

Freshwater Stream Sediment Monitoring Program Results 1987-2002

a.k.a.

“does anybody remember why we
collected these samples?”

Acknowledgements

Presented by:

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Outline of Presentation

- Problem statement
- Why monitor sediments?
- Available data
- Data analysis
- Results / major findings
- Future work

Problem Statement

- Q1: Are some constituents “problematic?”
 - A: It would appear so ... (begs question re: “compared to what?”)
- Q2: Are some stream sediment sampling sites substantially “different” from others?
 - A: It would appear so ... (more to come...)
- Q3: Does existing monitoring program provide appropriate/adequate info?
 - A: Some recognized data gaps to be filled

Why Monitor Sediments?

Sediment quality:

- Reflects water quality
- Changes slowly relative to water quality
- Affects aquatic life
- Varies over time and space
- Typically spatially heterogeneous

What can the dataset tell us about impacts, differences between sites, trends, etc.?

Available Data

- Samples collected annually, 1987-2002
- 27 streams within WRIAs 8 and 9 (*map*)
- Mainly metals & grain size
- Limited organics (mostly petroleum HCs)

Study Area (WRIs 8 & 9)



Data Analysis

- Graphs (e.g., conc.'s vs. time, by site)
- Summary statistics
- Detailed statistical analyses
- Compare results to FWSQGs, including:
 - Threshold Effects Level (TEL); $< \text{TEL} = \text{safe}$
 - Probable Effects Level (PEL); $> \text{PEL} = \text{concern}$

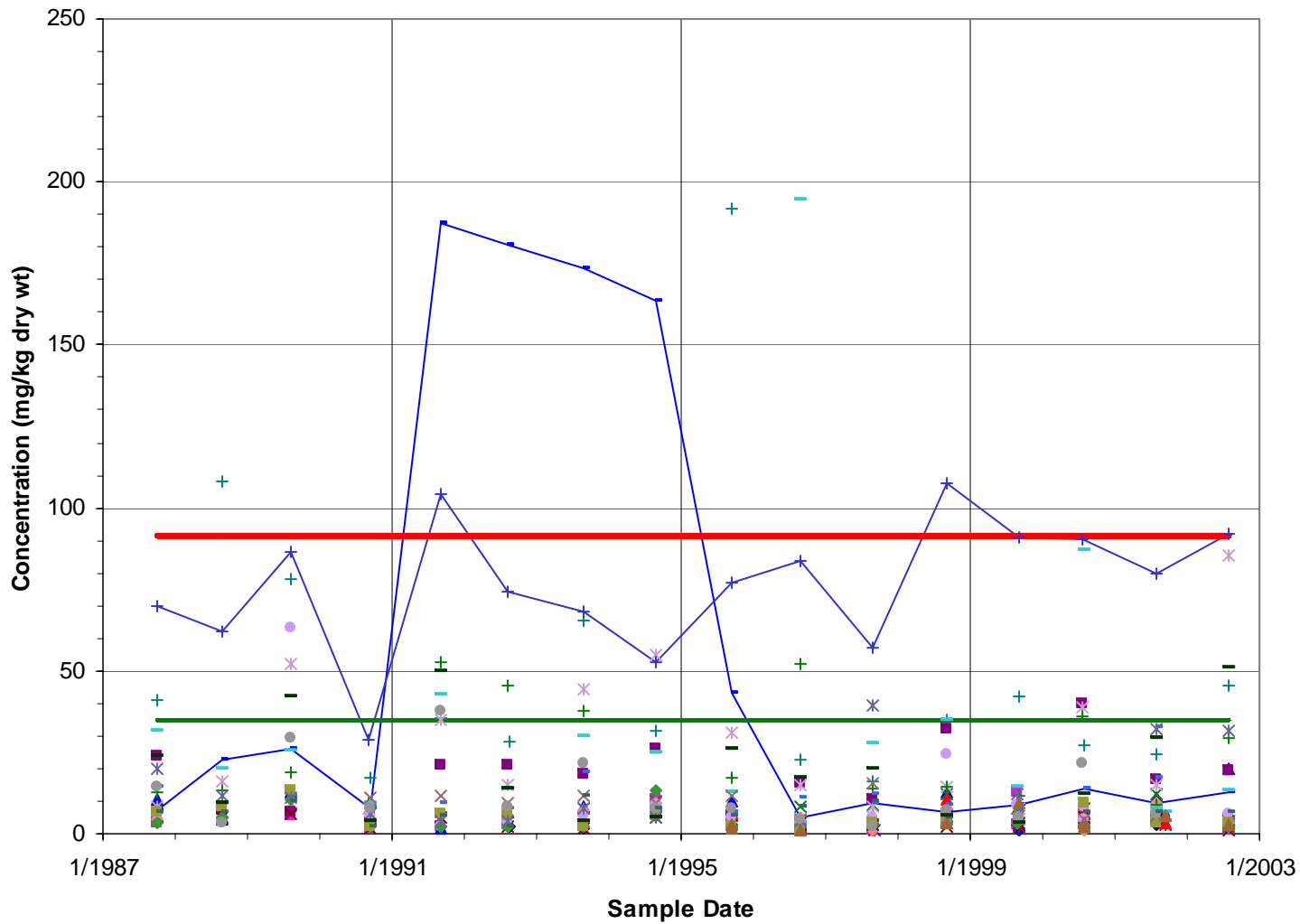
Results -- Chemical

- Of 170 chemical parameters analyzed:
 - 36 detected at least once
 - 134 never detected
- Of the 36 detected parameters:
 - 17 metals
 - 4 petroleum hydrocarbons
 - 15 add'l organics

Results -- Chemical (cont'd)

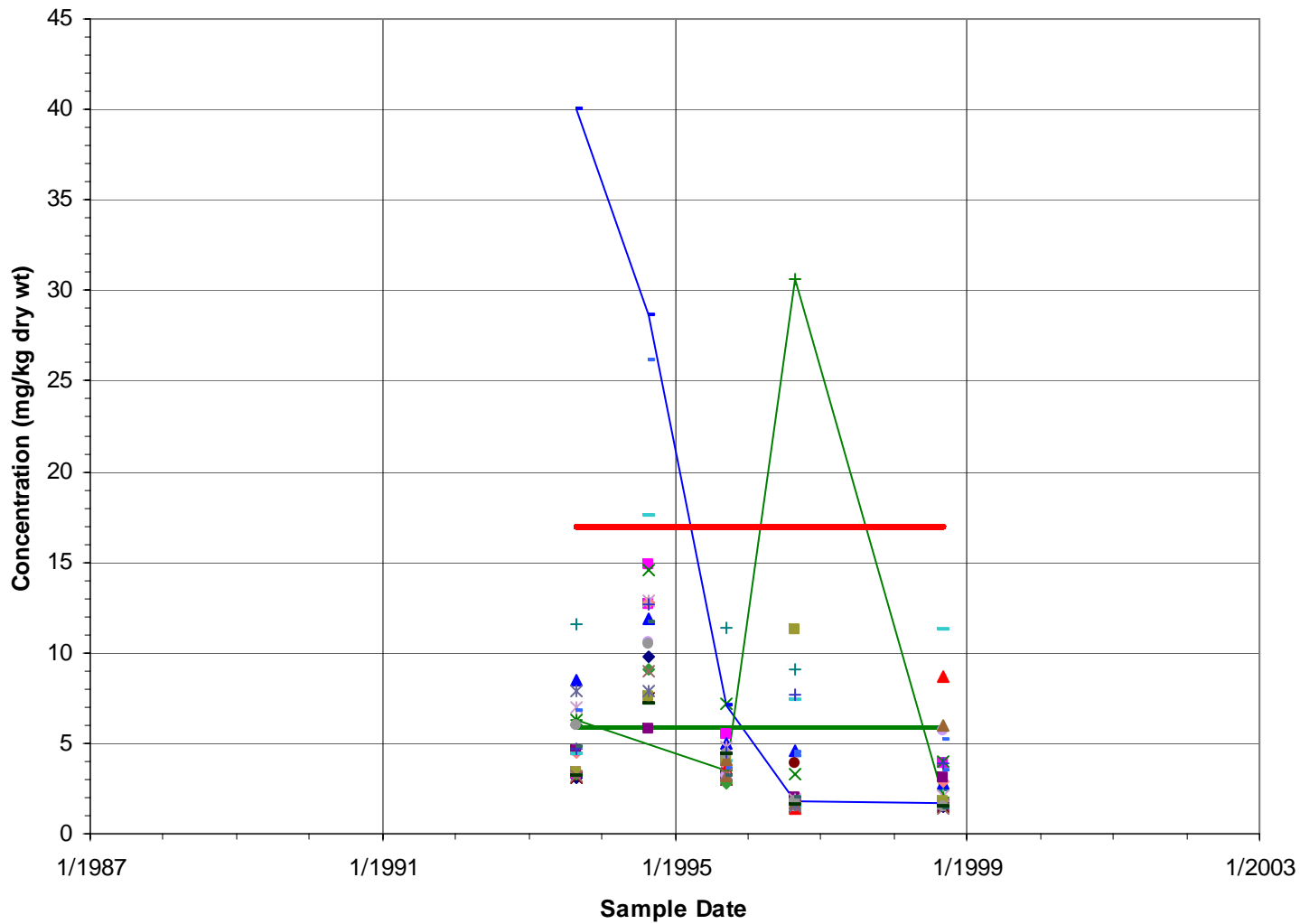
- Max. conc.'s of 4 metals exceeded PELs, but Screening Ratios (i.e., [Conc.]/PEL) were low:
 - Arsenic (SR=2.35)
 - Lead (SR=2.13)
 - Nickel (SR=1.78)
 - Zinc (SR=1.04)
- All 8 metals having TELs exceeded them (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)

**EXAMPLE:
Total Lead in Freshwater Sediments**



- ◆ Bear Creek (0484)
- Big Soos Creek (A320)
- ▲ Coal Creek East (0442)
- × Crisp Creek (0321)
- × Ebright Creek (A685)
- Eden Creek (A690)
- + Fairweather Bay Trib (0498)
- Forbes Creek (0456)
- Idylwood Creek (A620)
- ◆ Issaquah Creek (0631)
- Juanita Creek (0446)
- ▲ Lewis Creek (A617)
- × Little Bear Creek (0478)
- × Lyon Creek (0430)
- May Creek (0440)
- + McAleer Creek (0432)
- Mercer Slough (0444)
- Mill Creek (A315)
- ◆ Newaukum Creek (0322)
- North Creek (0474)
- ▲ Pine Lake Creek (A680)
- × Pipers Creek (0210)
- × Springbrook Creek (0317)
- Swamp Creek (0470)
- Thornton Creek (0434)
- Tibbets Creek (0630)
- Yarrow Bay Trib (0499)
- FWSQG_PELFW
- FWSQG_TELFW

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Total Arsenic in Freshwater Sediments**



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- FWSQG_TELFW

Results -- Chemical (cont'd)

- Differences by site: e.g., count # of times in “top 3” highest conc.'s, by chemical:
 - Forbes Creek (14 times)
 - Fairweather Bay Trib, McAleer Creek (8 times)
 - Thornton Creek (7 times)
 - Mill Creek (5 times)
 - Mercer Slough, Springbrook Creek (4 times)
- More detailed statistical tests pending

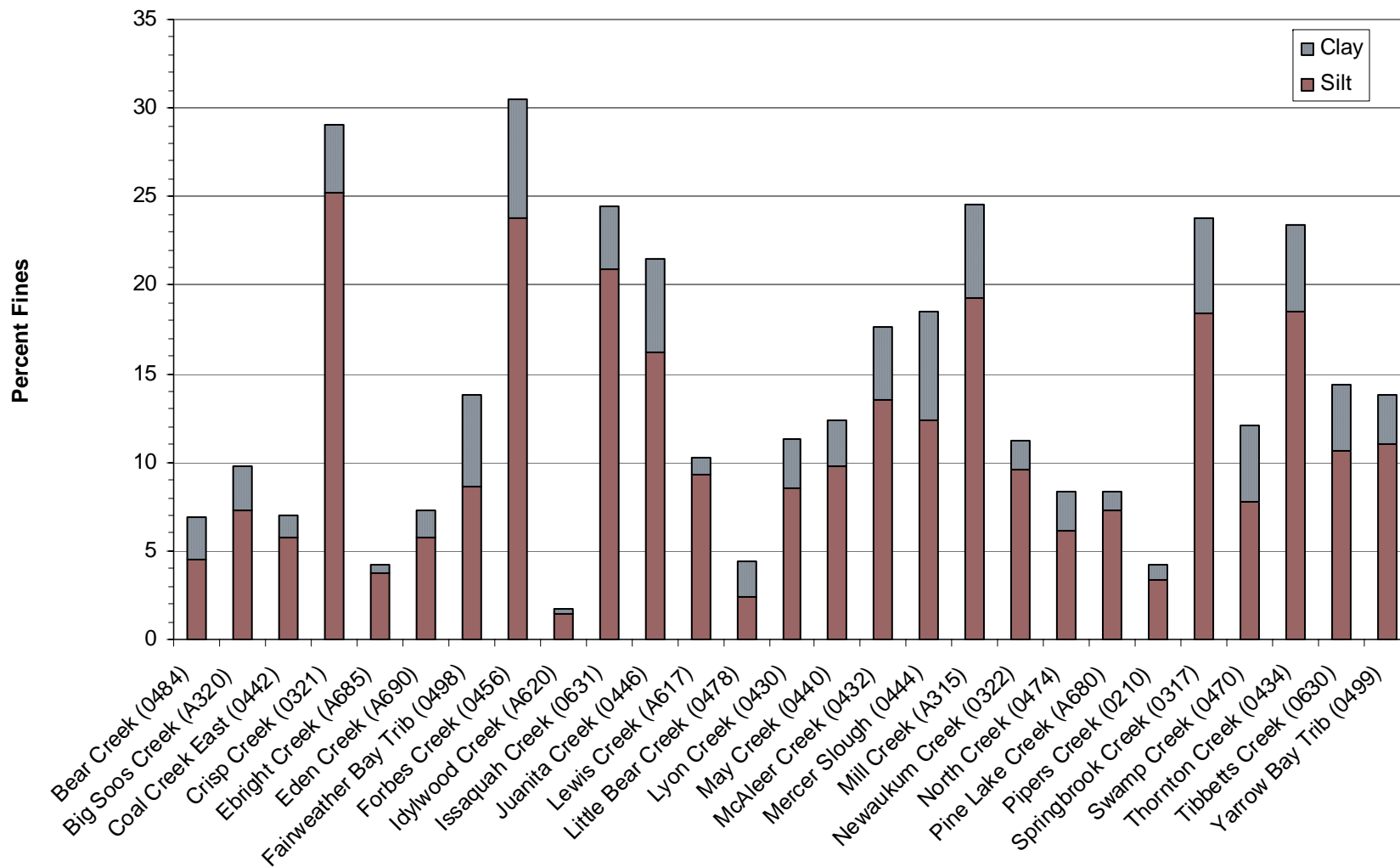
Results -- Chemical (cont'd)

- Work in Progress -- compare freshwater stream sediment data with:
 - Additional types of sediment quality guidelines (e.g., floating percentiles)
 - Lake sediment quality data
 - Puget Sound upland soils data

Results -- Grain Size

- Sites dominated by coarse (gravel + sand)
- Major differences in fines (silt + clay)
- Importance of fines:
 - Expect correlations with certain chemicals (pending detailed statistical analyses...)
 - Aquatic life habitat

Average Percent Fines by Site



SUMMARY

- Some chemicals (e.g., As, Pb, Ni, Zn) appear more likely problematic than others
- Some sites appear to have higher conc.'s than others (pending statistical analyses...)
- Can observe some trends over time

Future Work

- Additional statistical analyses (correlations, differences between sites, “trends”)
- Will likely continue program, with revisions re: analytes, methods, sampling schedule
- Fill data gaps (e.g., inconsistent analyte list, add useful info such as SEM/AVS, TOC)

Related Work

- Compare to new FWSQGs from Ecology
- Lake sediment quality monitoring
- Freshwater streams WQ monitoring
- Benthic macroinvertebrate surveys

STILL HAVEN'T HAD
ENOUGH ???

Detailed Statistics

- Correlations between parameters (e.g., between Metal A and Metal B; between Metal C and % Fines)
- Differences between sites (e.g., “for Chemical X, Site Y has significantly higher conc.’s than 23 of the 26 remaining sites”)
- “Trend” analysis; different slopes vs. time

Data Gaps -- Study Design Issues

- Not all sites sampled consistently for all parameters studied (limits trend analysis)
- Limited sampling of organic chemicals
- Acid Volatile Sulfides not sampled (limits interpretation of metals bioavailability)
- Total Organic Carbon not sampled (limits interpretation of bioavailability)

Data Gaps -- Missing Info

- Lack of FWSQGs for most chemicals
- Issues re: selection of appropriate sediment “background”/reference values
- MDLs issues (adequacy, changes over time)
- Statistical issues (e.g., potential for spurious correlations, can’t do “true” trend analysis)

Jon & Secret Service, 1984

- Gary Hart, Walter Mondale & Jesse Jackson
- John Hill & Barry Manilow; ex-girlfriends, drug dealers, et al.
- CBS, Dan Rather & Columbia University
- Jon & the Secret Service
- Jon & Susan on TV (with Dan, Gary, Walter & Jesse, of course...)