Mercury and the Gold Rush
Mercury and the Gold Rush

Mercury was used during hardrock and hydraulic mining. It is still entrained in the river gravels.

Deer Creek 1908  Greenhorn Creek 2011
Dust and the Gold Rush

- Rock crushed in mills
- Tons of waste rock spread over large areas
- Piles of rocks used for many things
  - Construction
  - Road surfaces
  - Fill Dirt
EPA officials played baseball wearing dust masks to test asbestos at an elementary school in El Dorado County and recorded significant exposure to asbestos in just one hour of play.
Gold Rush Legacy

- Mercury in Fish
- Metals in Dust
Water Bodies with Fish Consumption Advisories
Office of Environmental Health Hazard Assessment

Advisories in Northern Sierra Nevada Foothill Counties (1)

Trinity Lake (1)
Black Butte Reservoir (1)
Bear Creek (1)
Lower Feather (1)

Lake Pillsbury (1)
Lake Mendocino (1)
Clear Lake (1)
Cache Creek (1)
Lake Sonoma (1)
Lake Berryessa (1)
Putah Creek (1)

Tomales Bay (1)
San Francisco Bay (1,2)

Lake Nacimiento (1)

Lake Natoma (1)
Lower American River (1)
Cosumnes (1)
Mokelumne (1)
South Delta (1)
Grassland Area (4)
San Joaquin River (1)

Advisory Chemical:
(1) = mercury
(2) = PCBs
(3) = DDT
(4) = selenium
(5) = chlordane

Freshwater Advisories in San Francisco Bay Area Counties (1)

Pt. Dume (2,3)
Santa Monica Bay (2,3)
Palos Verdes Peninsula (2,3)
San Pedro Bay & Long Beach (2,3)
Newport Pier (2,3)

Los Angeles
Harbor Park Lake (3,5)
Salton Sea (4)

San Diego

OEHHA, 2007 ©
Existing Fish Consumption Advisories

Advisories in Northern Sierra Nevada Foothill Counties (1)

- Yuba
  - Englebright Lake
  - South Yuba River
- NEVADA
  - Deer Creek
  - Scotts Flat Reservoir
  - Rollins Reservoir
  - Camp Far West Reservoir
- Placer
  - Bear River
  - Lake Combie
  - EL DORADO
Fish Consumption

- Mercury Impaired waterbodies
  - CWA 303(d) listed (RWQCB)
  - Fish Consumption Advisories (OEHHA)
  - Need for more fish data
  - Angler Survey Results

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Deer Creek</td>
<td>X</td>
<td>X</td>
<td>**</td>
</tr>
<tr>
<td>Upper Scotts Flat Lake</td>
<td>X</td>
<td>X</td>
<td>**</td>
</tr>
<tr>
<td>Lower Scotts Flat Lake</td>
<td></td>
<td></td>
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<td>Lake Wildwood</td>
<td>X</td>
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<td>Bear River</td>
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<td>**</td>
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<td>Rollins Lake</td>
<td>X</td>
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<tr>
<td>Lake Combie</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Camp Far West Reservoir</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>South Yuba River</td>
<td>X</td>
<td>X</td>
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<tr>
<td>North Yuba River</td>
<td>X</td>
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<td>Lake Englebright</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Lower Yuba River (below Englebright)</td>
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<td></td>
<td></td>
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</table>
151 Completed Surveys
69 were collected in 2009
82 were collected in 2010
Are you going to eat the fish you catch today?

- Yes: 47%
- No: 51%
- Don't Know: 2%

If yes, are you going to feed it to your family?

- Yes: 73%
- No: 5%
- Left blank: 21%
- Don't Know: 1%

Household Information

- Children in household eaten sport fish in the last year, yes or no: 48%
- Pregnant or nursing women eaten sport fish in the last year, yes or no: 5%
- Women b/w 18-49 eaten sport fish in the last year, yes or no: 52%
Do you EVER eat the fish that you or someone you know catches?

- Yes: 92%
- No: 8%

Fish Consumption By Species

- Rainbow/Brown Trout: 77%
- Brown Trout: 67%
- Any Species of Bass: 65%
- Large Mouth Bass: 47%
- Stripped Bass: 45%
- Small Mouth Bass: 39%
- Catfish/Bullhead: 39%
- Kokanee Salmon: 39%
- Crappie: 28%
- Crawdads: 26%
- Sunfish/Bluegill: 24%
- Bass (unknown species): 23%
- Chinook Salmon: 12%
- Other: 11%
- Sturgeon: 11%
- Clams: 8%
Methylmercury Exposure from Sport Fish Consumption

**OEHHA Recommended Safe Level for Women over 45 and Men**
- Assume 70 kg (154 lbs)

**OEHHA Safe Level for Sensitive Populations**
- Assume 70 kg person and 35 kg child (154 lbs and 77 lbs child)

- Women over 45 and Men
- Sensitive Populations*

### Survey Participant Metrics
- 21 µg MeHg/Day
- 7 µg MeHg/Day
Angler Survey
Summary and Conclusions

- Over 90% of anglers reported eating fish that was caught from mercury-contaminated areas.
- Over 50% feed the fish they catch to children under the age of 18 and/or to women of child bearing age.
- ~10% are consuming mercury at levels above the OEHHA safe eating guidelines.
- Posted warnings were not present at most fishing locations.
- Exposure potential is high with limited awareness.

www.sierrafund.org/mining/Gold_Country_Angler_Survey.pdf
Gold Rush Legacy

- Mercury in Fish
- Metals in Dust
Dust and Mounds

- Recreation creates dust
- Trails go through Abandoned Mines
- Is there a problem?
  - Exposure Scenarios
  - Site Specific Risk Assessments
- How big is this problem?
How high is too high?

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>ALS Chemex Detection Limits (ME-ICP41m)</th>
<th>US EPA PRGs for Residential Soil</th>
<th>Cal EPA Industrial CHHSLs</th>
<th>BLM Risk Management Criteria for Recreation</th>
<th>Initial Screening Level</th>
<th>Secondary Screening Level</th>
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<tbody>
<tr>
<td>Arsenic</td>
<td>As</td>
<td>2</td>
<td>22</td>
<td>0.24</td>
<td>300</td>
<td>22</td>
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<td>Chromium</td>
<td>Cr</td>
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<td>210</td>
<td>100,000</td>
<td>210</td>
<td>100,000</td>
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<td>Lead</td>
<td>Pb</td>
<td>2</td>
<td>400</td>
<td>320</td>
<td>1000</td>
<td>80</td>
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<td>Mercury</td>
<td>Hg</td>
<td>0.01</td>
<td>23.46</td>
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</table>
### Table 11: Foresthill OHV Area

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>Sample Date</th>
<th>Location</th>
<th>As</th>
<th>Cr</th>
<th>Pb</th>
<th>Asbestos</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>FS-TS1 SERP</td>
<td>6/1/2009</td>
<td>Foresthill</td>
<td>&lt;5</td>
<td></td>
<td>1610</td>
<td>19</td>
<td>12%* Trail 4 in Forest Hill OHV Use Area, near Pagge Creek</td>
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<tr>
<td>FS-TS2 SERP</td>
<td>6/1/2009</td>
<td>Foresthill</td>
<td>&lt;5</td>
<td></td>
<td>6490</td>
<td>11</td>
<td>2%* Trail 4 in Forest Hill OHV Use Area, dust in road past mound</td>
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<tr>
<td>FS-TS3 SERP</td>
<td>6/1/2009</td>
<td>Foresthill</td>
<td>&lt;5</td>
<td></td>
<td>2940</td>
<td>22</td>
<td>15%* Trail 4 in Forest Hill OHV Use Area, serpentine rock with fibrous appearance</td>
</tr>
<tr>
<td>FS-TS4 SERP</td>
<td>6/1/2009</td>
<td>Foresthill</td>
<td>&lt;5</td>
<td></td>
<td>1495</td>
<td>16</td>
<td>20%* Trail 4 in Forest Hill OHV Use Area, on steep slope of play mound</td>
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<tr>
<td>FS-TS5 SERP</td>
<td>6/1/2009</td>
<td>Foresthill</td>
<td>9</td>
<td></td>
<td>1190</td>
<td>1540</td>
<td>12%* In Marall Chrome Mine pit in center of open area (target practice area)</td>
</tr>
<tr>
<td>FS-MW6 SERP</td>
<td>6/1/2009</td>
<td>Foresthill</td>
<td>&lt;5</td>
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<td>578</td>
<td>123</td>
<td>40%* In Marall Chrome Mine pit in depression on side of open area crushed fibrous serpentine rock</td>
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<td>27</td>
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<td>710</td>
<td>4790</td>
<td>na In Marall Chrome Mine, dust from slope of play hill (Target practice area)</td>
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<td>FS-TS8 SERP</td>
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<td>Foresthill</td>
<td>&lt;5</td>
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<td>1200</td>
<td>453</td>
<td>15%* In Marall Chrome Mine pit, on side of open pit</td>
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<td>FS-MS9</td>
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<td>3560</td>
<td>4190</td>
<td>na Marall Chrome Mine in outwash depression at low end of pit</td>
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<td>FS-TS10</td>
<td>6/1/2009</td>
<td>Foresthill</td>
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<td></td>
<td>9220</td>
<td>22</td>
<td>na At Forest Hill OHV recreation staging area, in North corner at entrance to Trail 1</td>
</tr>
</tbody>
</table>

mg/kg = milligrams per kilogram, na = not analyzed, (As=total arsenic, Cr=total chromium, Pb=total lead; analyzed by ME-ICP 61 assay method) (Hg= total mercury analyzed by Hg-CV41 cold furnace method), (Asbestos=percent asbestos, analyzed by CARB Method 435, *Chrysotile, **Tremolite)
Recommendation
Recreational Trails Survey

- Quantify dust exposure and exposure to specific COCs for recreational activities in the higher risk areas identified.
- Dust monitoring activities should be performed by qualified professionals with adequate health and safety training and protective equipment.
What can we do?

- Health professionals involved
  - Maternal Health Awareness
- Fish Consumption Advisories
- Dust Exposure Signs
  - Asbestos-NOA Trails
  - AML Trails

![Mercury Meter for Sierra Nevada Fish](image1)

![Assorted Vehicle Route Sign](image2)

![NOA Trails Sign](image3)
Long Term Solution-Clean it Up

- Mercury Removal from dredged sediments
  - What was once a non-point source is no longer

- Abandoned Mine Remediation
  - What was once remote is no longer

Thank you-Carrie Monohan, Ph.D.
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