Agenda Item 2

SEDIMENT TOXICITY TESTING – SELECTION OF SPECIES AND PROTOCOLS

Granite Canyon
Marine Pollution Studies Laboratory

UC Davis

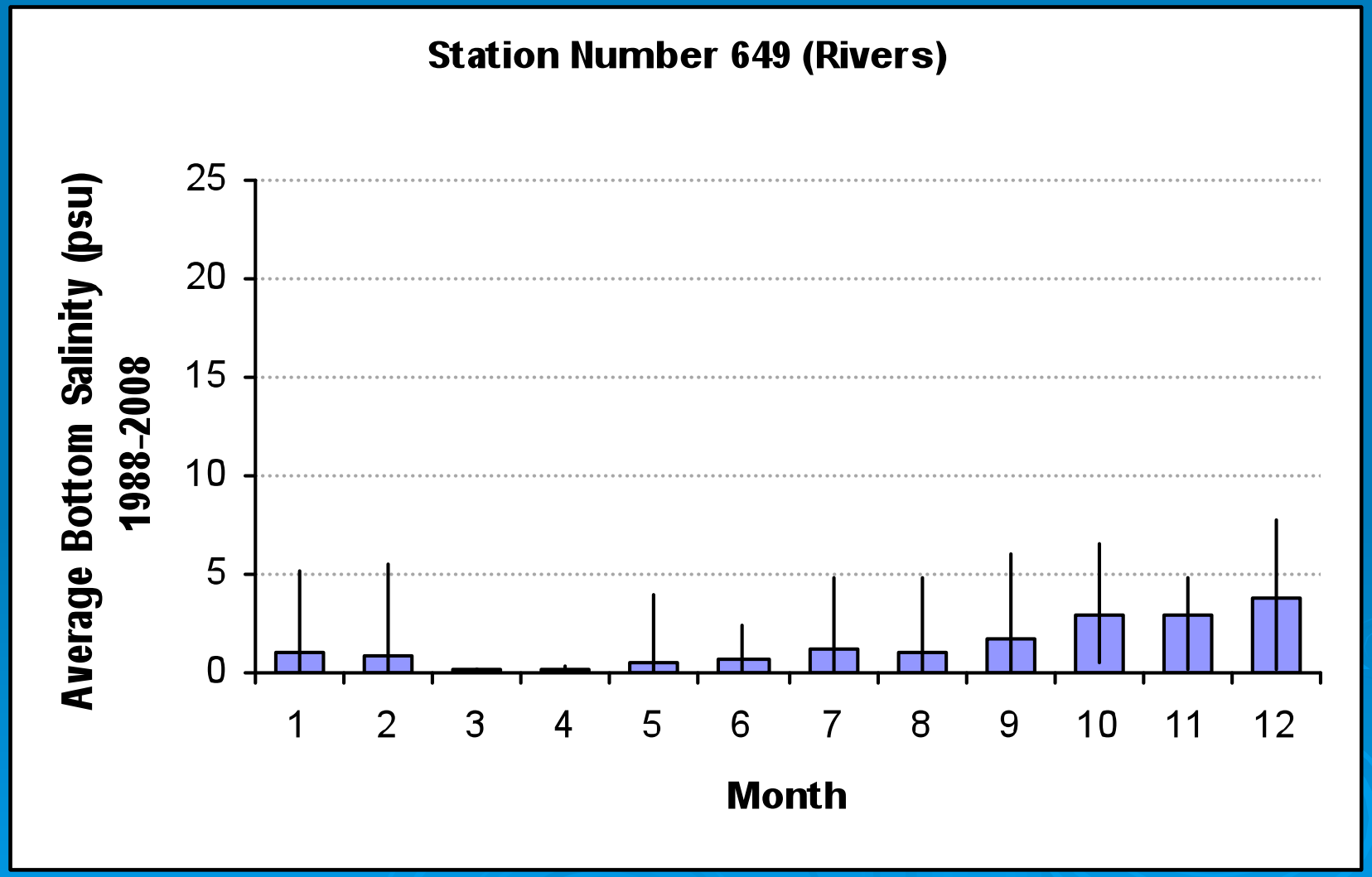
SELECTION OF CURRENT SPECIES

- BPTCP protocol evaluation – Hunt et al. 1998 *E. estuarius* 10d protocol + *S. purpuratus* 72h embryo-larval development (SWI + porewater) – MPSL switched to mussels
- SWRCB SQO protocols – Greenstein et al. 2008. *E. estuarius* 10d + *M. galloprovincialis* 48h (SWI)
- Additional SQO protocols: *L. plumulosus* 10d; *R. abronius* 10d, and *N. arenaceodentata* 28d
- Alternate Tests?

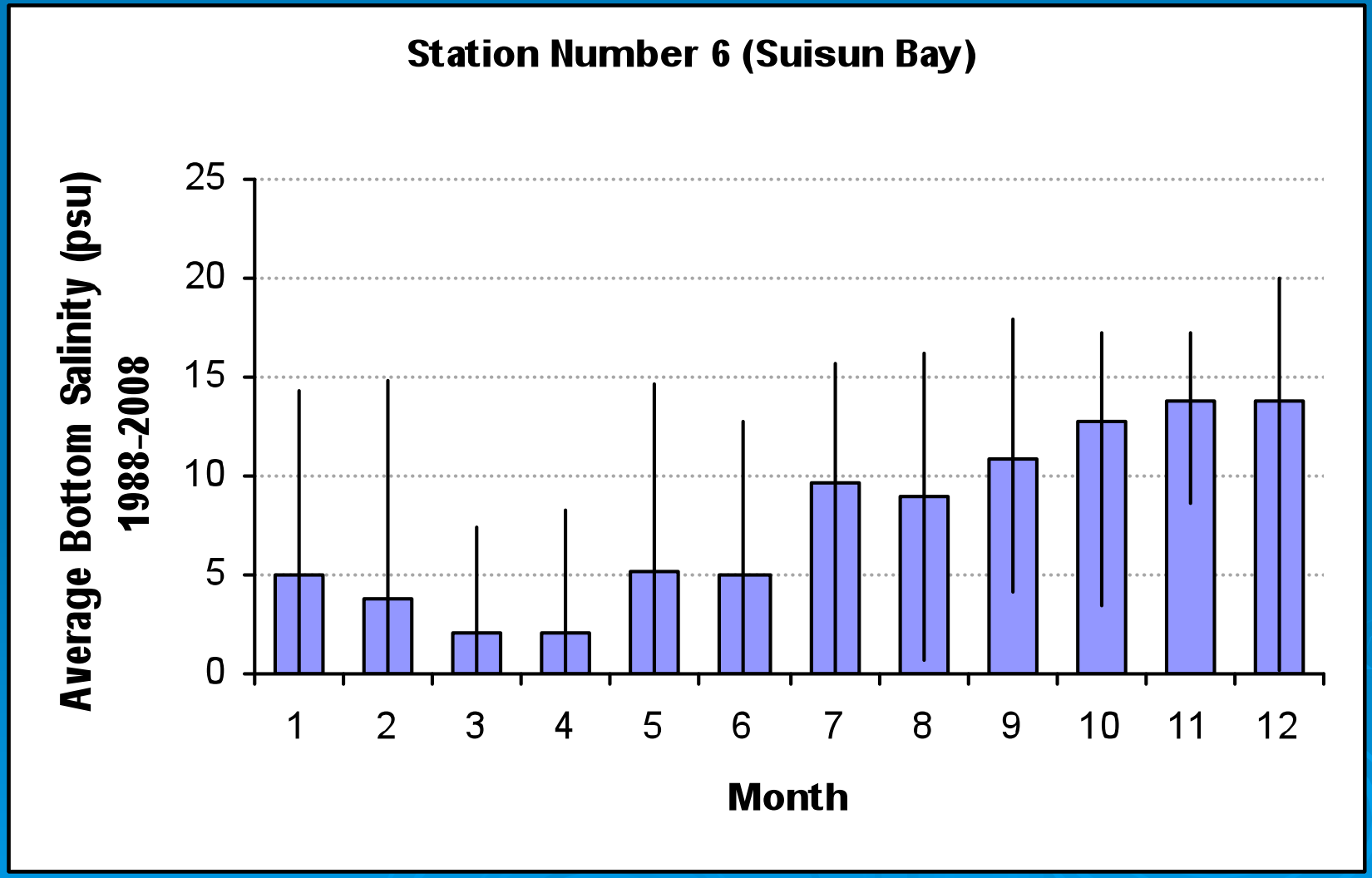
Are we using the best sediment toxicity tests for RMP monitoring?

- Salinity issues in the north estuary and rivers

20-Year Average Bottom Salinity



20-Year Average Bottom Salinity



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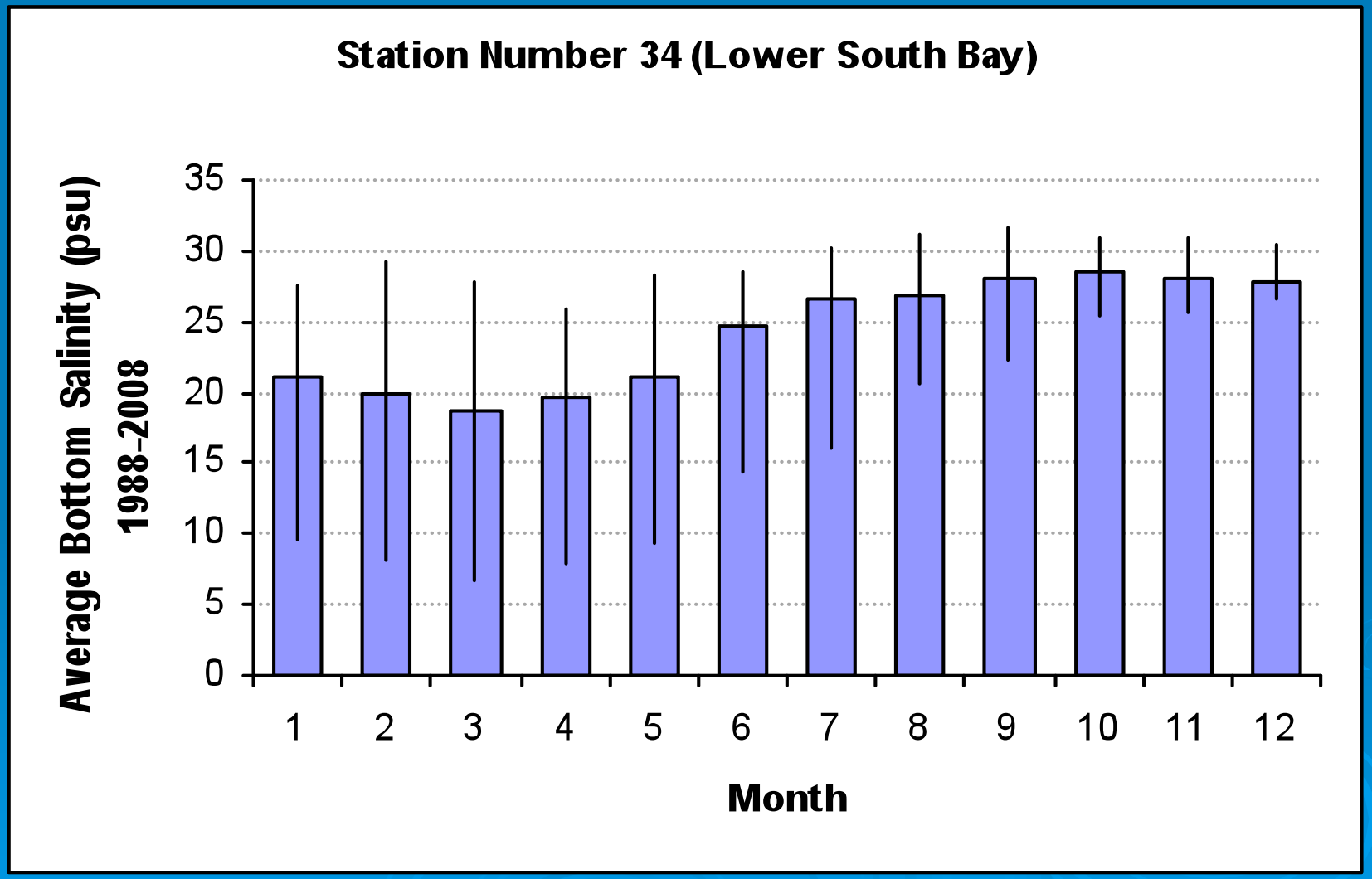


Test Organism Salinity Tolerances

Organism	Protocol	Actual
Eohaustorius	20 ± 3‰	0 – 34‰
Mytilus	28 or 34 ± 2‰	25 - 34‰
Hyalella	None	0 – 15‰
Chironomus	None	0 – 4200 uS
Ceriodaphnia	0 – 2500 uS	0 – 5000 uS

Tests at Different Salinities

from Winter 2001 Report

Station	*Eohaustorius* Sediment	*Hyalella* Sediment	*Mytilus* Elutriate	*Ceriodaphnia* Elutriate	*Ceriodaphnia* SWI
BF21	80	90	0	100	NA
BG20	95	98	3	100	96
BG30	83	95	0	96	100

Copper LC50s (water only)

- *Hyalella* 35 ug/L
- *Chironomus* 54 ug/L
- *Eohaustorius* 49 mg/L
- *Mytilus* 7 ug/L
- *Ceriodaphnia* 15 ug/L

Species Recommendations

- Replace *Eohaustorius* and *Mytilus* at River Stations
- Option: *Hyalella* and *Chironomus* whole sediment
- Option: *Hyalella* whole sediment and *Ceriodaphnia* SWI

- Keep *Eohaustorius* and *Mytilus* in Suisun Bay Station
- Add *Hyalella* in side-by-side tests?
- Add *Ceriodaphnia* SWI in side-by-side tests?

Agenda Item 3

Using Toxicity Identification Evaluation (TIE) Methods to Investigate Causes of Sediment Toxicity to Amphipods

Project Goals

- To use standardized and newly-developed sediment TIE methods to determine the causes of wet-season sediment toxicity at two stations located at the margins of the estuary.

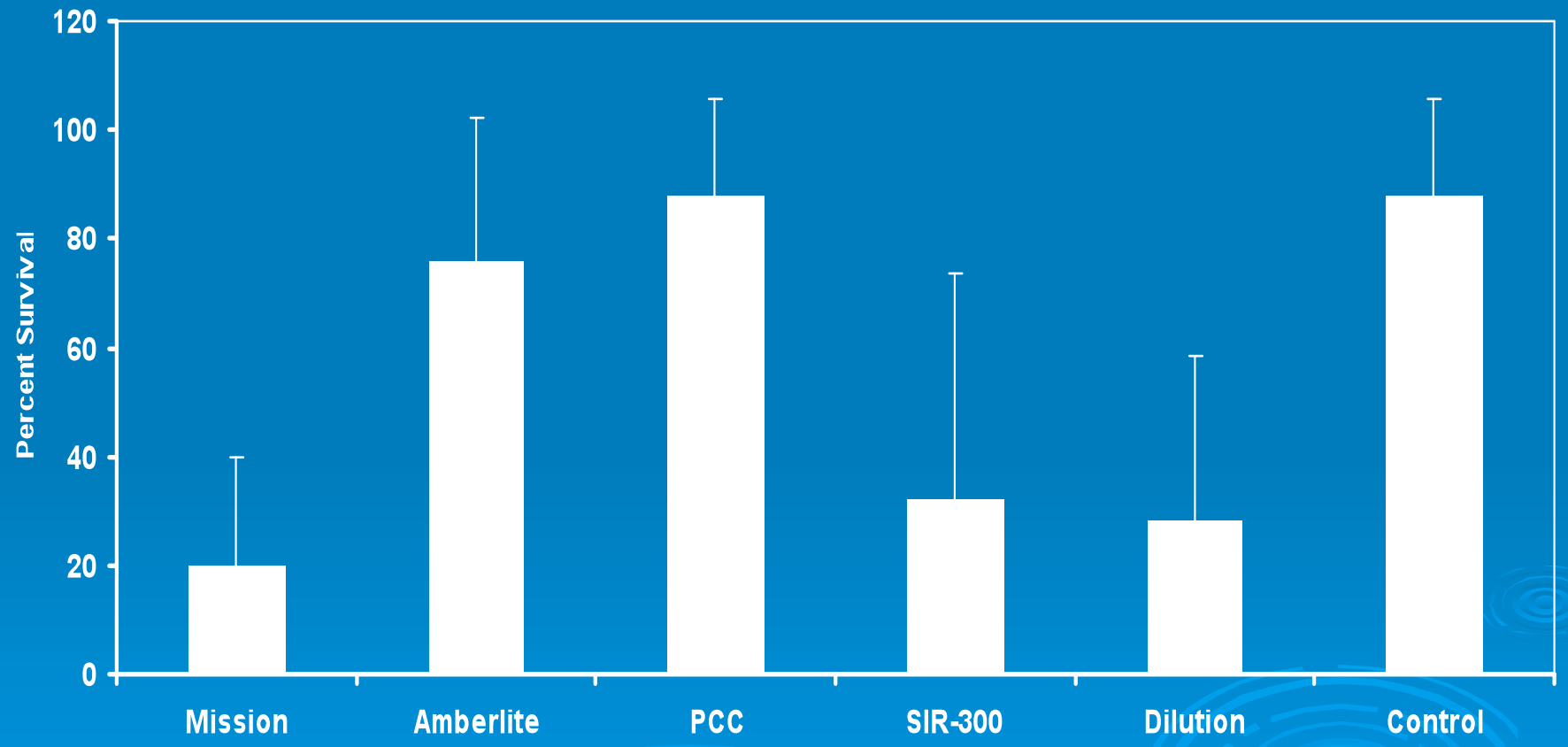
- Long-term goal to combine TIEs with sediment quality triad studies to evaluate State Water Resources Control Board sediment quality objectives for the San Francisco Estuary.

Site Selection

- Current knowledge of land use
- Conceptual models of sediment transport
- Previous monitoring results
  - must be located within the Estuary margin
  - high magnitude of sediment toxicity from previous studies (>50% mortality)
  - there must be evidence of persistent toxicity over time (>2 toxic samples if sampled more than once)
  - similar sediment quality characteristics as those generally found in the Estuary.
- Best professional judgment.

Station	Sediment TUs	Interstitial TUs
Rheem Creek	<1	<1
Mission Creek	~1	3.6
San Leandro Creek	<1	<1
San Mateo Creek 1	<1	<1
Islais Creek 1	<1	<1
San Mateo Creek 2	<1	<1
Islais Creek 2	<1	<1
Airport	<1	<1
Dumbarton Bridge	<1	<1
Kirker Creek	<1	<1
Suisun Bay	<1	<1
Castro Cove	<1	<1
Corte Madera Creek	<1	<1
Redwood Creek	<1	1.3

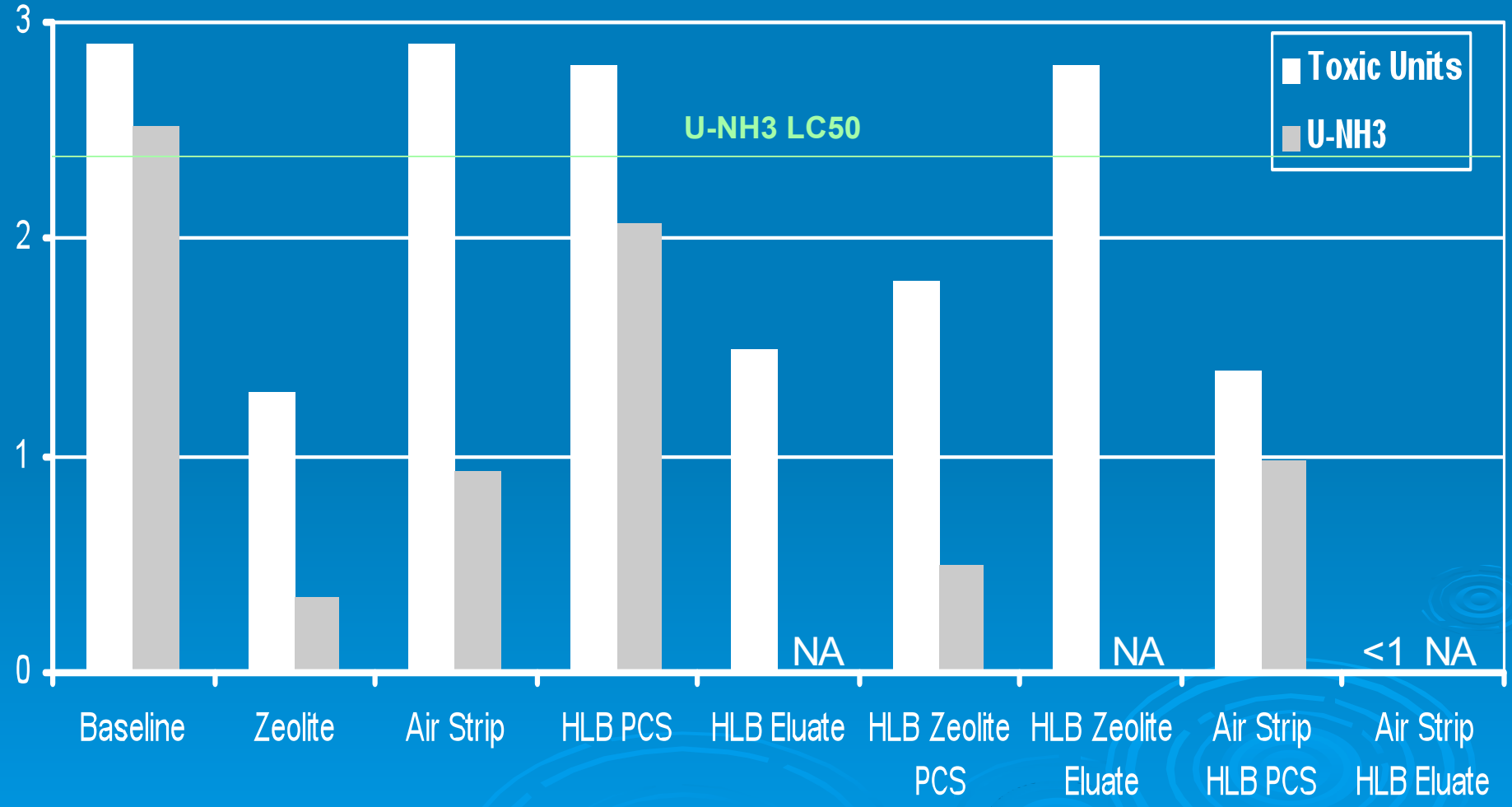
Mission Creek Whole Sediment



Whole Sediment Summary

- Ammonia was not a factor in whole sediment exposure
- Reduction of toxicity with Amberlite and PCC indicated organic toxicity
- Toxicity in Amberlite eluate further characterized the cause of toxicity as organic
- Interstitial Water TIEs focused on organics

Mission Creek Interstitial 1



Mission Creek Interstitial 2

- Used multiple columns in sequence to remove organic toxicity
- Column treatments followed by zeolite to remove ammonia
- 10-Day toxicity was still not reduced by up to three columns
- Additional columns increased the LT50 indicating some reduction of toxicity

Interstitial Water Summary

- Ammonia played a role in IW toxicity, but samples still toxic after ammonia reduction
- Reduction of toxicity by HLB columns and toxic HLB eluates characterize the cause of toxicity as organic

Sediment Chemistry Highlights

- Ammonia contributed to toxicity, but increased during sample storage
- Individual sediment chemicals were below threshold limits
- Sediment contained a complex mixture of chemicals
- SQGQ = 21.3 (Fairey et al. 2001) – 6.9 without chlordane (toxicity expected at >3.5)
- Some evidence of PAH toxicity – *R. abronius* LC50 exceeded and models predict small contribution

Eluate and IW Chemistry Highlights

- Chemicals measured in the TIE eluates and IW were compared to water-only LC50s for *E. estuarius* as part of the identification phase of the TIE
- Only PAH analyzed in IW
- No individual chemicals were above LC50s
- Amberlite eluate provides qualitative evidence
- No chemicals were detected in HLB eluate
- Models used to evaluate PAH in Amberlite eluate and IW
  - Target Lipid Model (Di Toro et al. 2000)
  - Equilibrium Partitioning Sediment Benchmark Model (US EPA and Hawthorne et al. 2008)

Agenda Item 4

Recommendations

- Continue to work at Mission Creek
  - Further pursue TIE method development
- Tenax and Amberlite
  - Shorter equilibration time to address bioavailable component of sediment
- Liquid/Liquid Extraction for IW
  - Some chemicals don't adsorb to column and others are difficult to elute
  - Experiment with different IW extraction method
- LC50 data development
  - There are still a number of common and emerging chemicals in Mission Creek sediment for which there is no toxicity data

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