CALFED BAY-DELTA PROGRAM

Item #4

Summary and Synthesis of Mercury Studies in the Cache Creek Watershed, California, 2000-2001

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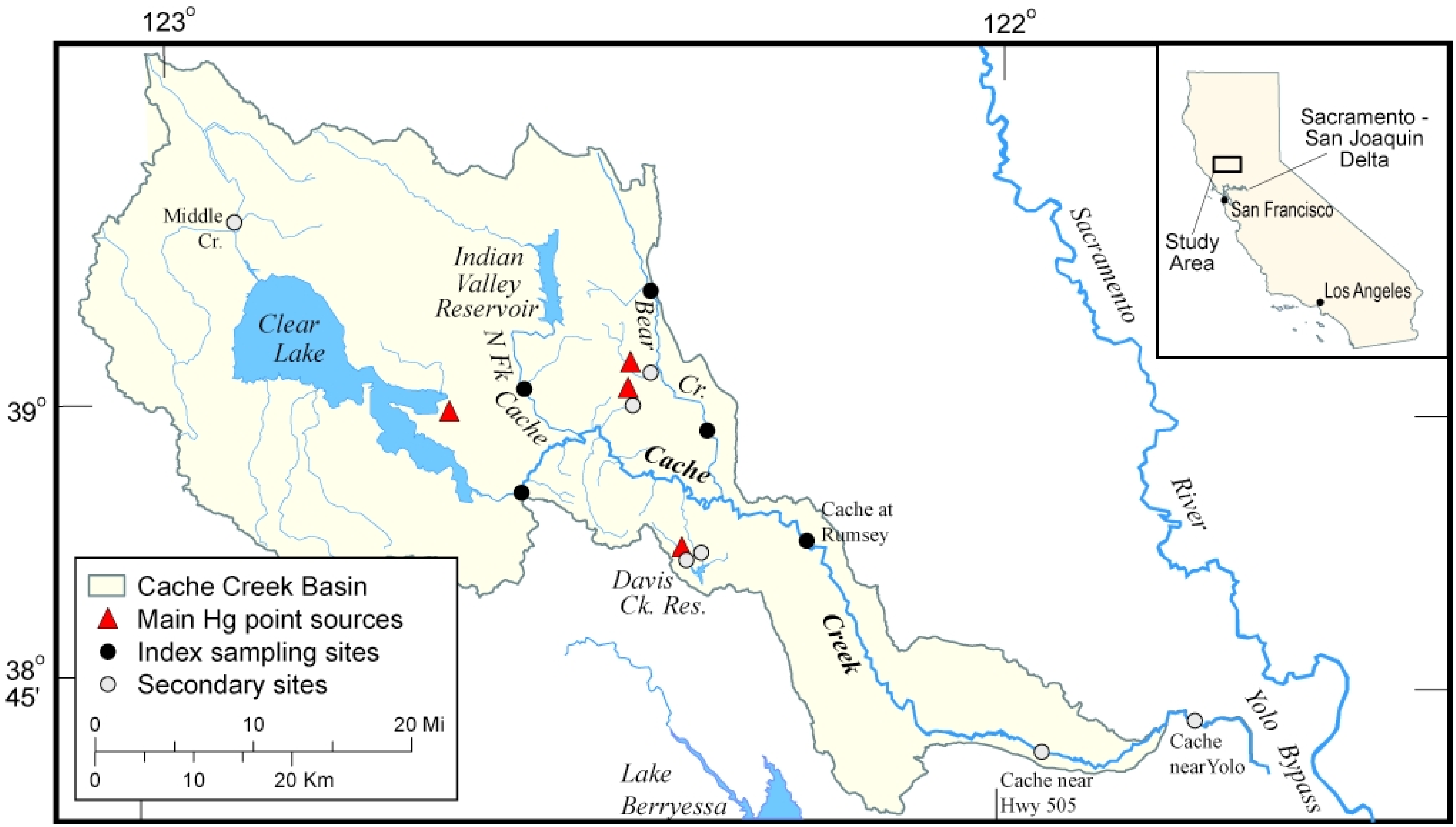
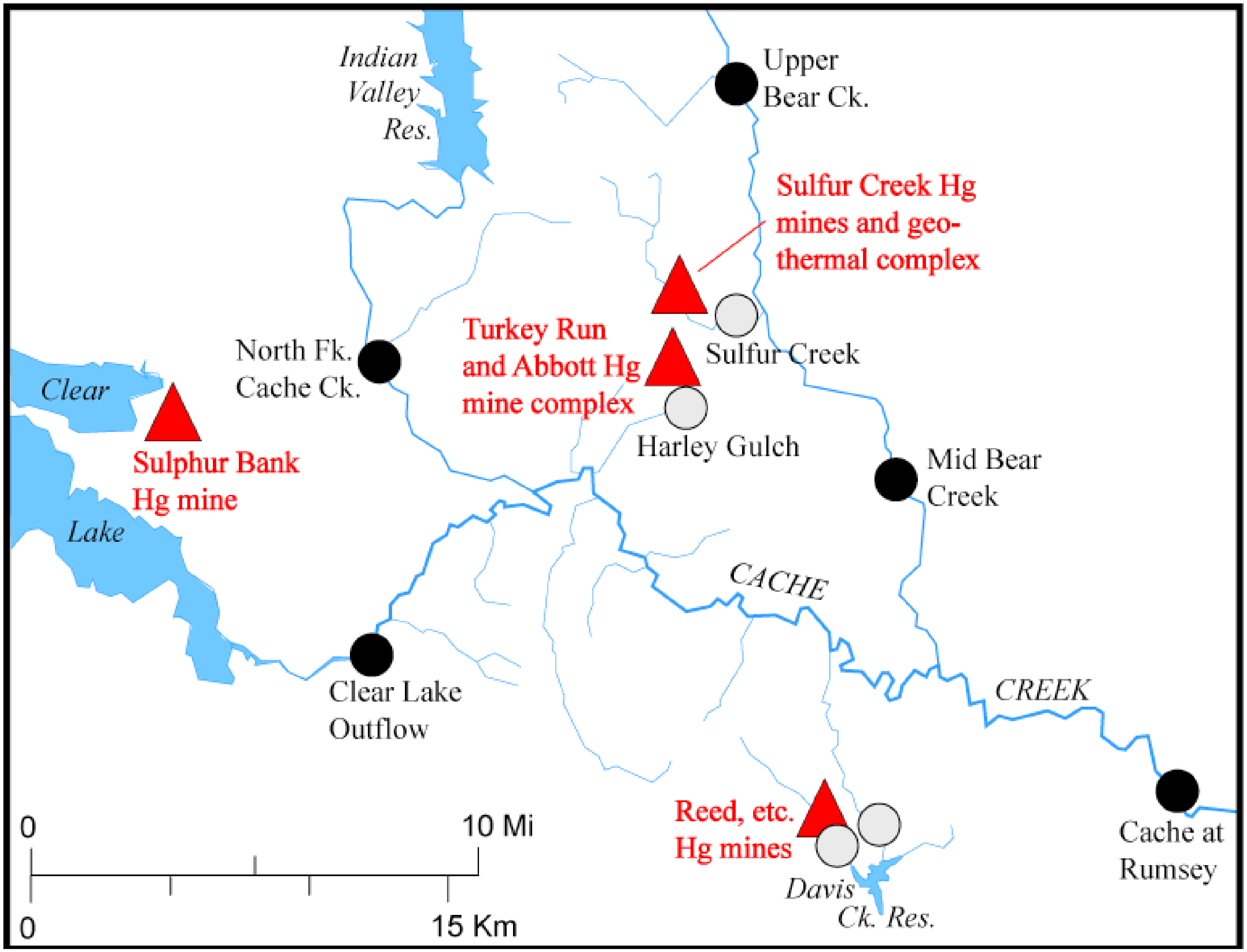
[1] USGS [2,3] UC Davis [4] USF&WS
[5] CGS [6] Frontier Geosciences

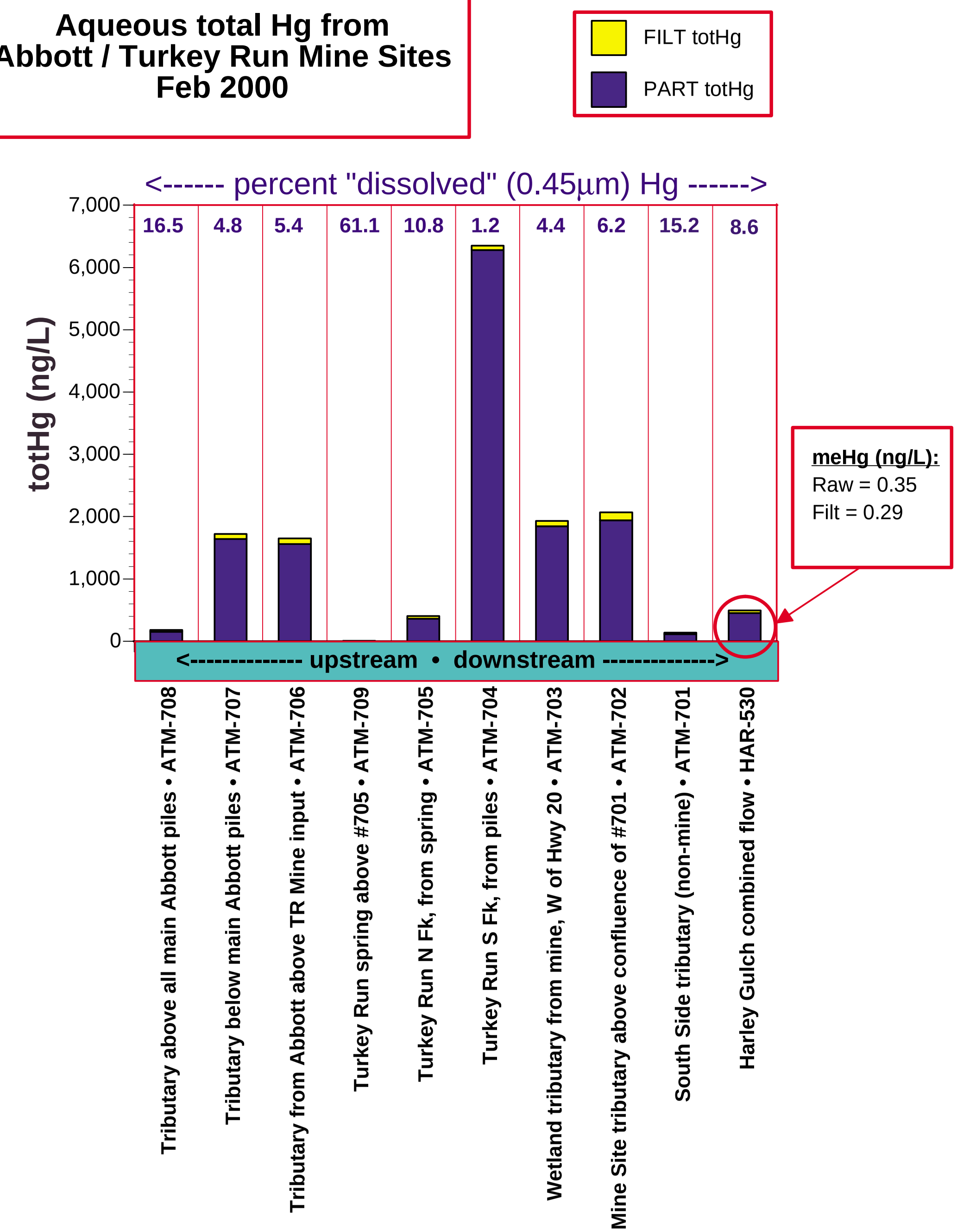
Cache Creek Watershed – Mercury sources and sampling sites

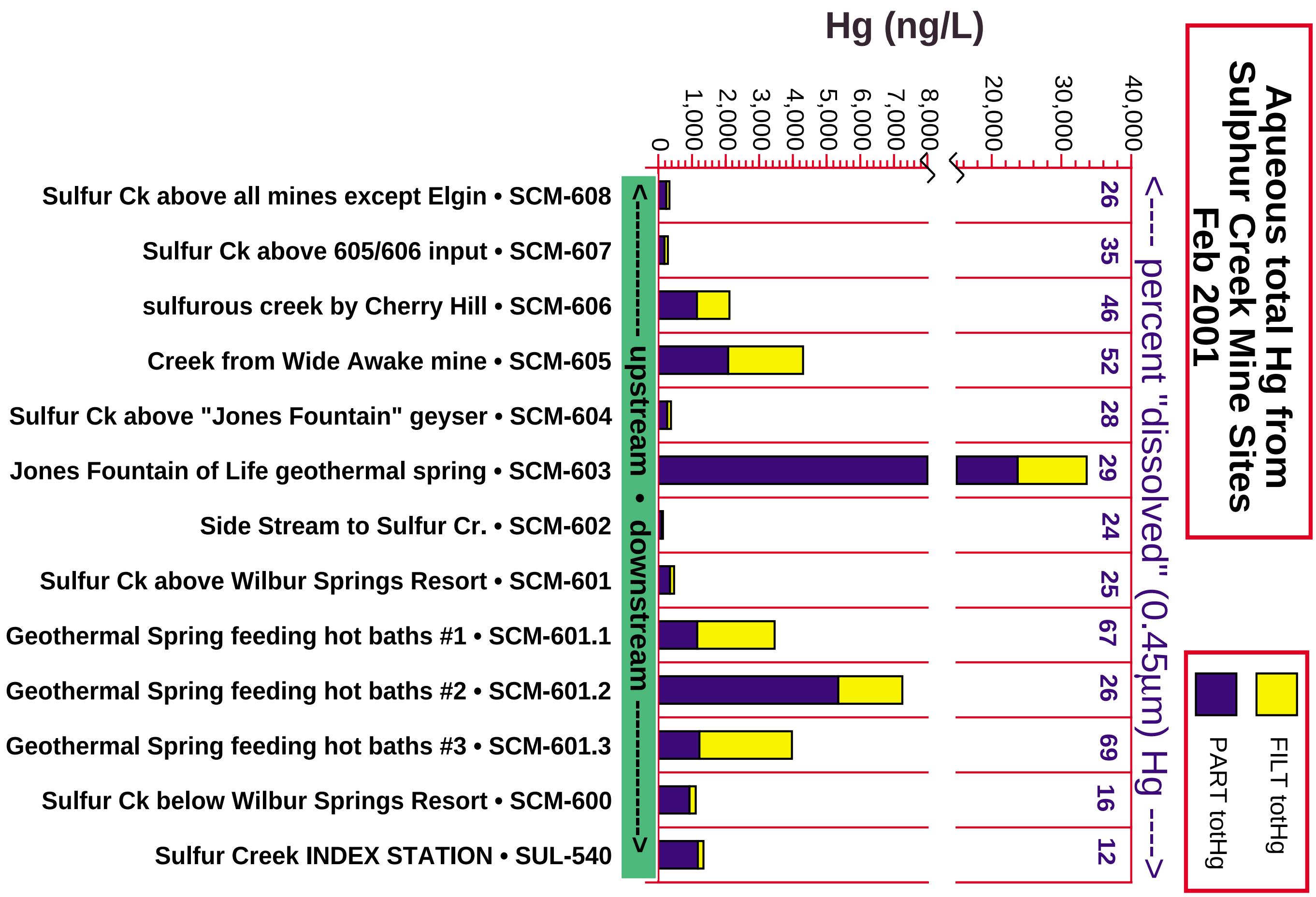


Cache Creek Watershed – Mercury sources and sampling sites



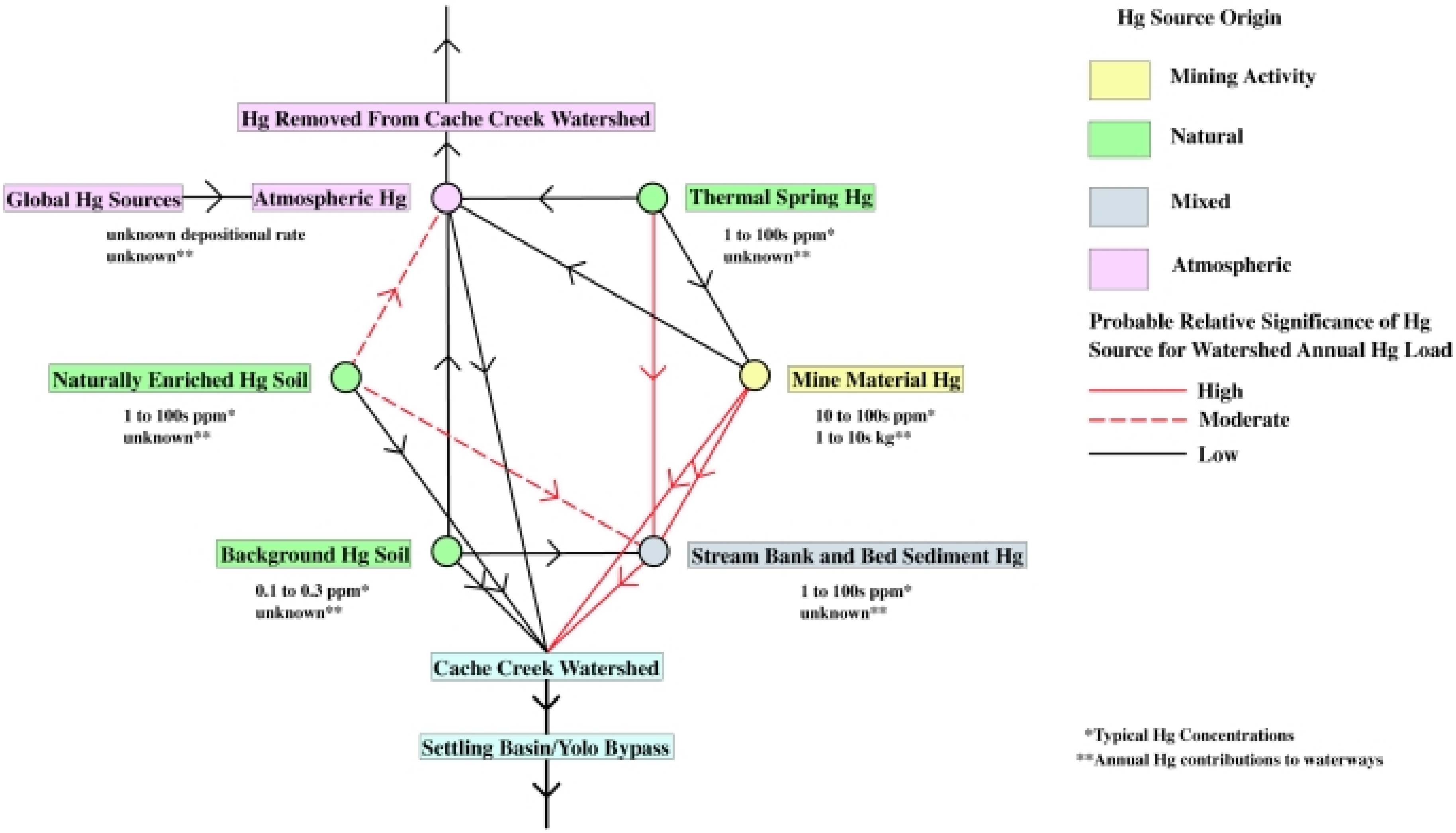
Aqueous total Hg from Abbott / Turkey Run Mine Sites Feb 2000



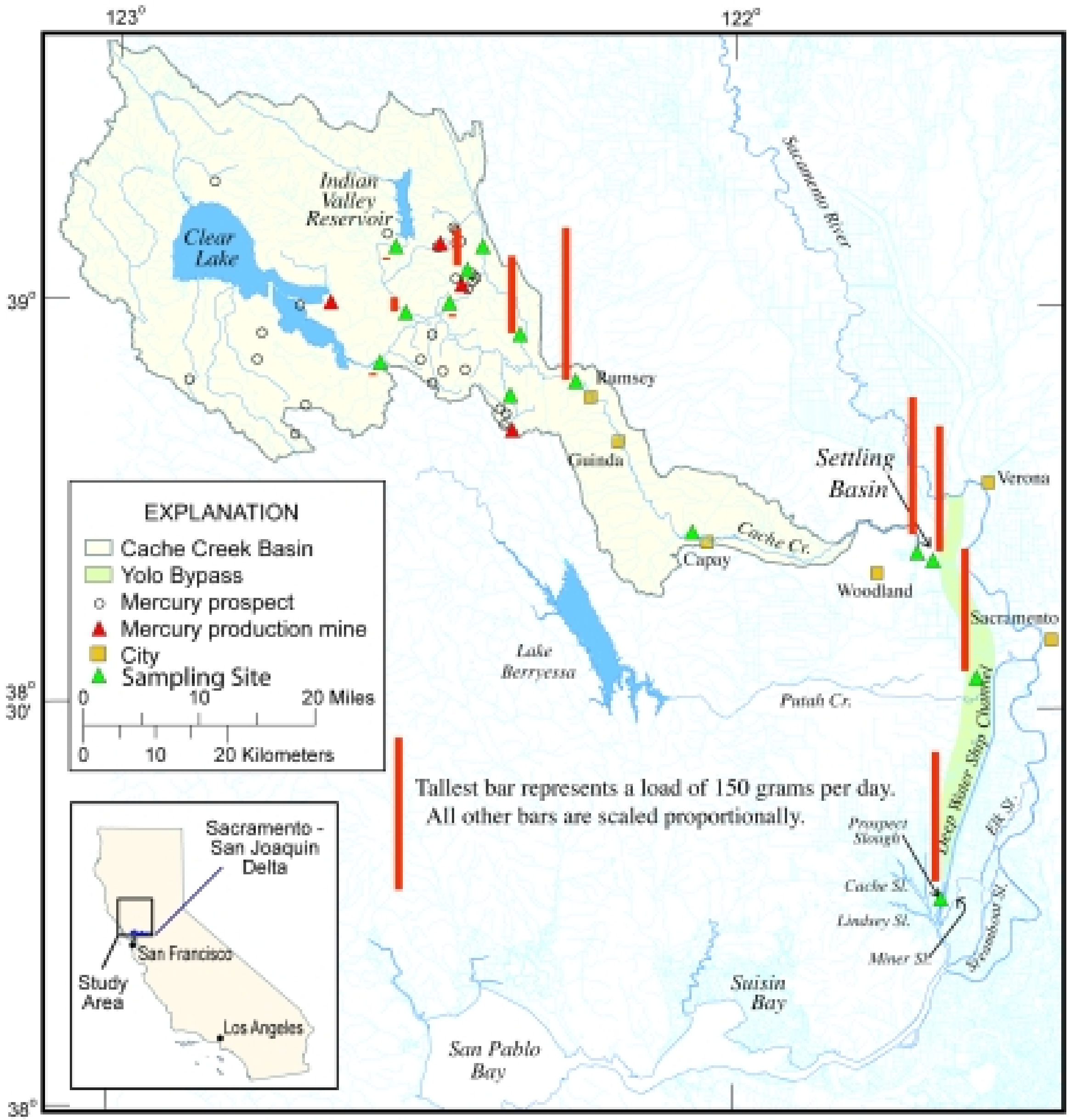


Aqueous total Hg from Sulphur Creek Mine Sites Feb 2001
FILT totHg
PART totHg
Hg (ng/L)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
20,000
30,000
40,000
<--- percent "dissolved" (0.45µm) Hg --->
<------------ upstream • downstream ------------>
Sulfur Ck above all mines except Elgin • SCM-608
Sulfur Ck above 605/606 input • SCM-607
sulfurous creek by Cherry Hill • SCM-606
Creek from Wide Awake mine • SCM-605
Sulfur Ck above "Jones Fountain" geyser • SCM-604
Jones Fountain of Life geothermal spring • SCM-603
Side Stream to Sulfur Cr. • SCM-602
Sulfur Ck above Wilbur Springs Resort • SCM-601
Geothermal Spring feeding hot baths #1 • SCM-601.1
Geothermal Spring feeding hot baths #2 • SCM-601.2
Geothermal Spring feeding hot baths #3 • SCM-601.3
Sulfur Ck below Wilbur Springs Resort • SCM-600
Sulfur Creek INDEX STATION • SUL-540
26
35
46
52
28
29
24
25
67
26
69
16
12

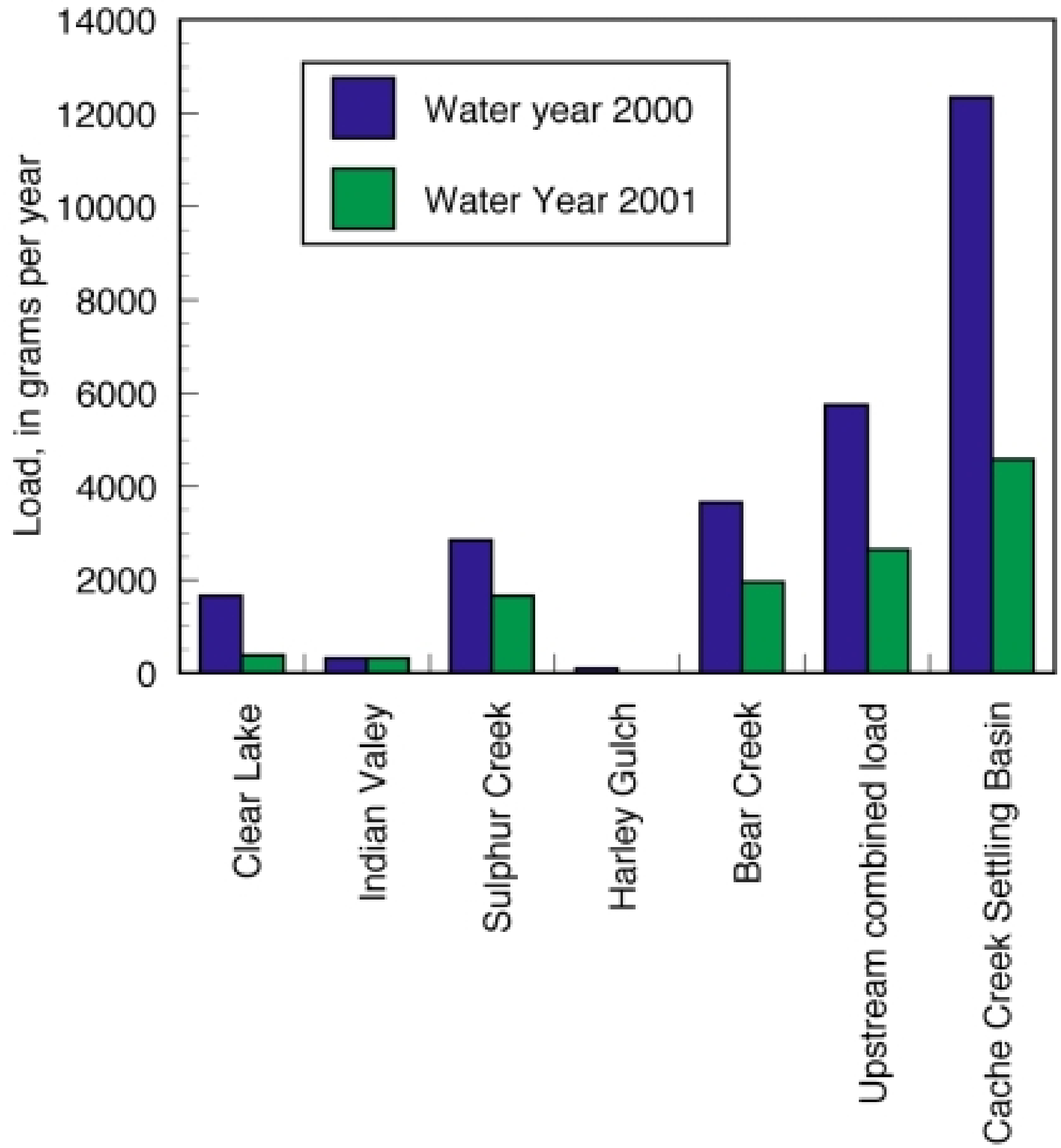
Sources and Fate of Mercury in the Sulphur Creek Mining District



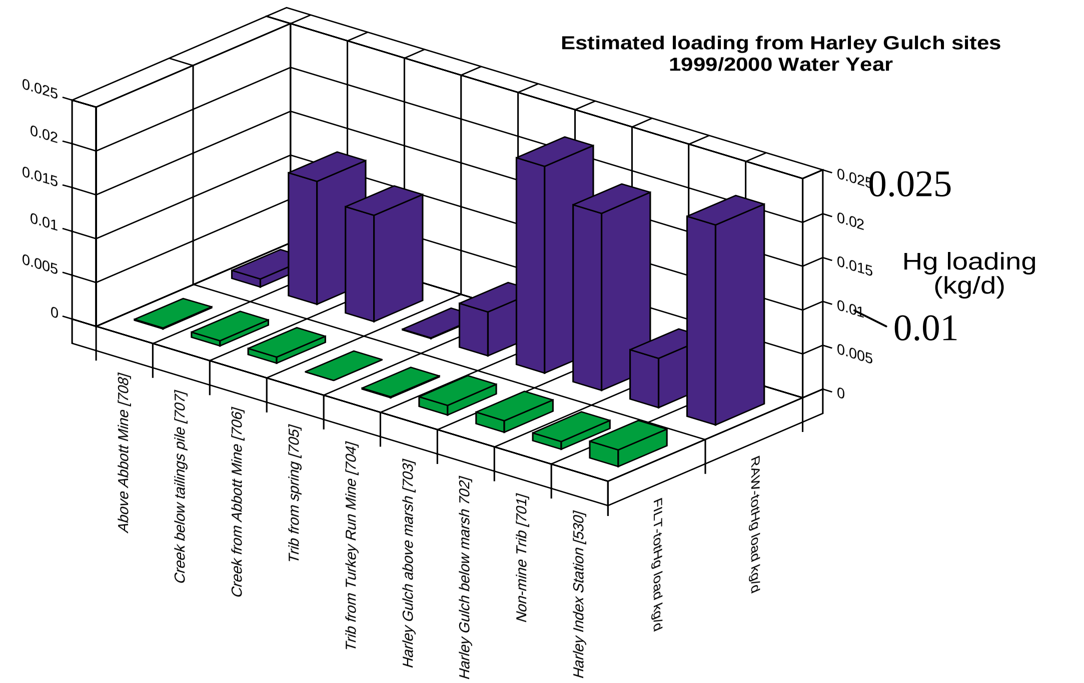
Total mercury loads, February 20-23, 2001

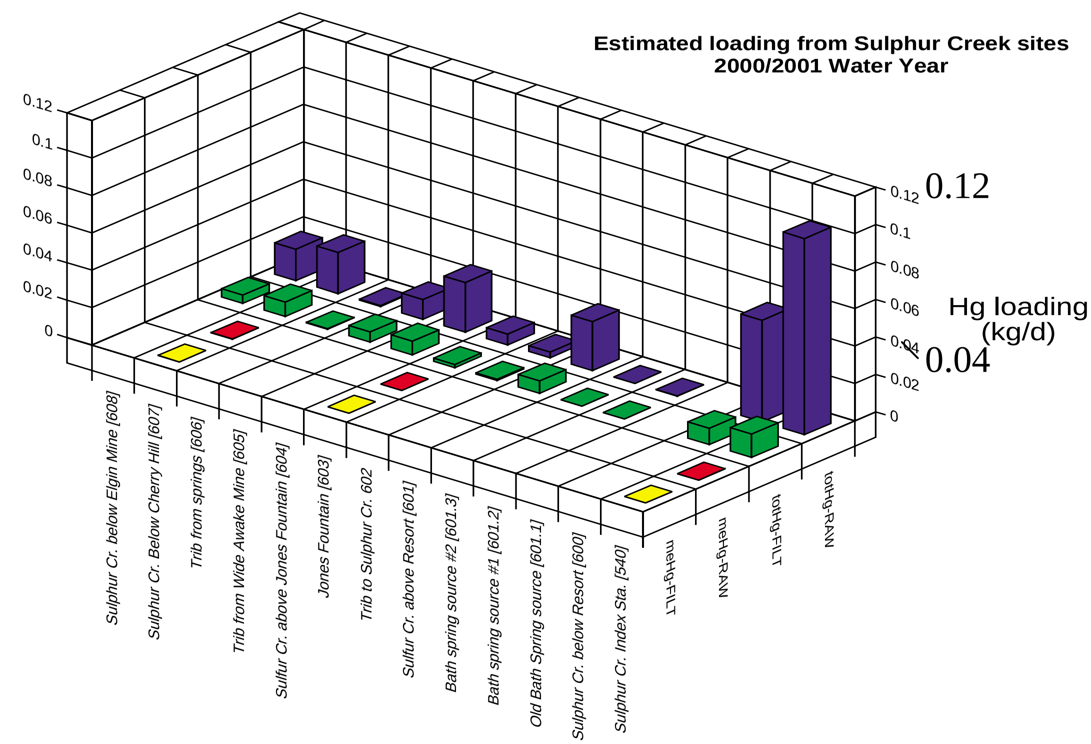


Annual loads, total mercury

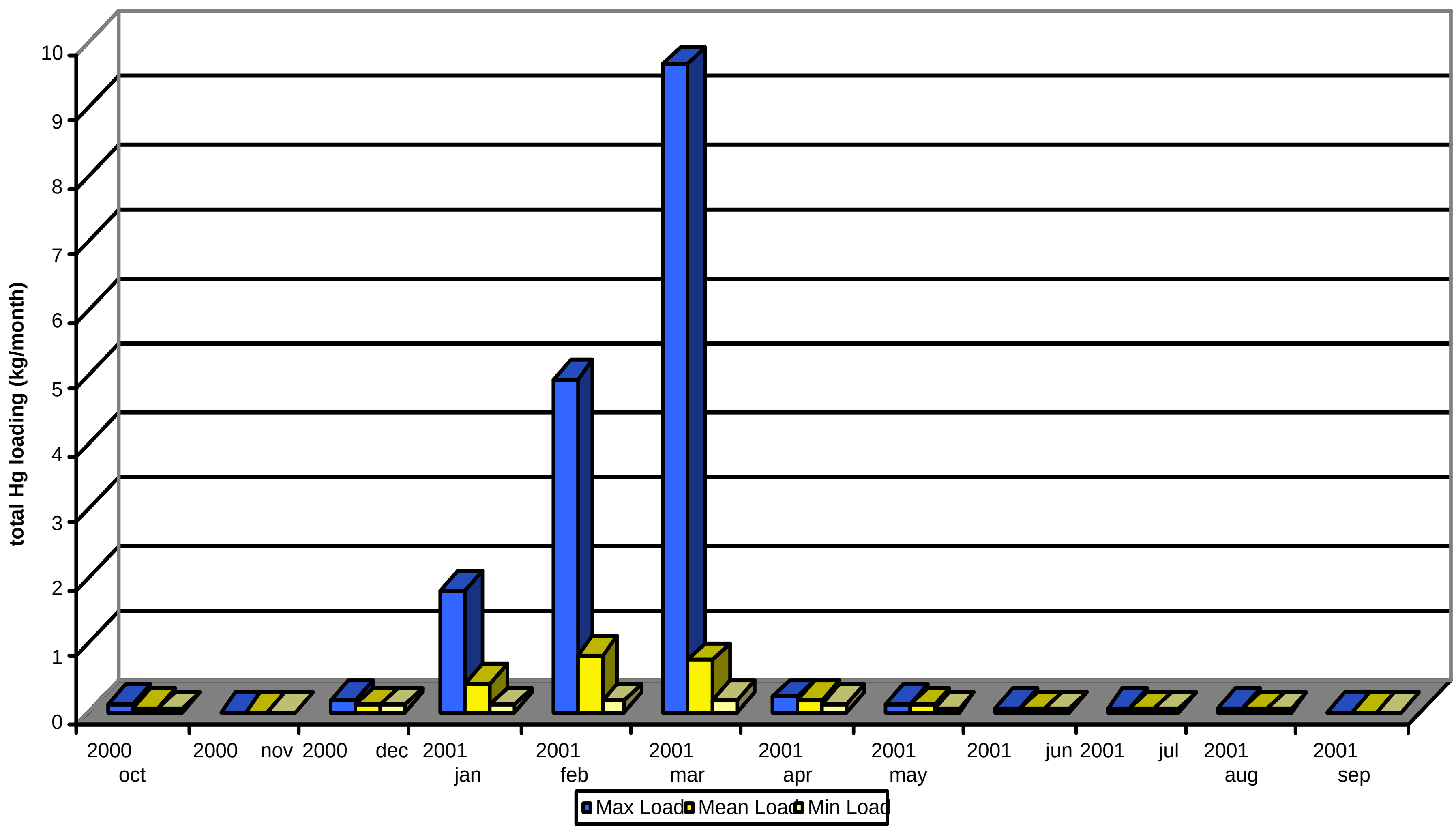


Estimated mercury loads in mined areas



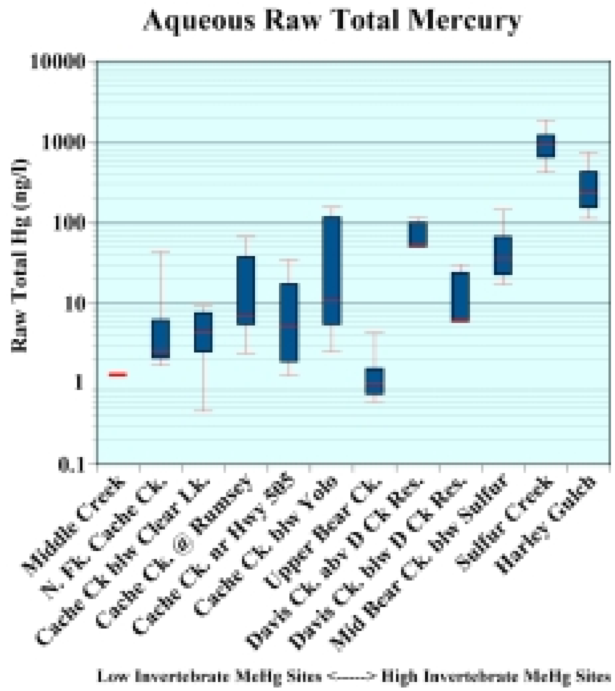


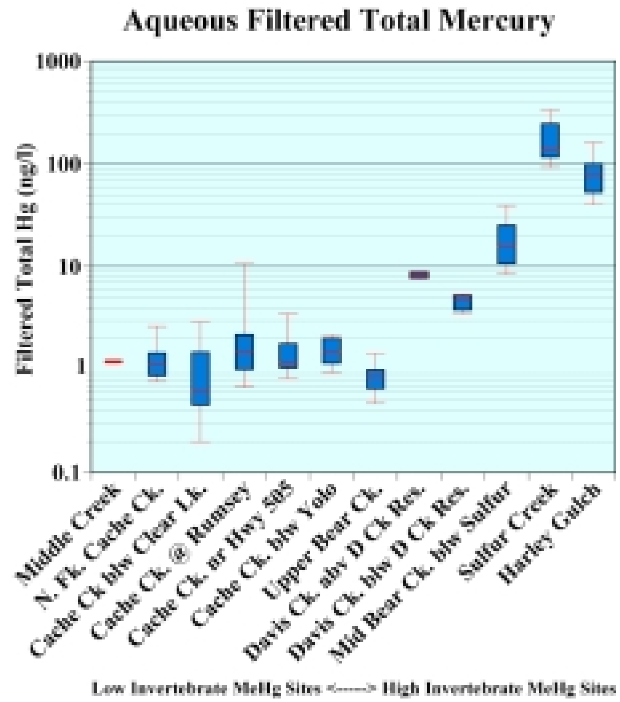
Estimated monthly loads of total mercury, Sulphur Creek WY 2001

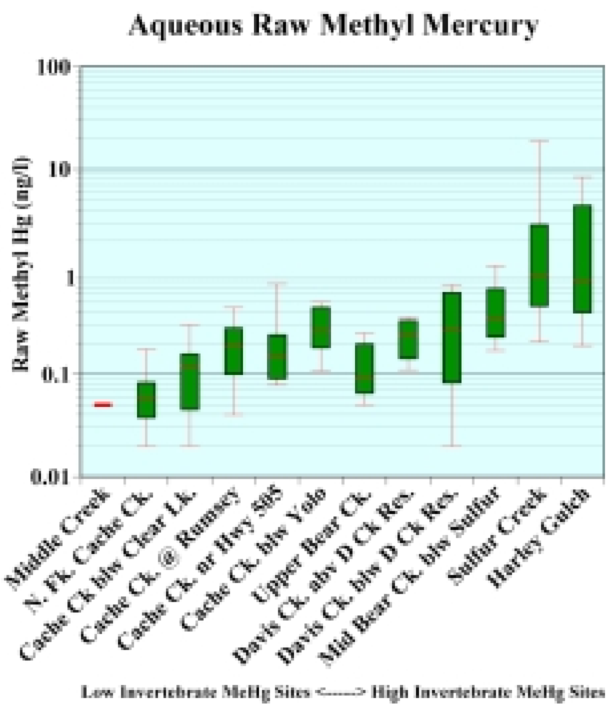


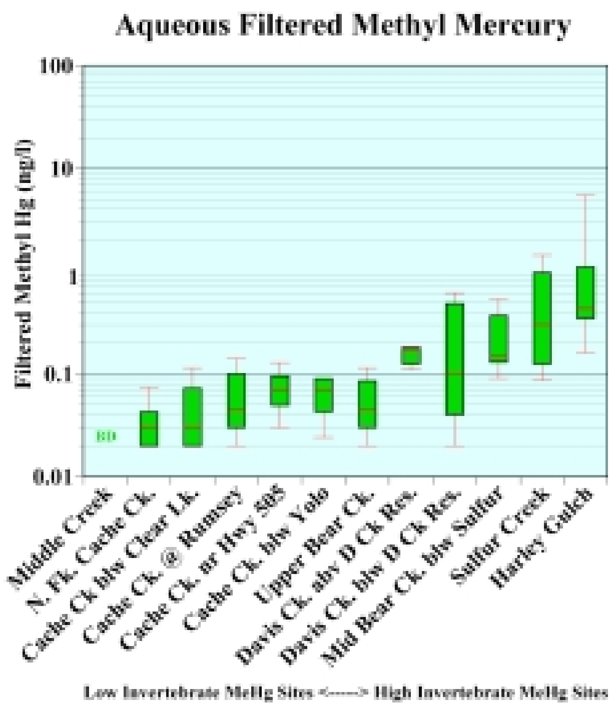
Mercury and Methylmercury Concentrations in Water,

Cache Creek Watershed, 2000-2001

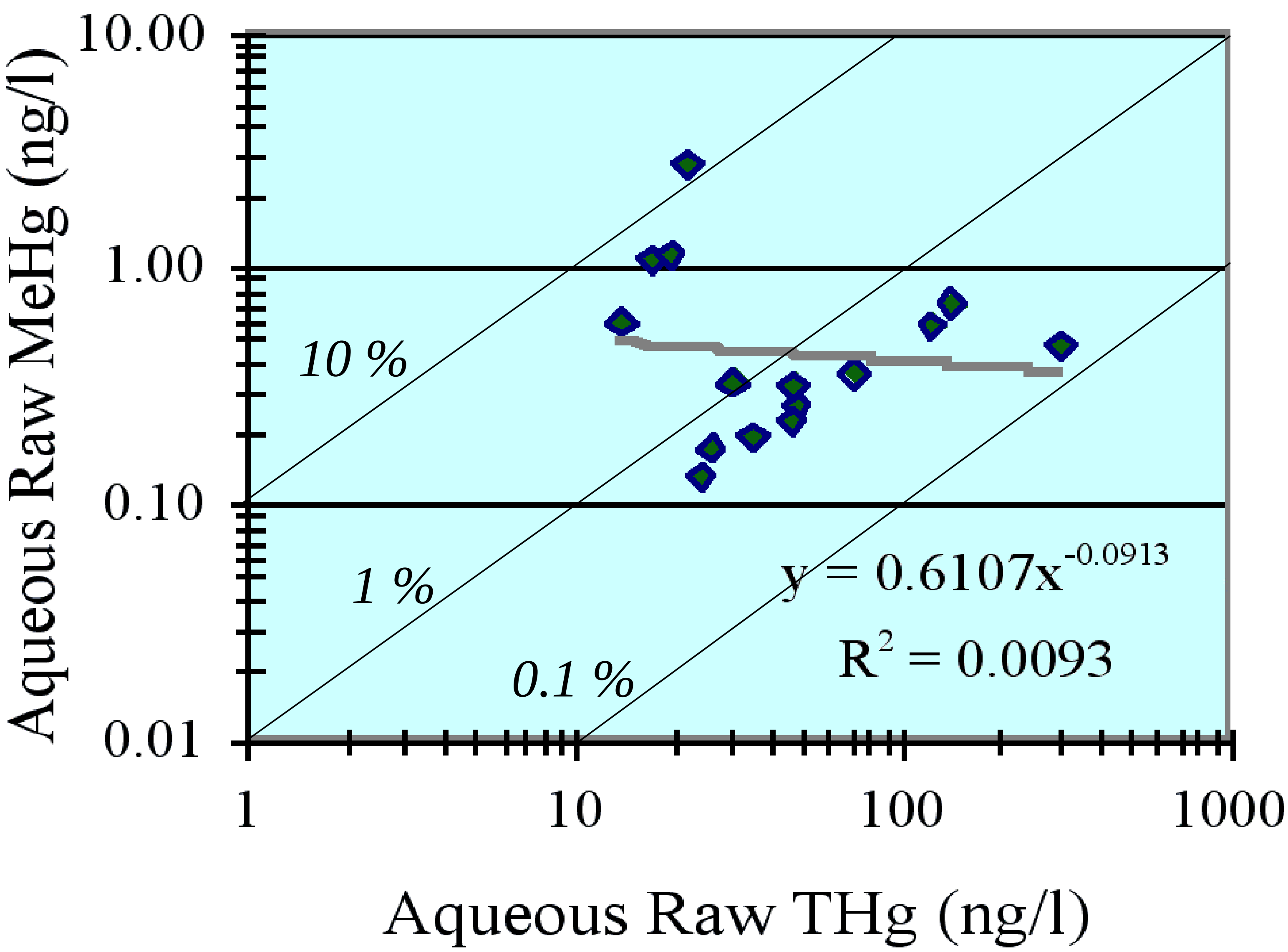






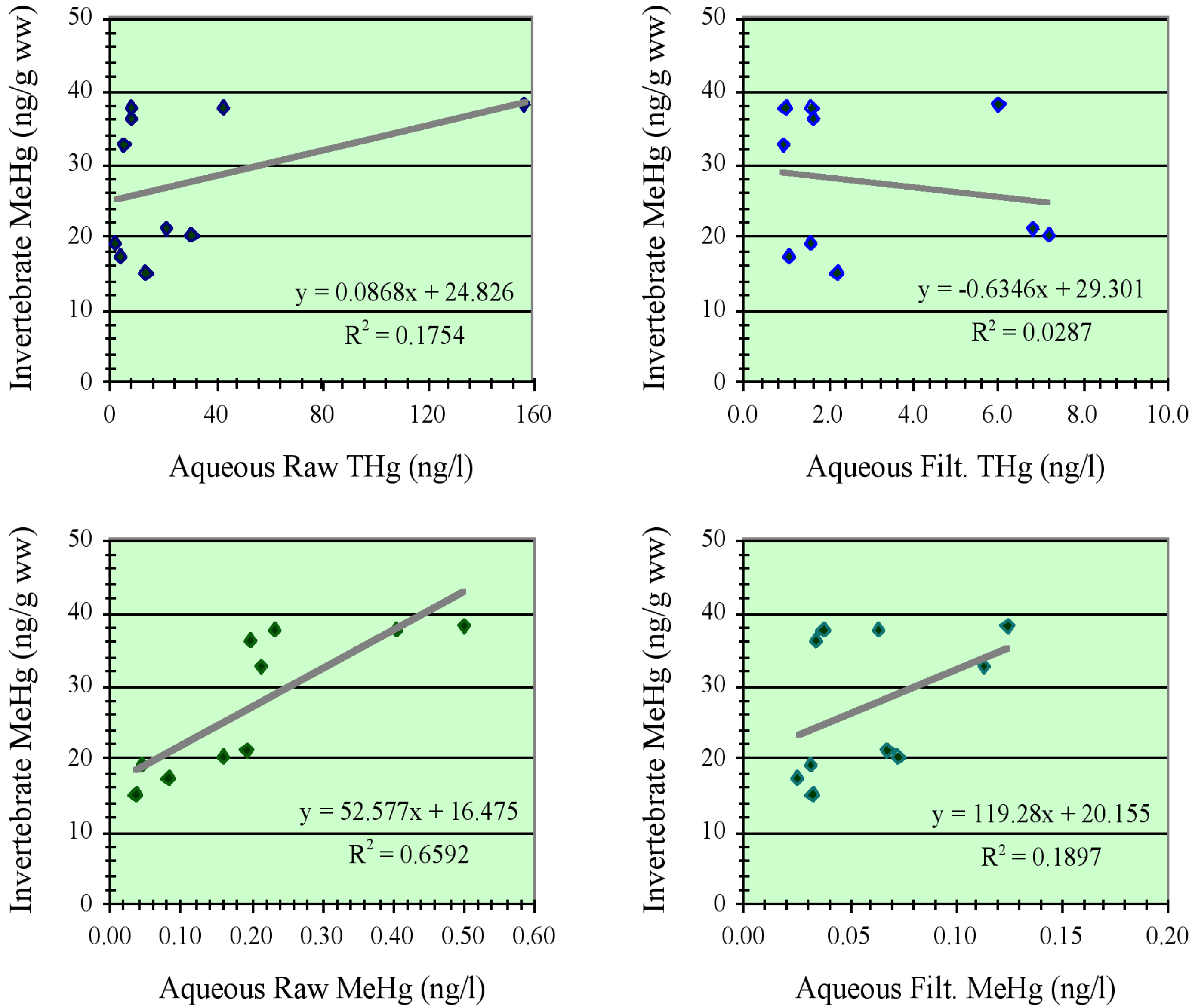


Total Hg *vs*. MeHg in water, mid Bear Creek



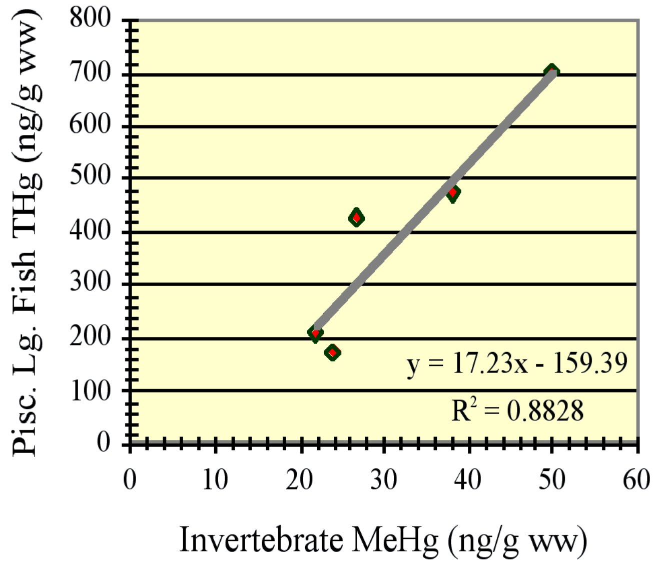
Hg and MeHg in Water *vs.* MeHg in Invertebrates

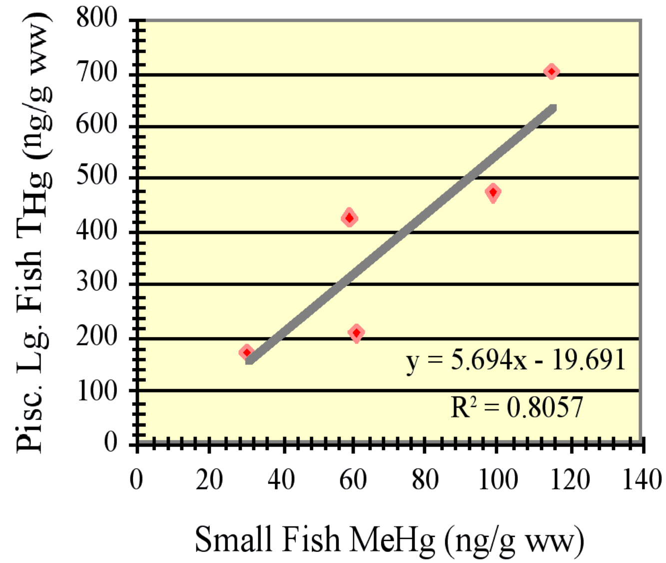
Cache Creek at Rumsey, 2000-2001

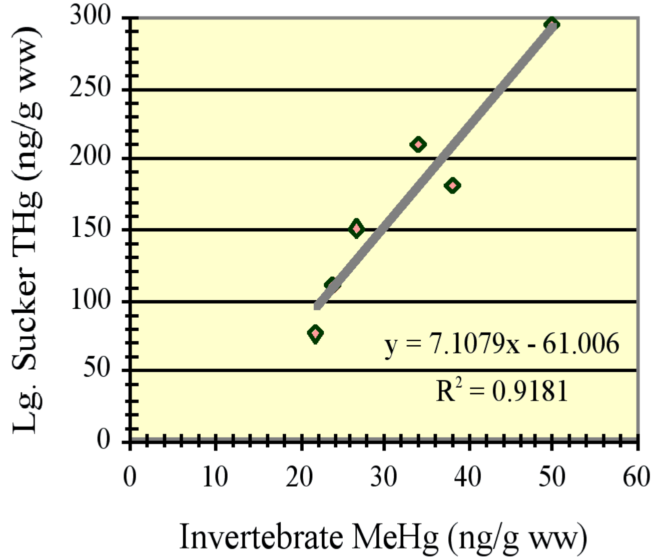


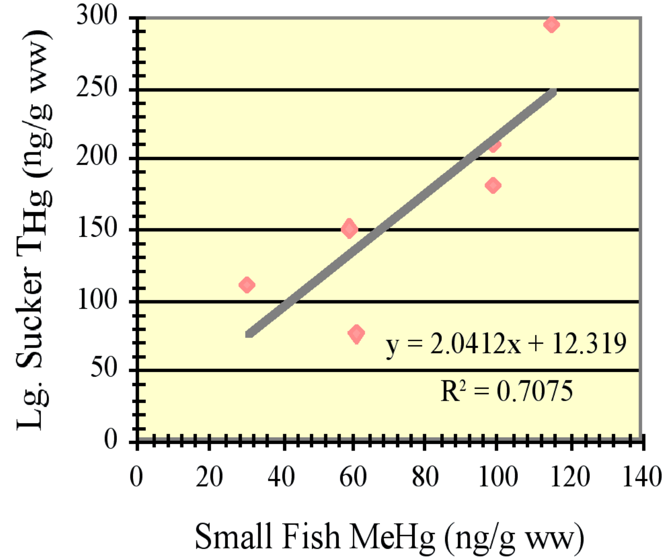
MeHg in Inverts or Small Fish *vs.* Hg in Large Fish

Selected sites, Cache Creek Watershed, 2000-2001









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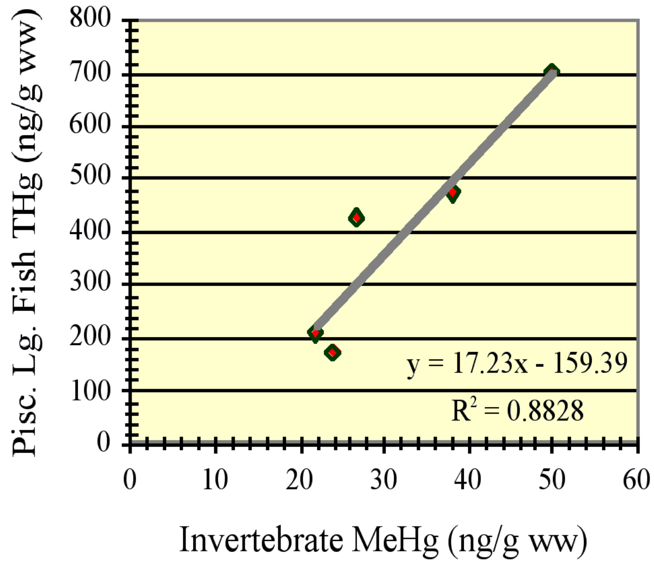

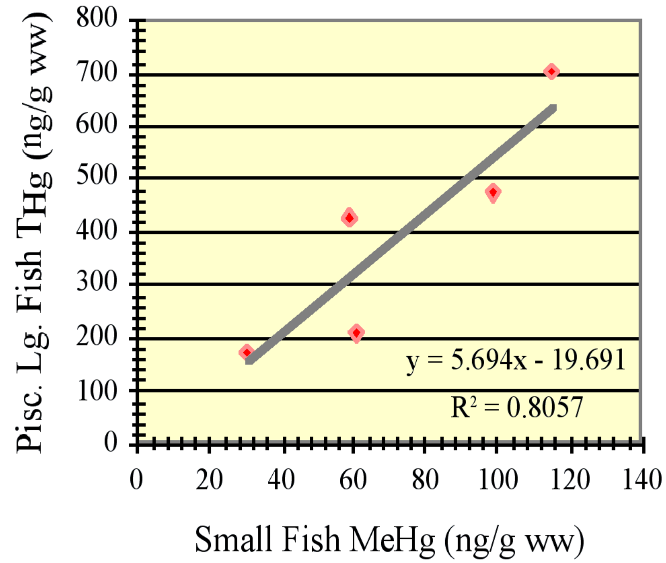

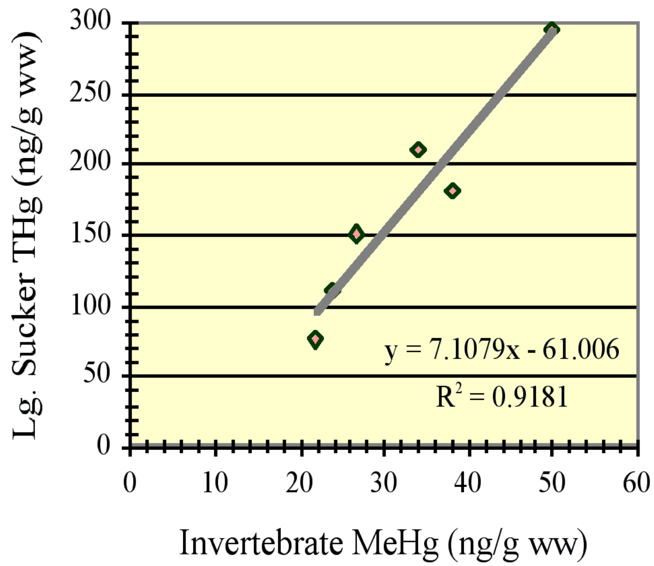

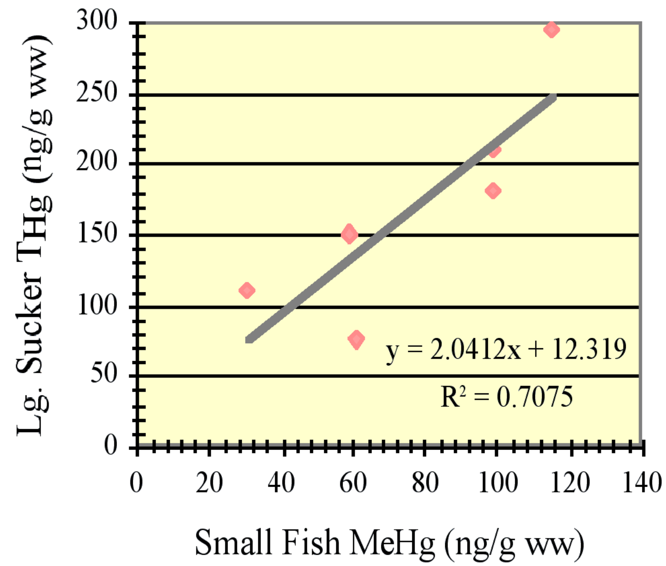

Working Hypotheses (1 of 3)

1) Mine sites and geothermal sources are major sources of mercury and potentially methylmercury to creeks and streams.

2 Geothermal discharge is important in the subsequent production and accumulation of methylmercury within the Cache Creek watershed.

3) Effective minesite remediation should be based on general site erosion control measures. Measures to reduce the amount of sulfate entering waterways from thermal springs and to reduce interaction between sulfate-rich thermal spring water and mine materials should also be considered.

Working Hypotheses (2 of 3)

4) Sediments of Cache Creek below the mine sites and geothermal sources are sources of mercury and methylmercury to the aquatic ecosystem because of a greater than 100-year history of erosion from mine sites and because of continuous discharge from geothermal springs.

5) While much of the mine-site materials appears to be HgS and m-HgS and therefore relatively unavailable for conversion to toxic methylmercury, the mine sites and the geothermal sites also discharge more labile forms of mercury.

6) Some portion of the mercury derived from the identified point sources is being methylated within the watershed, particularly in the upper tributary environments.

Working Hypotheses (3 of 3)

7) Clear Lake and Indian Valley Reservoir do not contribute high concentrations of bioavailable mercury to the aquatic environment.

8) The aquatic food chain below mine sites and geothermal sources is greatly affected by accumulation of methylmercury.

9) A predictive relationship exists between unfiltered methylmercury in the water and methylmercury bioaccumulation in invertebrates and small fish.

10) Mercury in lower trophic-level bioindicator organisms is predictive of mercury bioaccumulation in large fish.

Mercury Transport and Cycling in the Cache Creek Watershed