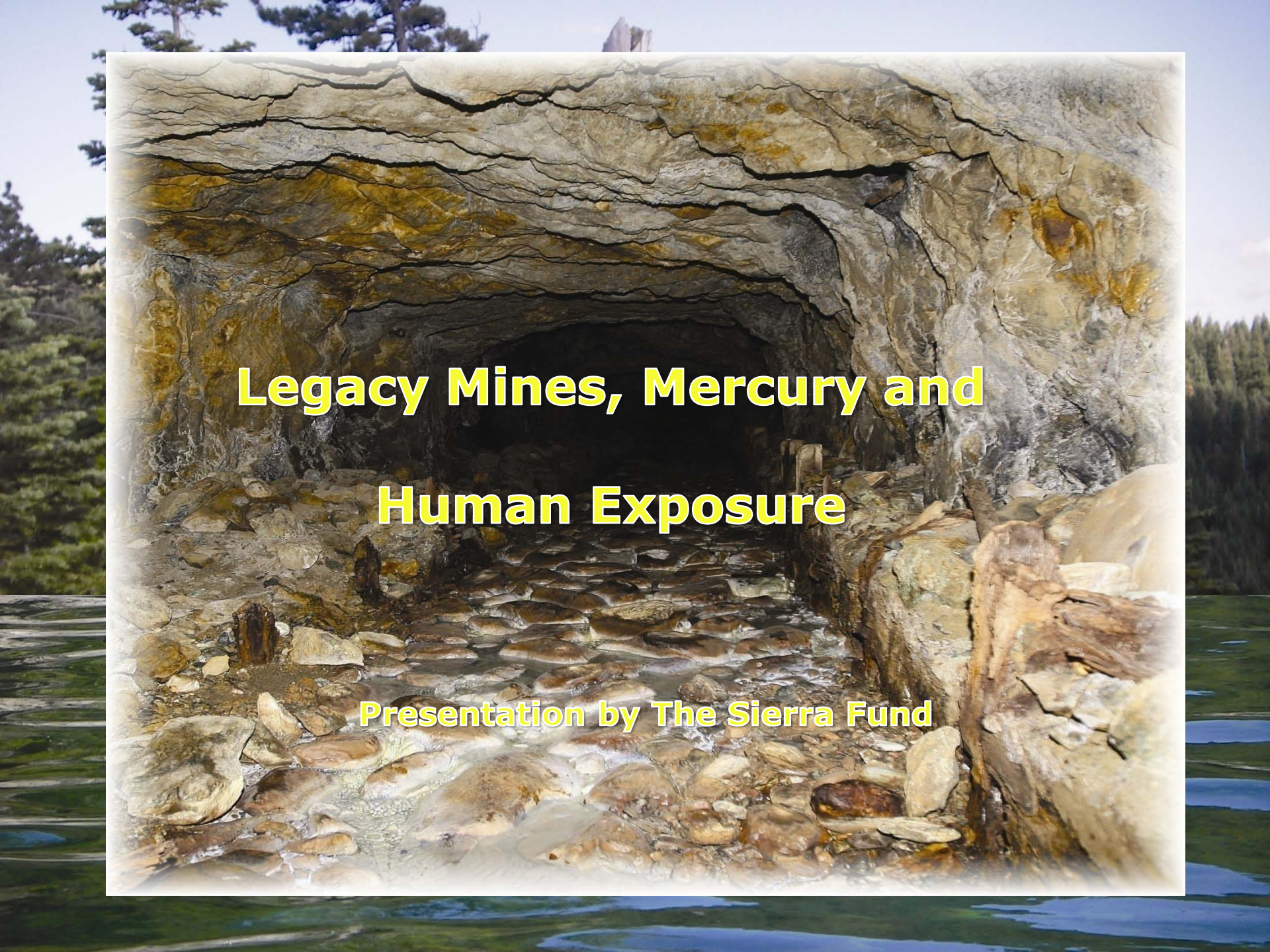
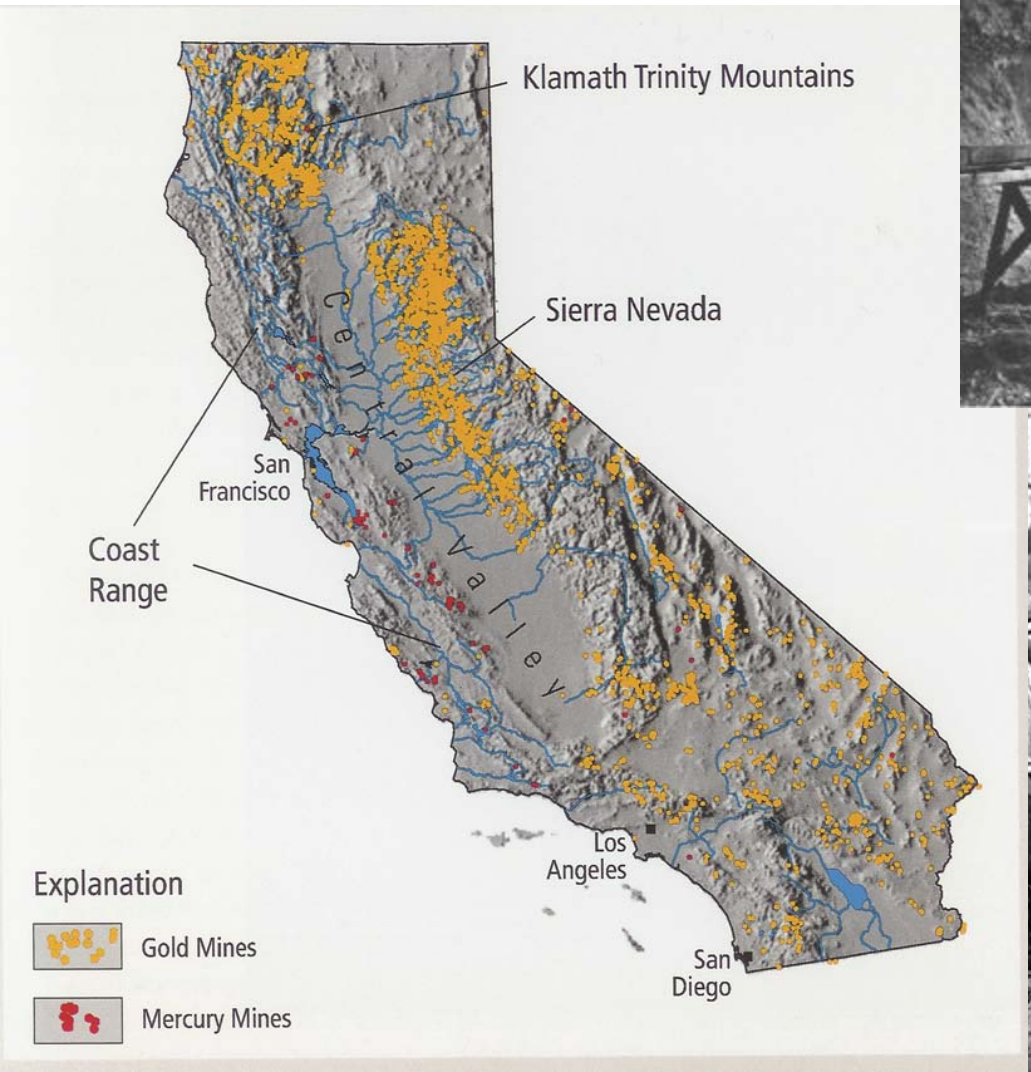
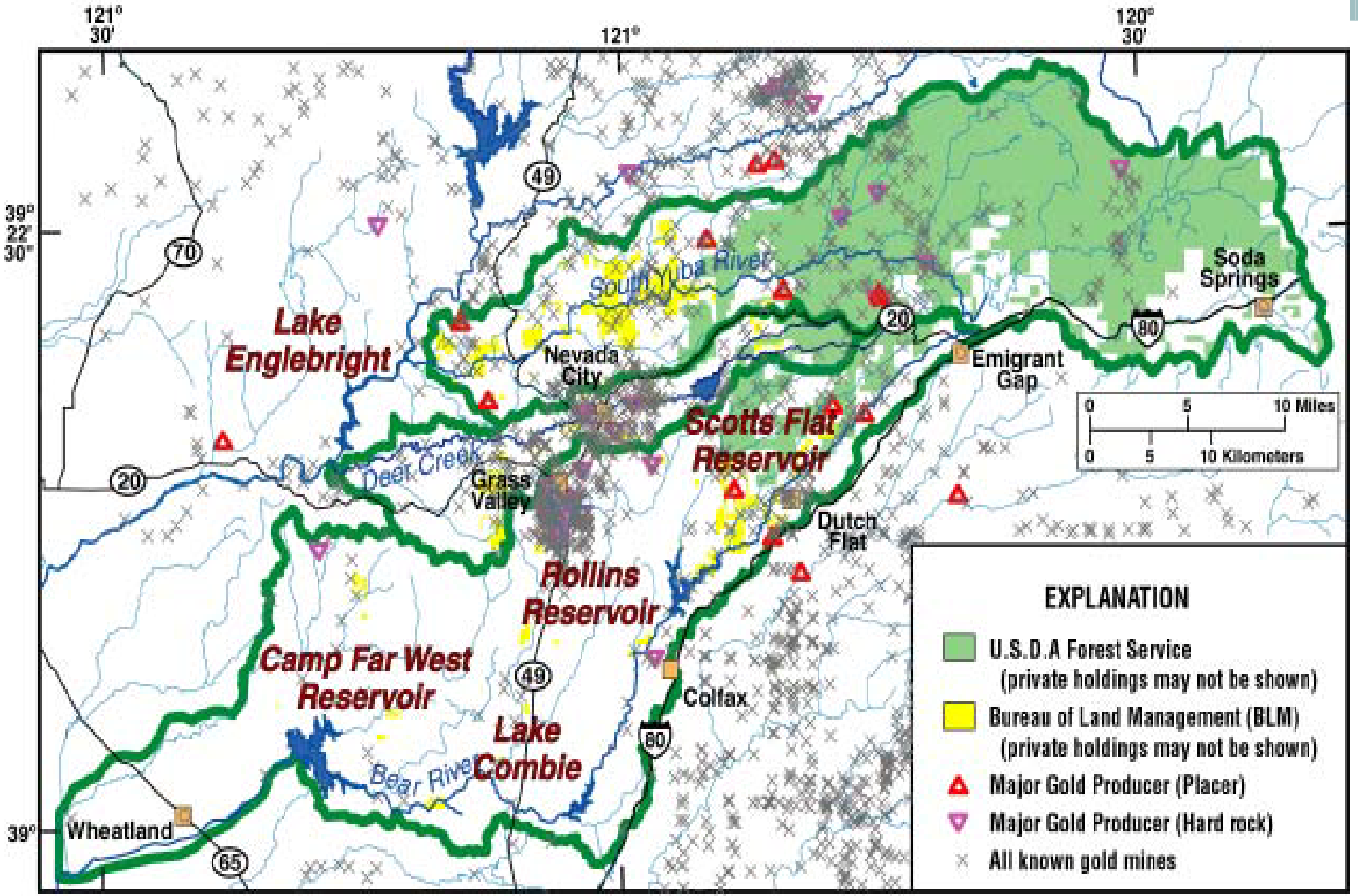

Legacy Mines, Mercury and
Human Exposure
Presentation by The Sierra Fund

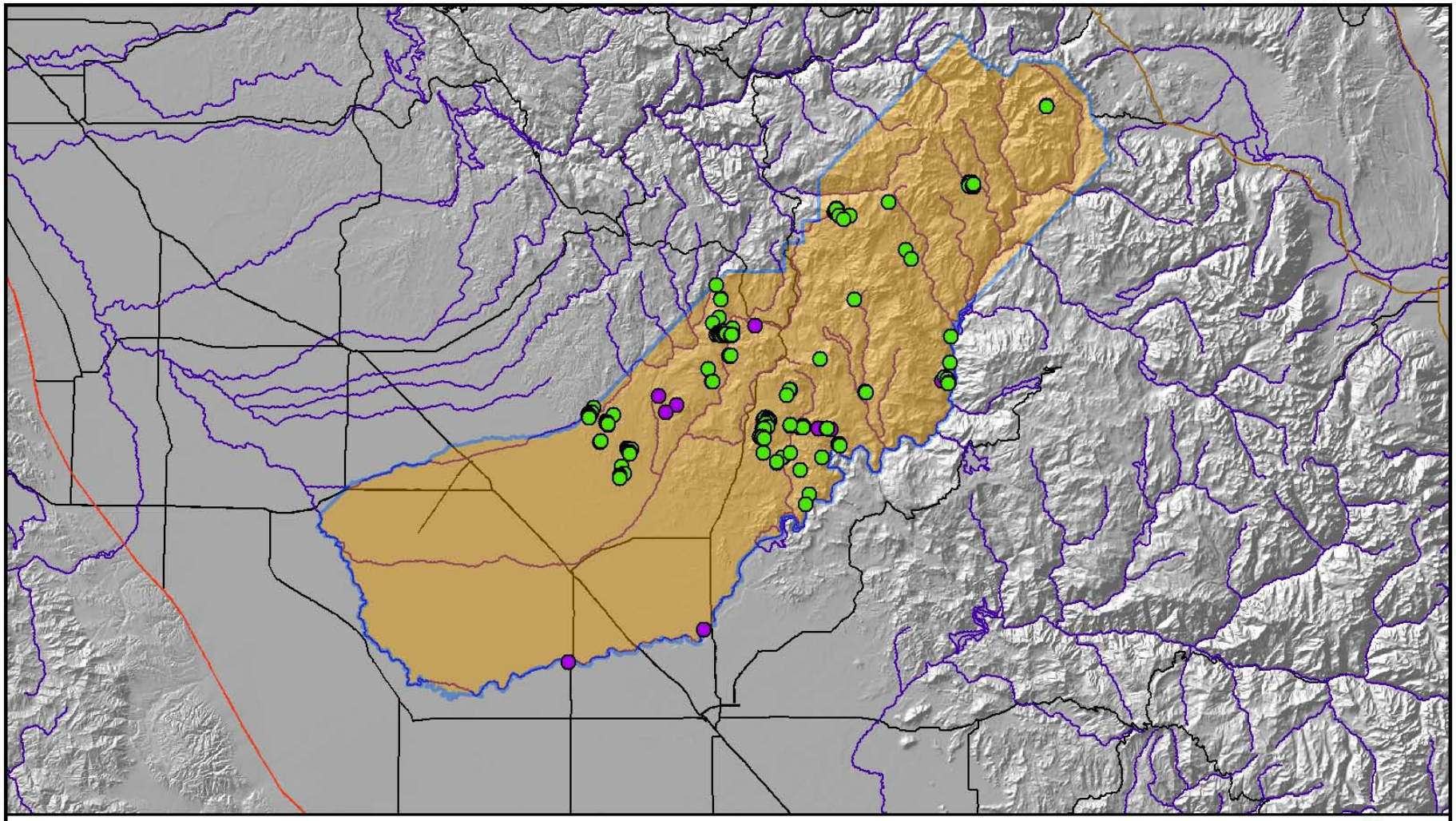

The Sierra Fund
Our Mission: Increase public & private investment in the Sierra
Izzy Martin
CEO

Mercury and the Gold Rush

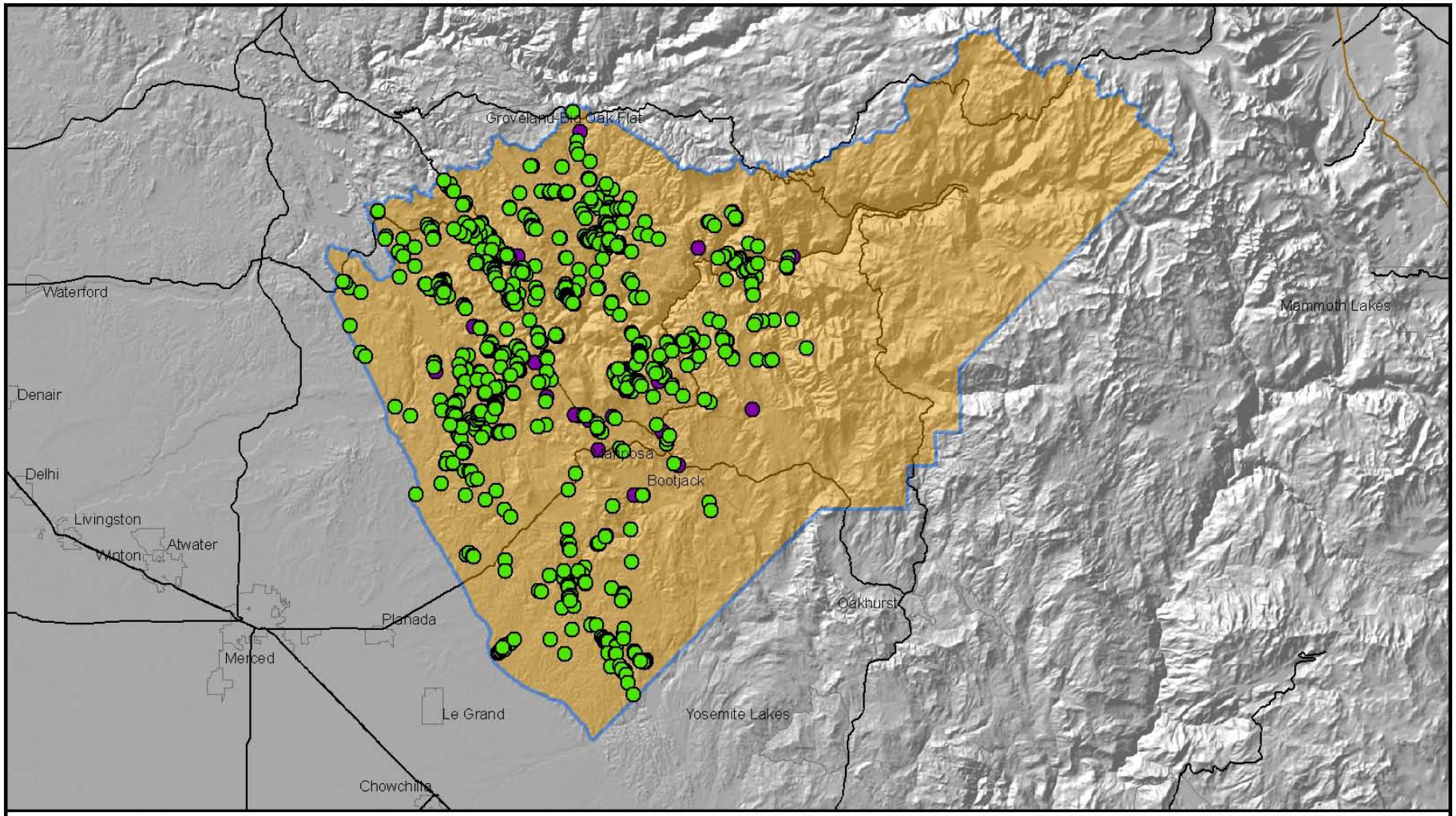



121° 30'
121°
120° 30'
39° 22' 30"
39°
Lake Englebright
Nevada City
South Yuba River
Soda Springs
Emigrant Gap
Scotts Flat Reservoir
Deer Creek
Grass Valley
Dutch Flat
Rollins Reservoir
Camp Far West Reservoir
Colfax
Lake Combie
Bear River
Wheatland
70
49
20
80
65
0 5 10 Miles
0 5 10 Kilometers
EXPLANATION
U.S.D.A Forest Service (private holdings may not be shown)
Bureau of Land Management (BLM) (private holdings may not be shown)
Major Gold Producer (Placer)
Major Gold Producer (Hard rock)
All known gold mines

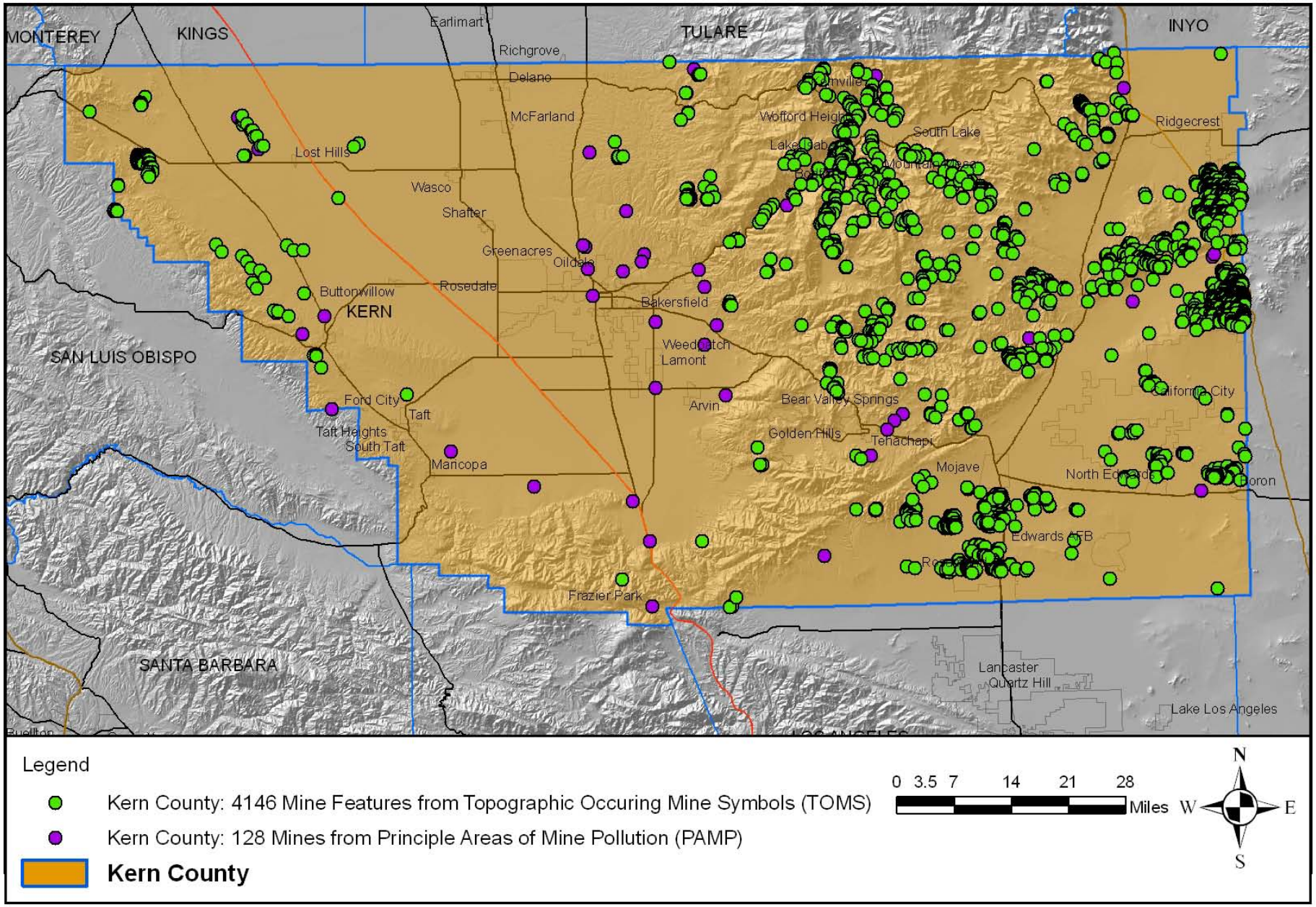
DEPARTMENT OF TOXIC SUBSTANCES CONTROL
MADERA COUNTY MINES AND MINING FEATURES

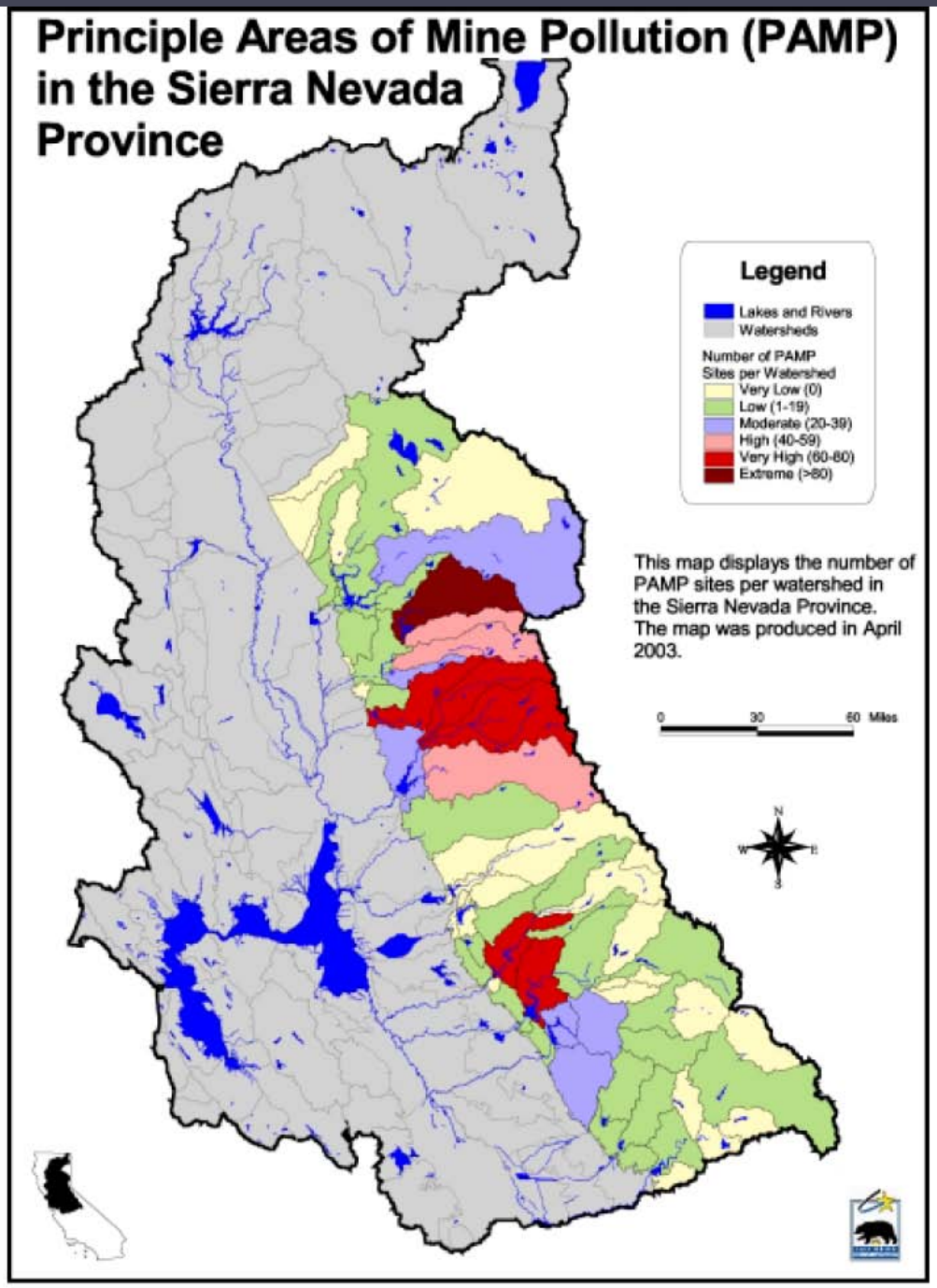


DEPARTMENT OF TOXIC SUBSTANCES CONTROL
MARIPOSA COUNTY MINES AND MINING FEATURES



DEPARTMENT OF TOXIC SUBSTANCES CONTROL
KERN COUNTY MINES AND MINING FEATURES




Principle Areas of Mine Pollution (PAMP) in the Sierra Nevada Province
Legend
Lakes and Rivers
Watersheds
Number of PAMP Sites per Watershed
Very Low (0)
Low (1-19)
Moderate (20-39)
High (40-59)
Very High (60-80)
Extreme (>80)
This map displays the number of PAMP sites per watershed in the Sierra Nevada Province. The map was produced in April 2003.
0
30
60 Miles
N
W
E
S

Modern-day effects of historic mining in the Sierra Nevada

Physical Hazards

- open mine shafts
- underground tunnels

Health Impacts

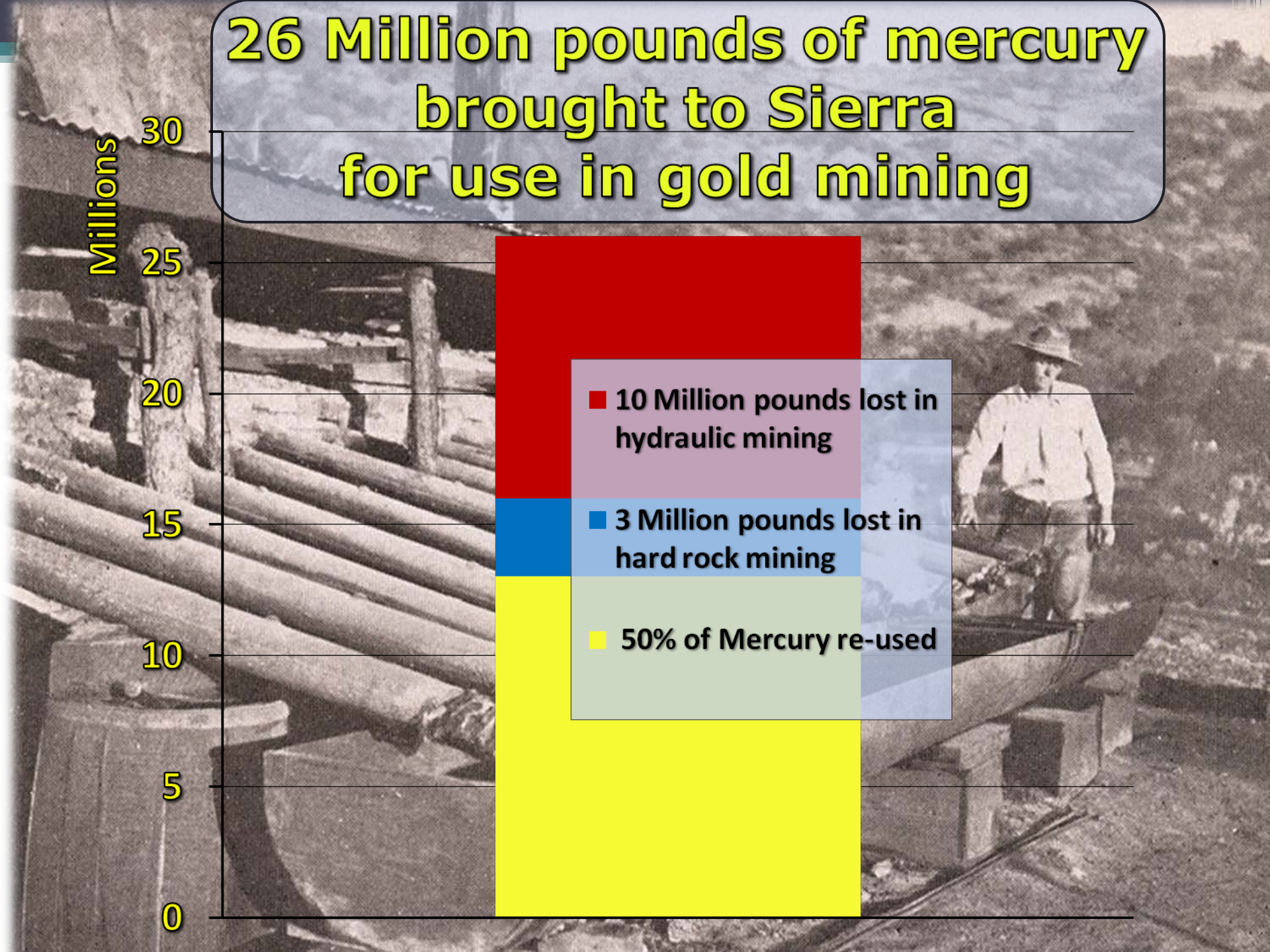
Mercury

Arsenic

Lead

Asbestos

26 Million pounds of mercury brought to Sierra for use in gold mining



Gold Country Angler Survey

A Pilot Study to Assess Mercury Exposure from Sport Fish Consumption in the Sierra Nevada

Carrie Monohan, Ph.D.

THE SIERRA FUND

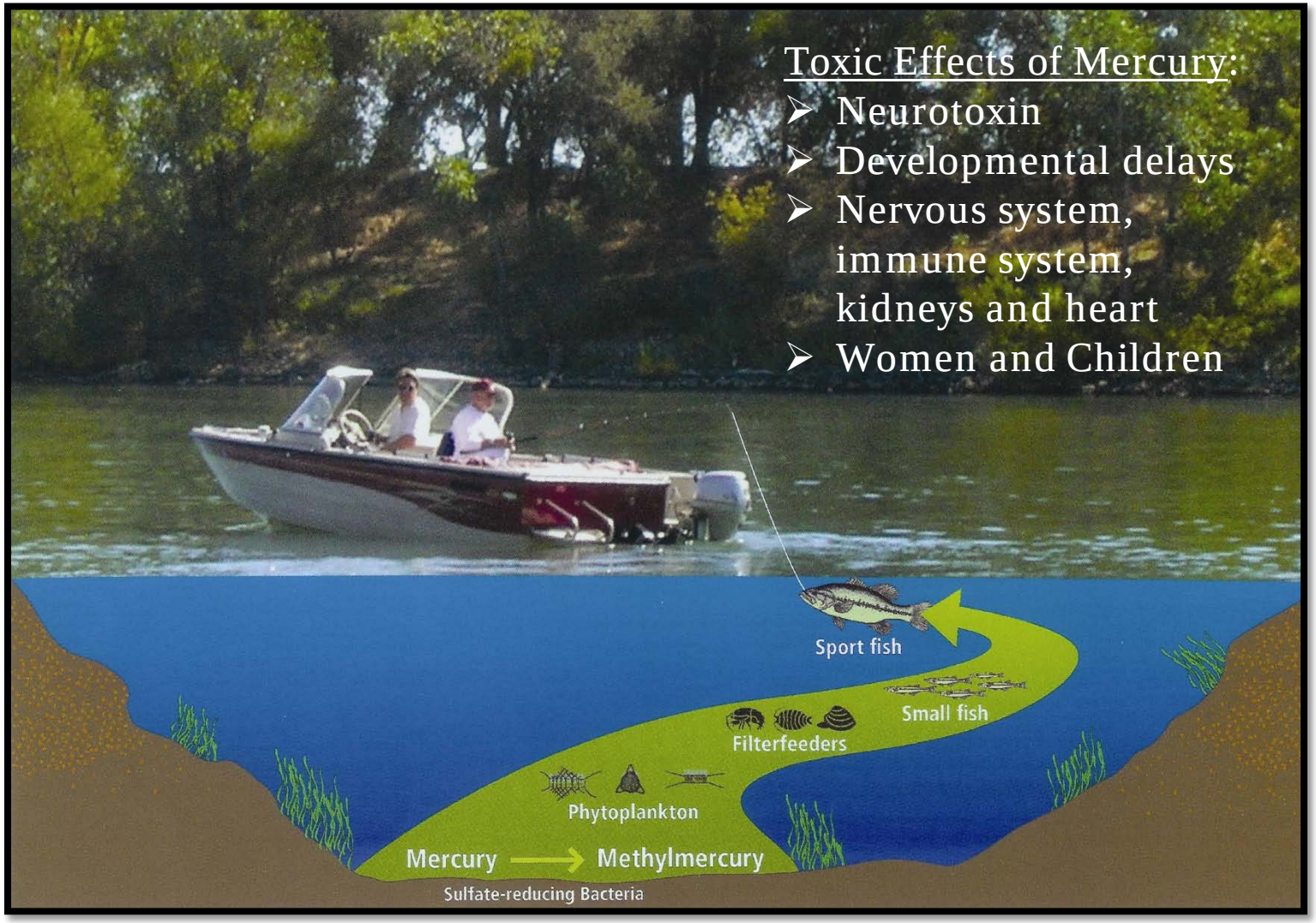
Mercury and the Gold Rush

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

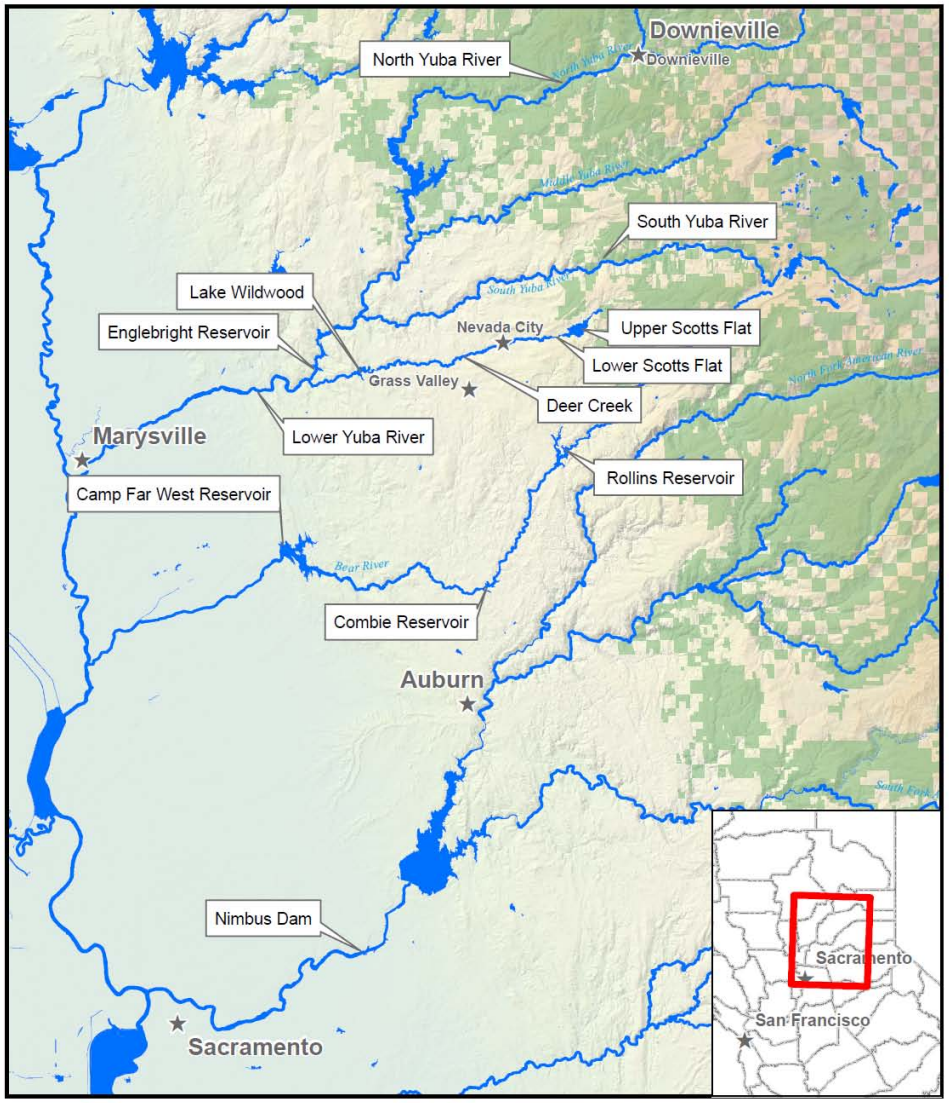
Deer Creek 1908

Greenhorn Creek 2011

Sport Fish Consumption and Mercury



Gold Country Angler Survey



- Trained volunteers 2009, 2010
- 10 minute Oral survey
- 151 surveys so far

Selection Criteria

- 303d listed (and/or)
- History of mining

Survey Locations

- Deer Creek
- Upper Scotts Flat Lake
- Lower Scotts Flat Lake
- Lake Wildwood
- Bear River
- Rollins Lake
- Lake Combie
- Camp Far West Reservoir
- South Yuba River
- North Yuba River
- Lake Englebright
- Lower Yuba River (below Englebright)

Survey Methods

- Developed by DPH and UCD

Alyce Ujhara and Fraser Shilling

Training and visuals

- 2009

Watershed and Fly Fishing Groups

- 2010

Interns from Chico State

- 2011 & 2012-not yet analyzed

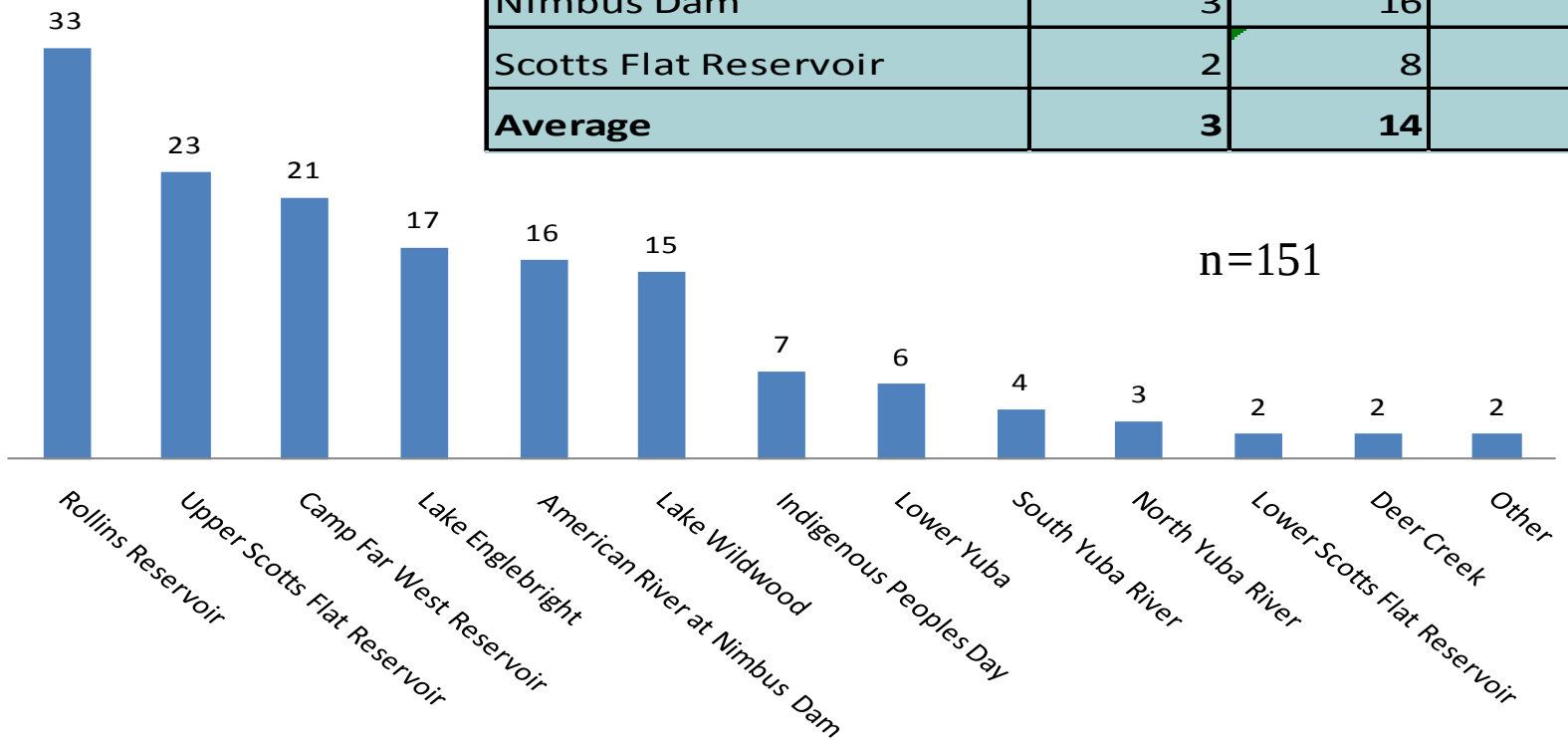
Upper American River Foundation

Bill Templin and Jen Hemmert

- 10 minute oral survey
- Anyone with a fishing pole was a candidate
- Approach
- Individual responses to a series of question about fish catch and consumption over previous 30 days and household demographics
- Education and thank you gifts at the end of the survey

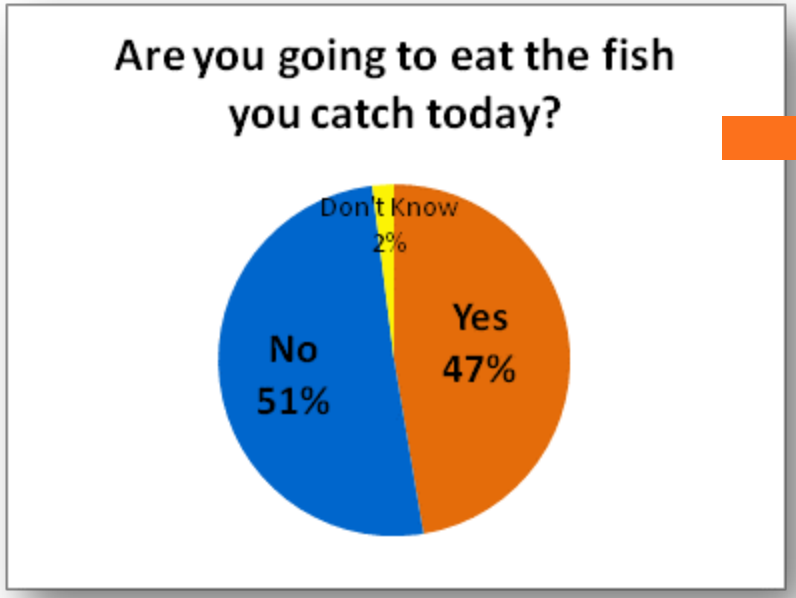
Number of Surveys Completed

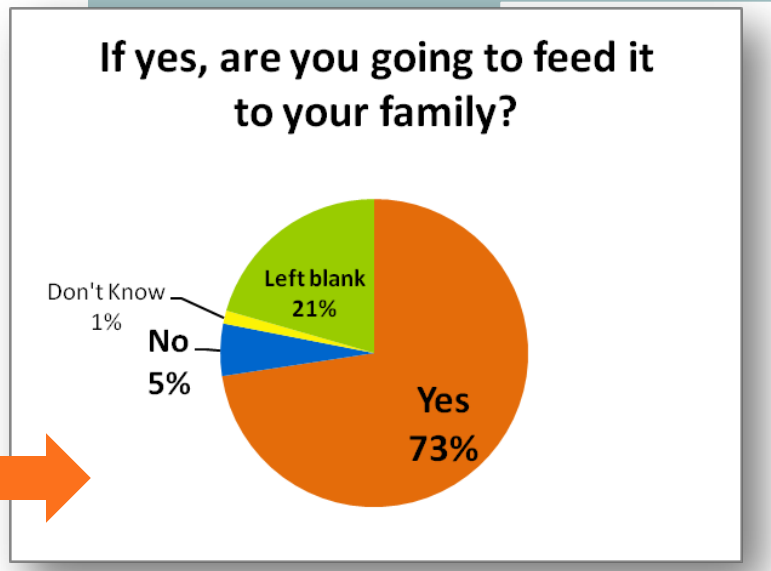
2010 Field Effort Results	Number of Site visits	Number of Survyes collect in 2010	Average survey/hour
Camp Far West Reservoir	3	20	2
Lake Wild Wood	3	7	2
Rollins Reservoir	6	24	2
Lake Engebright	3	6	2
Nimbus Dam	3	16	2
Scotts Flat Reservoir	2	8	1
Average	**3**	**14**	**2**

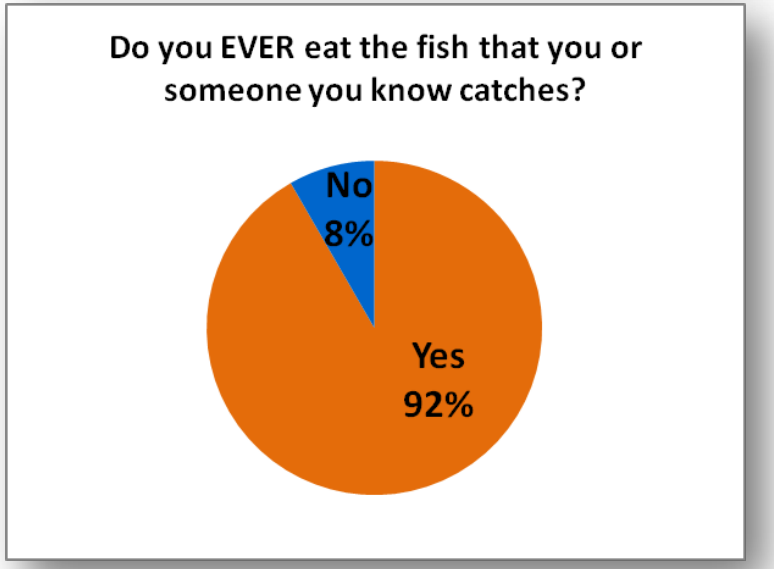


Survey Results

47% of anglers surveyed were trying to catch fish to eat



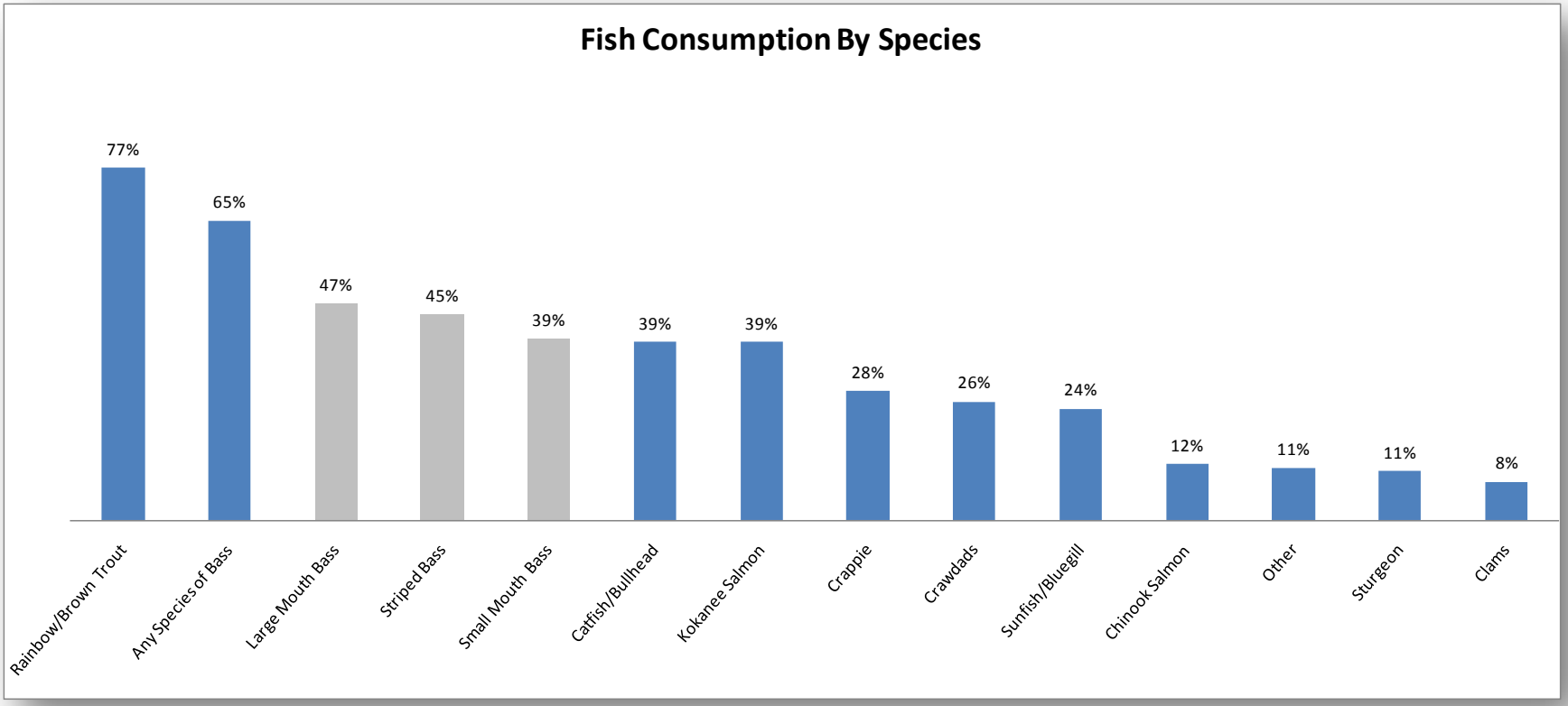




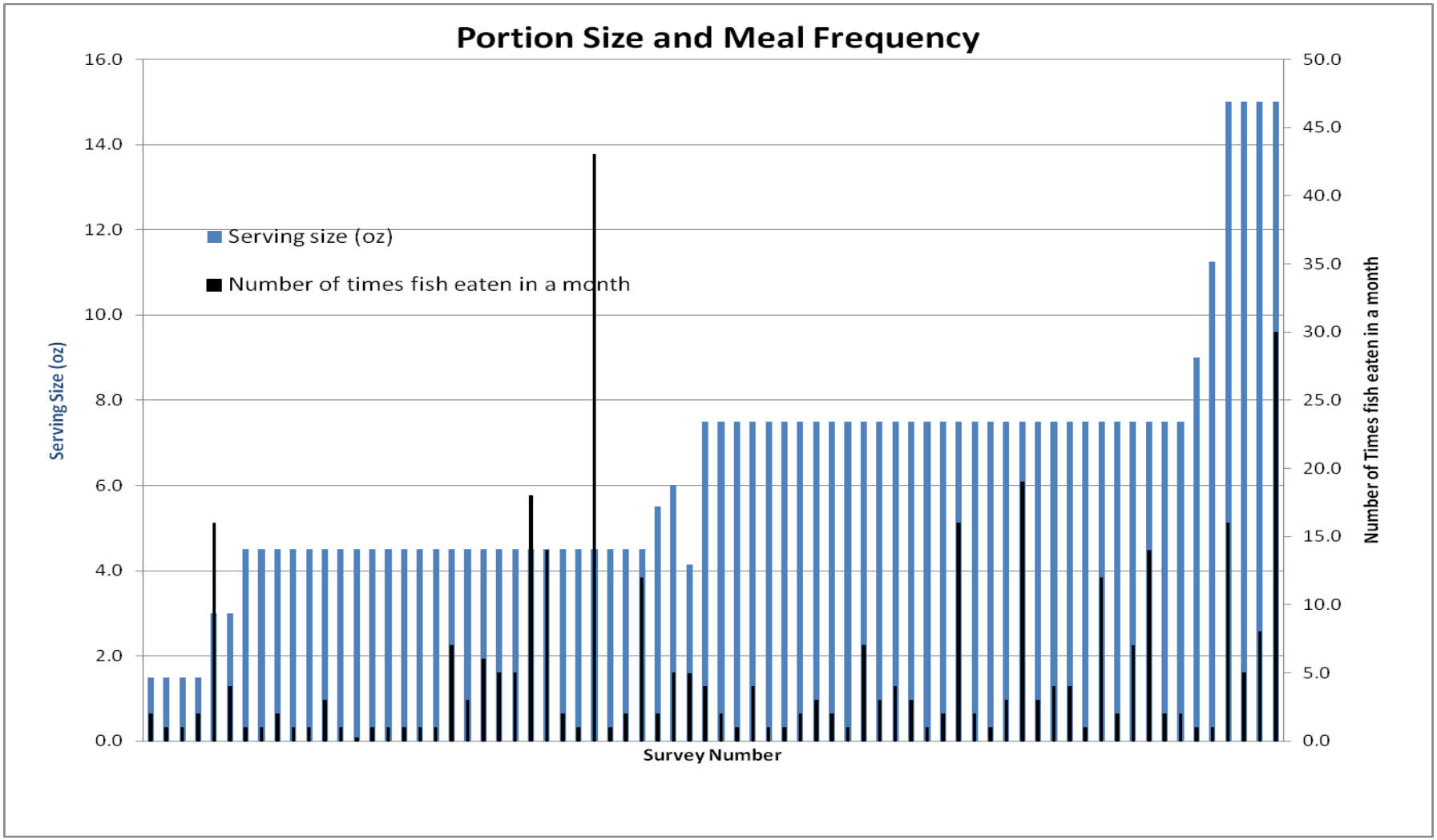
92% of anglers surveyed eat sport fish

What fish did people eat?

Trout and Bass were the most popular



How much fish did people eat?

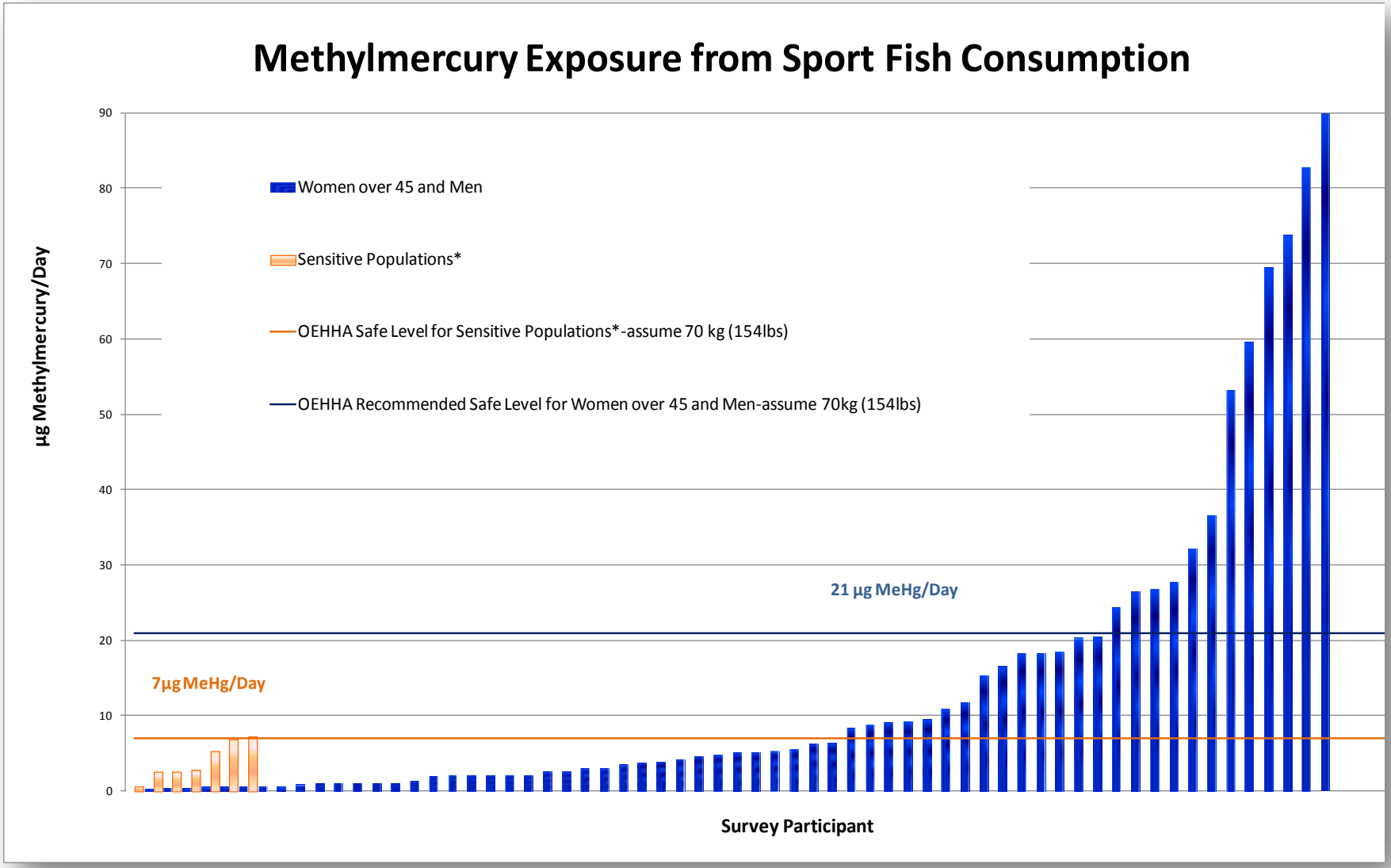


Calculate MeHg Exposure of Gold Country Angler Survey Participants

- How much sport fish he or she consumed in the last 30 days
- Which species of sport fish were consumed
- Where the fish had been caught, and
- The typical serving sizes.

- How much of what kinds of commercially bought fish he or she consumed in the last 30 days, and
- Participant's exact weight

Calculate Exposure of Gold Country Angler Survey Participants and compare to OEHHA Thresholds



Existing Fish Consumption Advisories

www.oehha.ca.gov/fish.htm

OEHHA
Office of Environmental Health Hazard Assessment

Safe Eating Guidelines for Fish from Rollins Reservoir

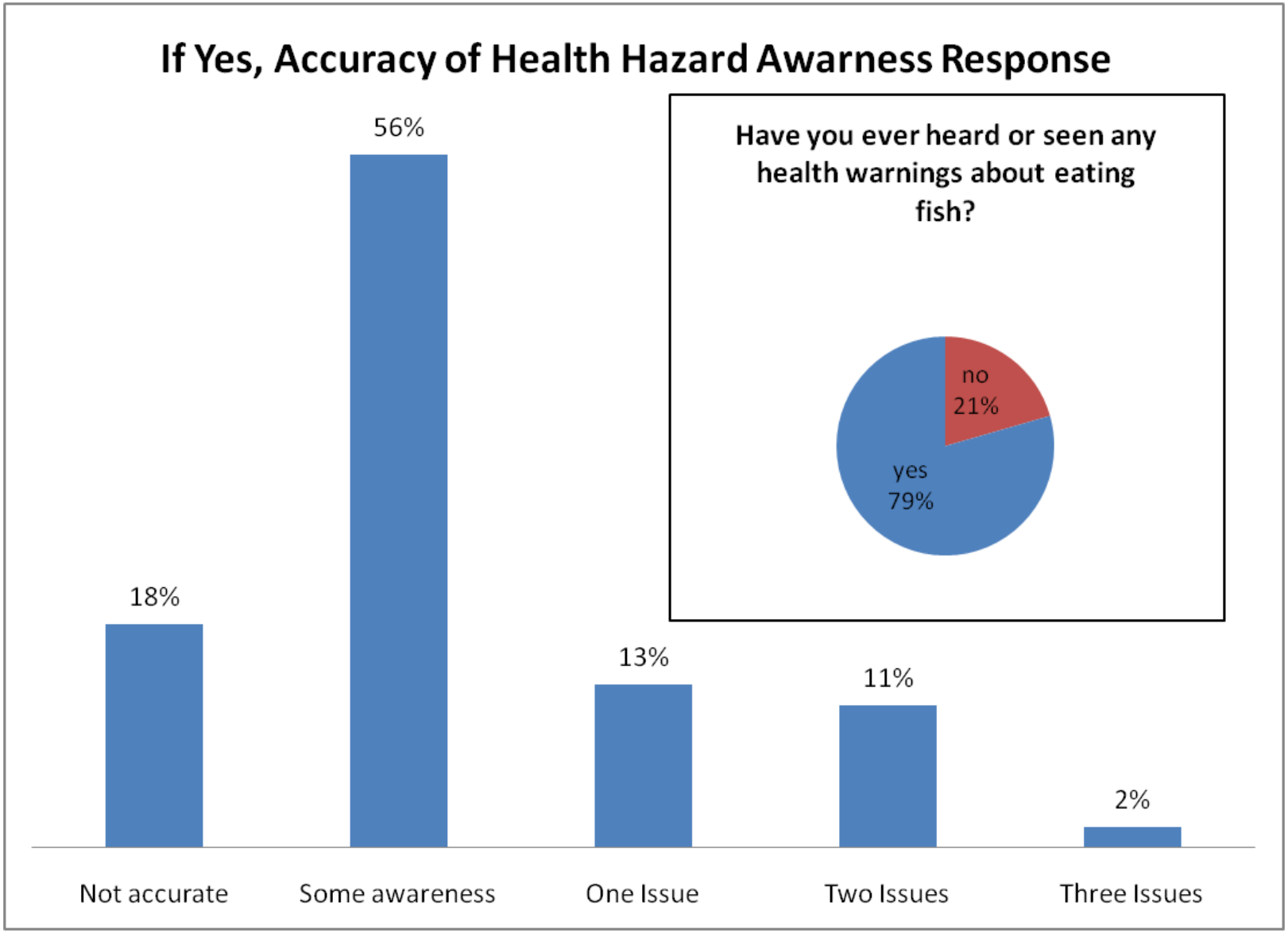
Women 18 – 45 and Children 1 – 17 Years

None	 catfish	None
2 or more Servings a week	1 Serving a week	Do not eat

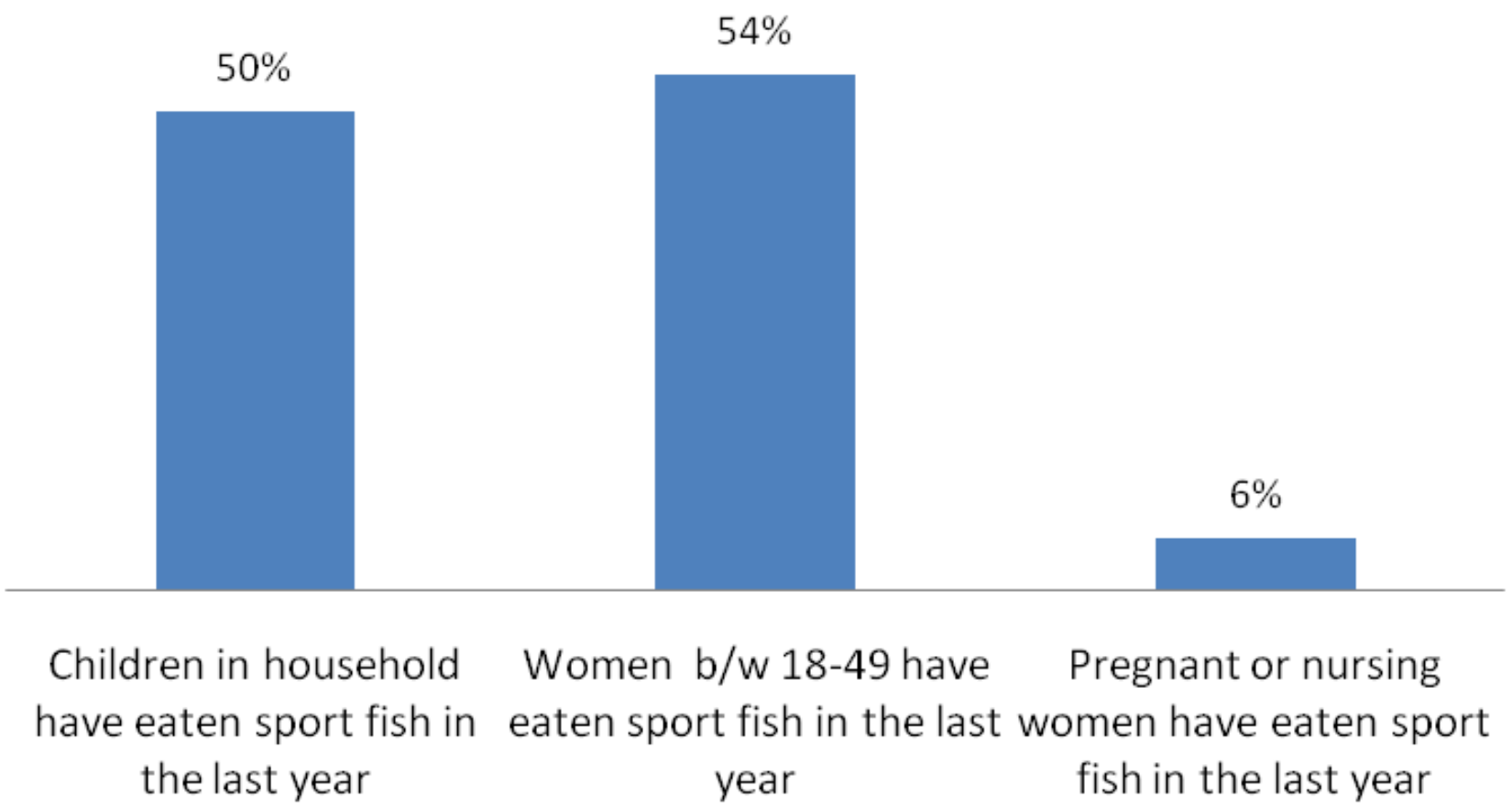
Men over 17 Years and Women over 45 years

None	 catfish	None
3 or more Servings a week	2 Serving a week	1 Serving a week

Health Hazard Awareness



Household Consumption Information



Summary

- 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

Recommendations and Next Steps

- Complete the fish consumption advisory information
  - Prioritize sites that are listed as impaired for Hg
  - Collect more fish data as needed by OEHHA
- Get the information out to the public
  - Posting at fishing locations
  - General information postings
- Remove mercury from Reservoirs
  - Combie Reservoir Sediment and Mercury Removal Project

Water Bodies with Fish Consumption Advisories
Office of Environmental Health Hazard Assessment

Advisory Chemical

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

Existing Fish Consumption Advisories

OEHHA 2007

Where do we need more fish data?

Mercury-Impacted Water Way	303(d) Listed as impaired by mercury (CVRWQCB 2010)	Fish Consumption Advisory 2003 (OEHHA 2003)	Fish Consumption Advisory 2009 Update (OEHHA 2009)
Deer Creek	X*	X	**
Upper Scotts Flat Lake	X	X	**
Lower Scotts Flat Lake			
Lake Wildwood	X		
Bear River	X	X	**
Rollins Lake	X	X	X
Lake Combie	X	X	X
Camp Far West Reservoir	X	X	X
South Yuba River	X	X	**
North Yuba River	X		
Lake Englebright	X	X	X
Lower Yuba River (below Englebright)	X		

* 303(d) listings have been issued for Little Deer Creek, a tributary to Deer Creek.

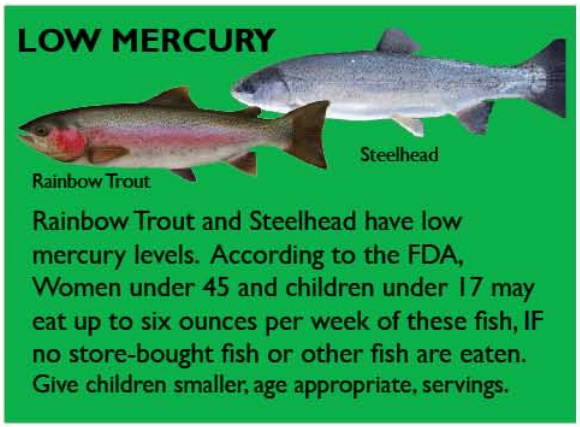
** Removed from the fish advisory during the 2009 update due to insufficient number of samples

Critical Information Gaps

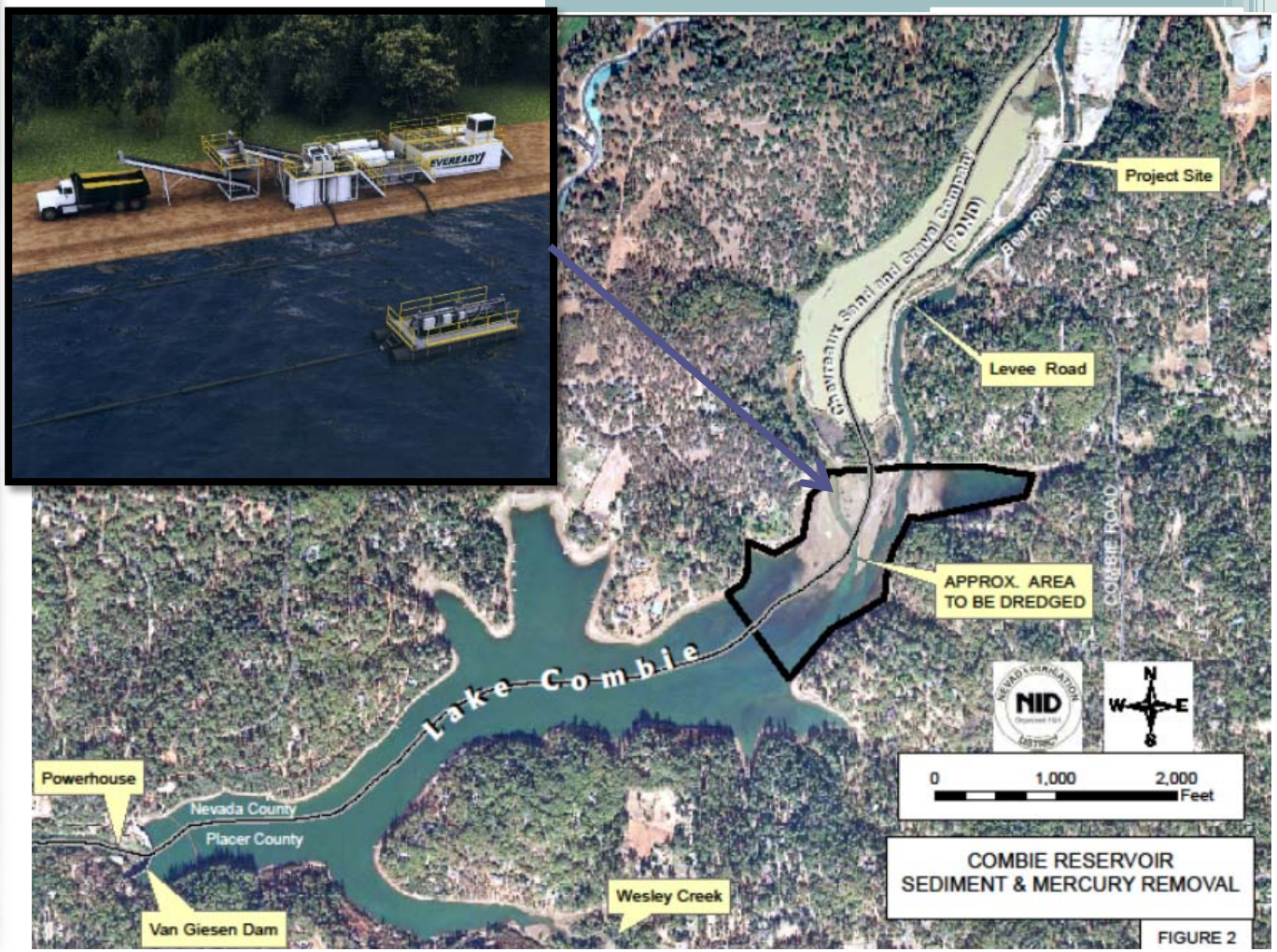
- Listed as impaired but do not have a fish advisory
- Has a fish advisory for only some species
- No posting of information
- Sustenance fishing not quantified

What do we do with limited information?

Based on existing information and scientific knowledge, Sierra fish fall into the following categories:



NO INFORMATION DOES NOT MEAN IT IS SAFE TO EAT

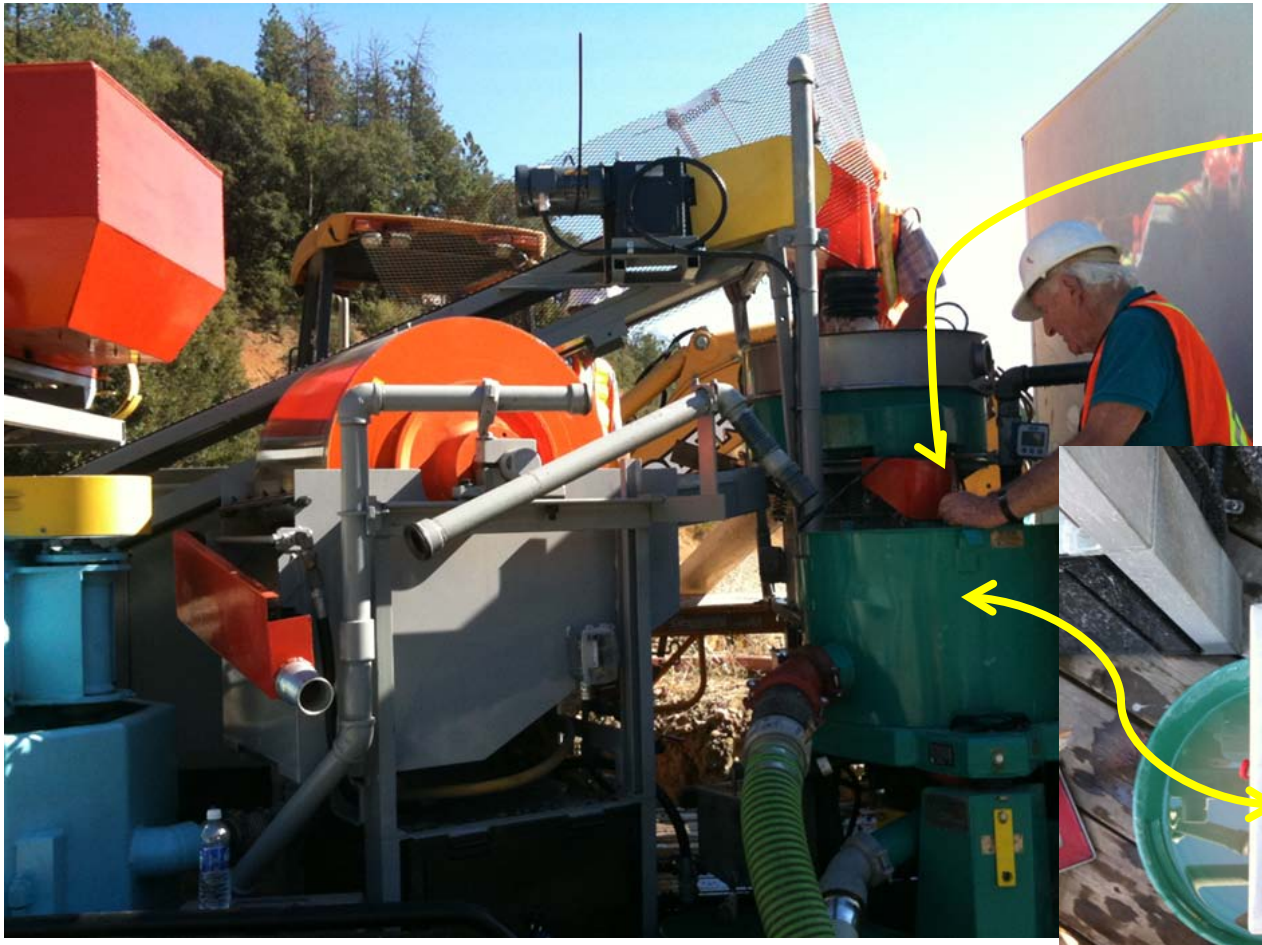


Combie Reservoir Sediment and Mercury Removal

NID

USGS
science for a changing world

Mercury Removal from Dredged Sediment



NID

USGS science for a changing world

Sediment and Mercury Removal from Reservoirs in the Gold Country

- Equipment Testing and Evaluation (2009)
- Environmental Permitting for Combie
- Funding is expected in 2013
- USGS studies accompany this project (pre and post)
- Regional impact
  - Rollins Reservoir
  - Other Irrigation Districts
  - CABY IRWMP
- Green Gravel
- Green Gold (Eco-Gold)
- Mercury TMDL-
  - Mercury Control Program

NID

USGS science for a changing world

Recommendations

1) Look up safe eating guidelines
www.oehha.ca.gov/fish.htm

2) Avoid large predatory fish
www.gotmercury.org

3) Make your voice heard
www.reclaimingthesierra.org

4) Develop projects to remove Hg
http://www.youtube.com/watch?v=OT5EHct4hzE

THE SIERRA FUND

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Upper American River Foundation

www.sierrafund.org/mining/Gold_Country_Angler_Survey.pdf