity of sediments with a known degree of reliability**
- **SQGs should be used as one of the lines of evidence in an ERA**
- **If SQGs and other LOE disagree find out why**

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