Sampling Design for a Statewide Survey of Contaminants in Sport Fish in California Rivers and Streams

The Bioaccumulation Oversight Group

Products and Timeline

- BOG planning discussions – November-January
- Draft Sampling Plan and QAPP – January
- Peer Review Panel meeting – January/February
- Finalize Sampling Plan and QAPP – End of February
- Begin sampling – End of February
- Year 1 data available – May 2012
- Draft report on year 1 – January 2013
- Final report on year 1 – May 2013

SWAMP/BOG Monitoring Objectives

1. Status
2. Trends
3. Sources and Pathways
4. Effectiveness of Management Actions

Over the long-term, primary BOG emphasis on 1 and 2; 3 and 4 are secondary

In the near-term, emphasis on 1 (Status)

Beneficial Uses

1. Fishing
2. Aquatic Life

Over the long-term, the Program will evaluate the impacts of bioaccumulation on both, with an emphasis on 1

In the near-term, emphasis on 1 – Aquatic Life NOT INCLUDED

Toolbox of Bioaccumulation Indicators

- Sport fish
- ~~Prey fish~~
- ~~Birds~~
- ~~Mammals~~
- ~~Bivalves~~

Benefits of This Survey

- Consistent statewide assessment of all water body types

  - overall summary report when we're done?

- Rivers and streams part of long-term survey cycle

- Complete array of analytes

Significant Prior Work

- TSMP
- Fish Mercury Project
- Region 5 Studies
  - Mercury
  - Organics
- Sacramento River Watershed Program
- UC Davis
- USGS – Alpers et al, Valley work
- USEPA National Rivers and Streams Assessment

Budget

SFEI Coordination	$55,000
MPSL Coordination & QAPP prep	$100,000
Peer Review	$15,000
Collection	$235,600
Prep	$10,250
Chemical Analysis	$181,265
Data Entry and Validation	$50,000
Data Analysis and Reporting	$82,000
Freezer Costs	$8,000
SJSUF	$8,667

Total $745,782

Cost per site

Collection	$5300	
Prep	$230	
Chemistry	$4395	
	Mercury	$665
	Selenium	$300 (2 X 150)
	PCBs	$1090 (2 X 544)
	OC Pests	$1170 (2 X 584)
	PBDEs	$1170 (2 X 584)
Total	$9925	

With these assumptions, budget covers 41 sites

Management Questions For This Screening Study

LAKES

1. 305(b): What is the condition of California lakes with respect to contamination?
   - Indicator: lakewide average concentration
2. 303(d): Should a given lake be on the 303(d) list?
   - Indicator: Two independent samples above the relevant guideline (different days or different locations)
3. *(Consumption Guidelines: Should additional sampling be conducted for the purpose of developing an advisory?)*

COAST

1. Status of the Fishing Beneficial Use
   - For popular fish species, what percentage of popular fishing areas have low enough concentrations of contaminants that fish can be safely consumed?
2. Regional Distribution
   - What is the regional distribution of contaminant concentrations in fish?
3. Need for Further Sampling
   - Should additional sampling of bioaccumulation in sport fish (e.g., more species or larger sample size) in an area be conducted for the purpose of developing comprehensive consumption guidelines?

Audience

- Policy makers
- Water quality managers
- The fishing public

Design Basics

- Population of interest: humans that consume fish

- Spatial unit: fishing location

- Species of interest:

  - Fish species that are:

    - Popular
    - Widely distributed
    - Good indicators

Coordination
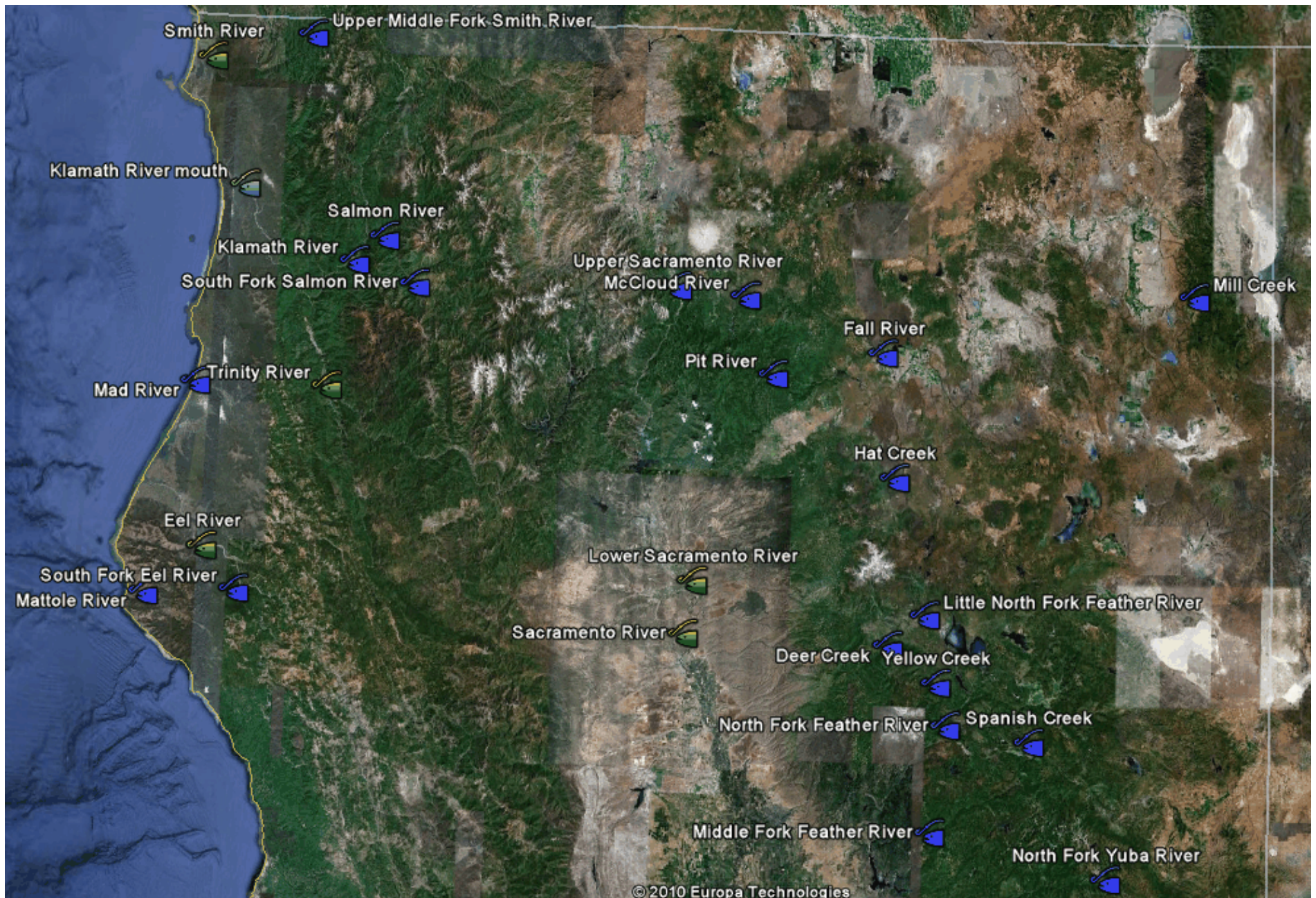
Coordinated Efforts

- Are there any other studies happening that we should coordinate with?

- Check into:
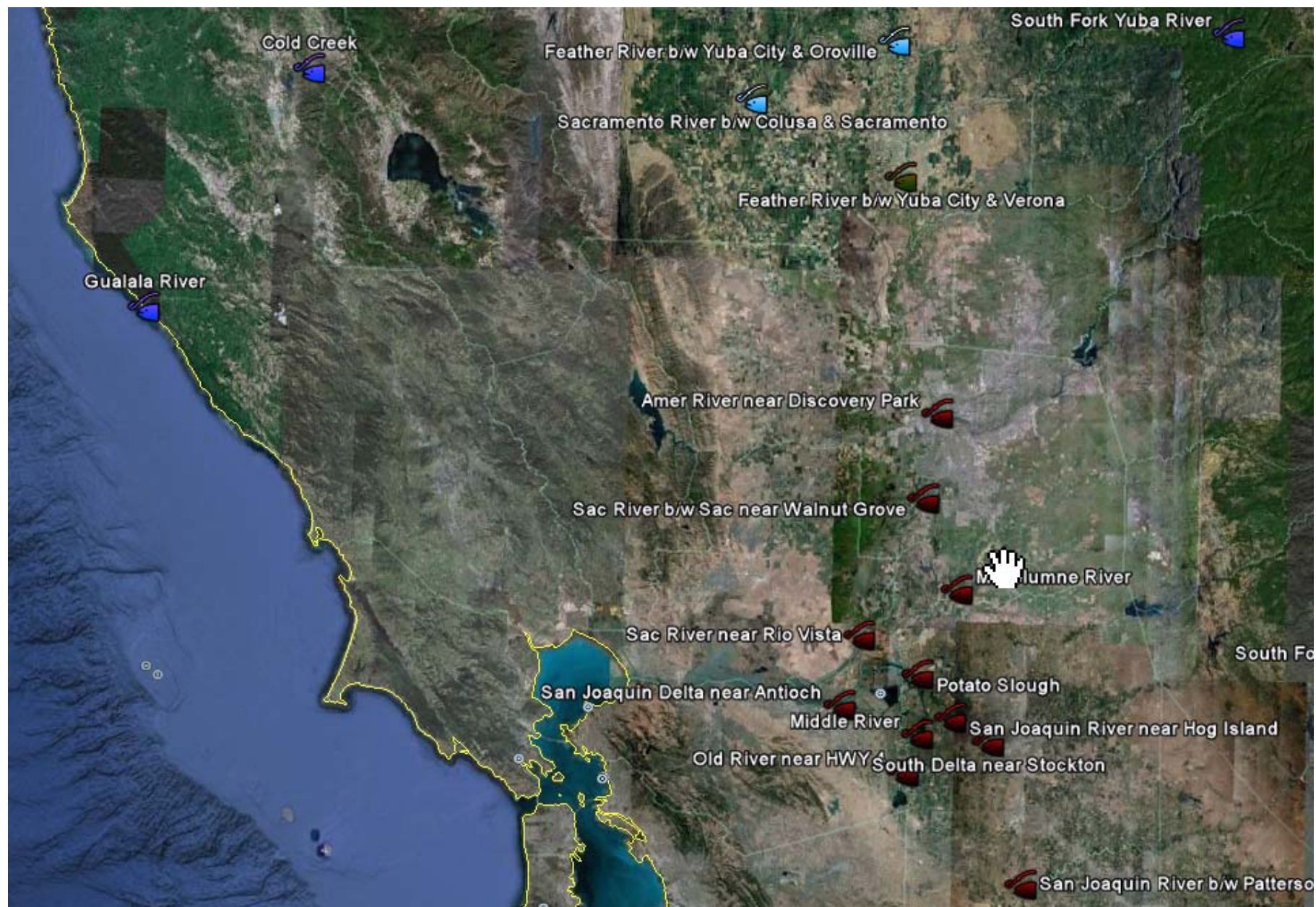   - Alpers work in the Sierra
    - The Sierra Fund

Strategy for Phasing
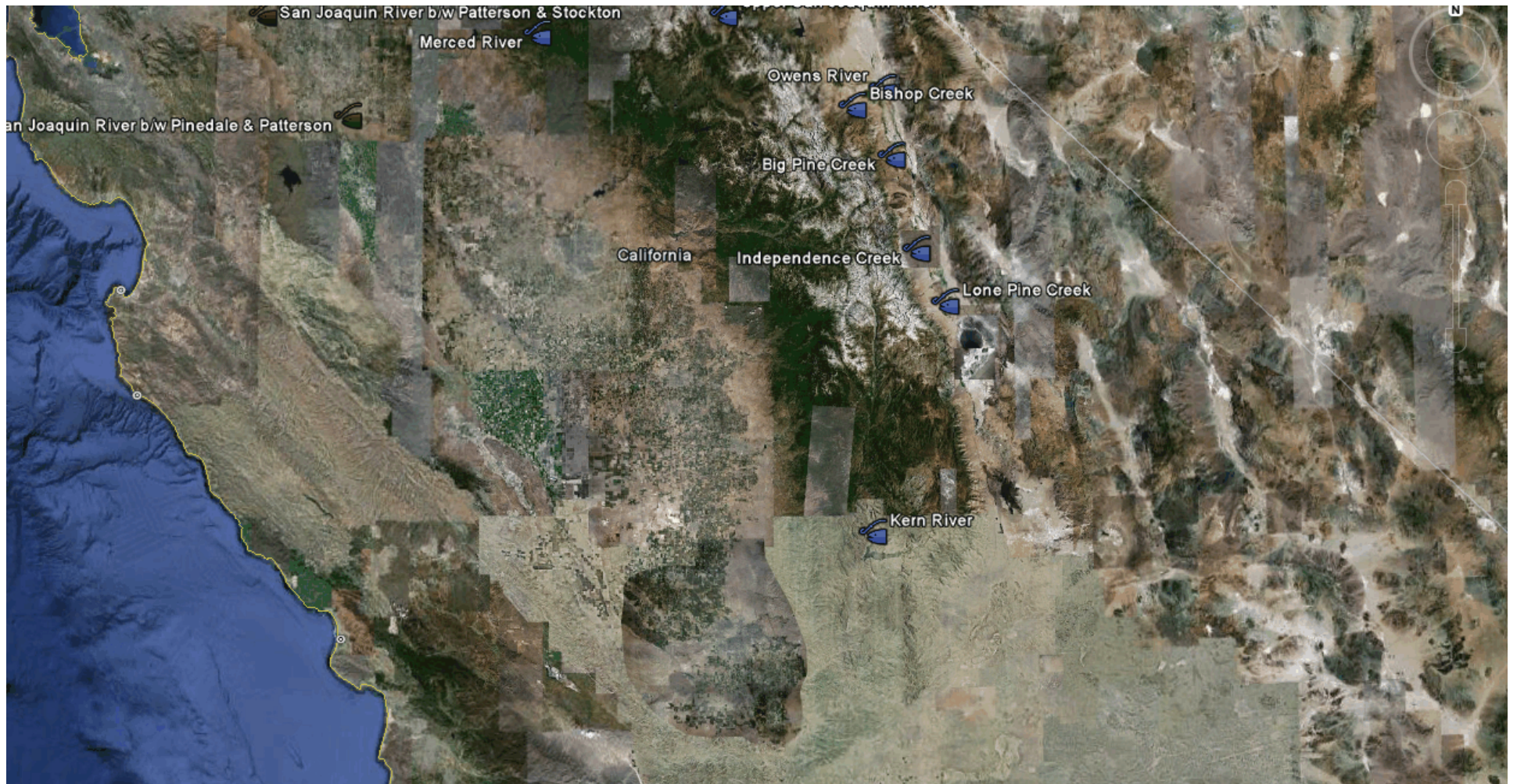
- One year

- No phasing needed
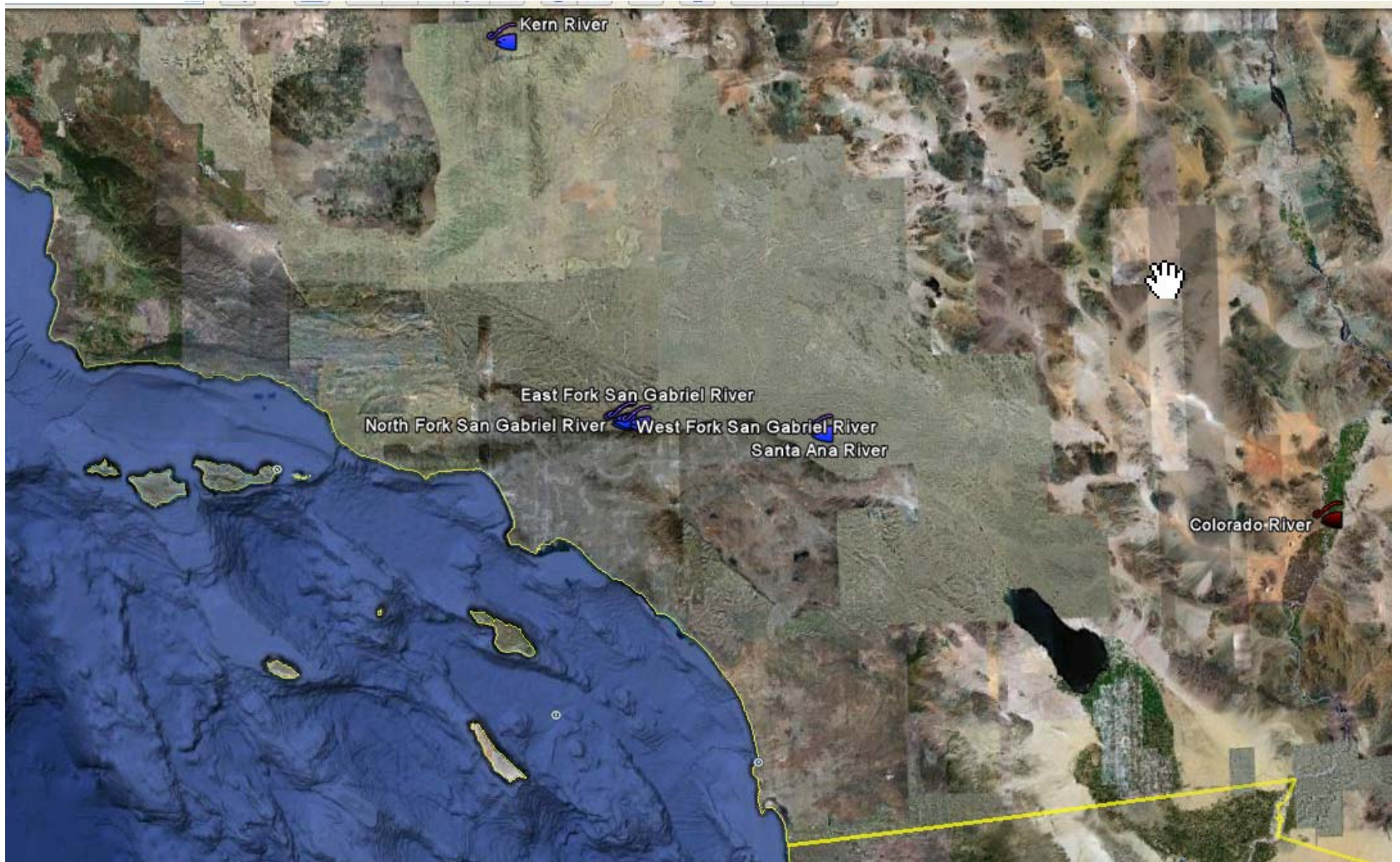
Locations

- The following maps show 60 locations based on sites with a 6 or higher rating in *Stienstra, T. 2004. California Fishing: The Complete Guide to Fishing on Lakes, Streams, Rivers, and Coasts. Foghorn Outdoors, Emeryville, CA*, plus 8 locations added by Gary for the Delta based on his past work there. Are there popular sites for catch and consumption missing from these maps?

South Fork Yuba River

Truckee River

Verona

Rubicon River

West Fork Carson River

East Fork Carson River

Silver Creek

West Walker River   East Walker River

kelumne River

Virginia Creek

Buckeye Creek

South Fork Stanislaus River

Slough

Joaquin River near Hog Island

ear Stockton

Lee Vining Creek

Questions

- How many locations to include?
- Which locations?

Other Questions

- How far to go with coverage of streams?
- How to handle hatchery vs resident fish?
 - Sample hatcheries?

Spatial Units: Fishing Locations

- Similar to locations used in lakes

- Up to 1 mile length

- Considerations for selection

  - Coverage of popular locations for sport fish consumption

  - Stakeholder (Regional Board) interest

Target Species

- Fish species that are (in order of priority):
  1. Popular for consumption
  2. Sensitive indicators of problems – "bad boys" – for the different pollutants of concern – helps with evaluating safe consumption
  3. Widely distributed – spatial coverage and patterns
  4. Cleaner species
  5. Represent different exposure pathways (benthic vs pelagic)
  6. Continuity with past sampling

Target Species

- Primary Targets
  - Where possible, two indicator species per location
    - Top predator as a mercury indicator
    - High lipid benthic species as an organics and mercury indicator
    - Some waters will only have trout

- Secondary Targets
  - In case primary targets are not found

- Vary by region

- Bycatch
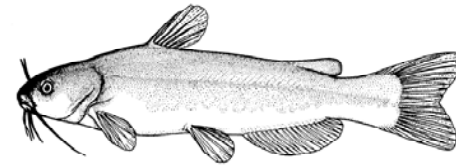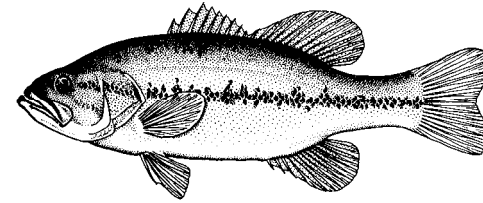
Target Species

Species	Foraging Type		Trophic Level	Distribution			
	Water column	Bottom feeder		Low Elevation	Low Sierra	High Sierra	Good Candidate
Largemouth bass	X		4	**X**	**X**		**A**
Smallmouth bass	X		4	x	**X**		**A**
Spotted bass	X		4	x	**X**		**A**
Sacramento Pikeminnow	X		4	x	x		B
White catfish		X		x	x		**A**
Brown bullhead		X	3	x			B
Channel catfish		X	4	**X**	**X**		**A**
Carp		X	3	**X**	**X**		**A**
Sacramento sucker		X	3	x	x		B
Tilapia		X	3				B
Bluegill	X		3	**X**	**X**		B
Green sunfish	X		3	**X**	**X**		B
Crappie	X		3/4	x	x		B
Redear sunfish	X		3	**X**	**X**		B
Rainbow trout	X		3/4	x	x	**X**	**A**
Brown trout	X		3		x	x	**A**
Brook trout	X		3			x	**A**
Kokanee	X		3	?	x	x	B

Target Size Ranges and Compositing for Each Species

- Composite to stretch dollars
- Use 75% rule
- Target middle of distribution that is caught and consumed
- Need to determine ranges
- Numbers in composites
  - Generally 5

Design Within Each Location

- Replication to support 303(d) listing?
- Sampling design with a follow-up strategy to conserve budget?

Sample Processing and Analysis

- Ancillary data

    - Total length, fork length

    - Location coordinates to store in database: start of a trawl, fishing, gill net or dive

    - Field observations: dominant substrate, Beaufort scale, wind direction, bycatch

- Skin-off fillets

Analytes in Tissue

- Mercury: generally composites, some individuals?
  - For bays and estuaries, consider picking mercury indicator species like lakes
  - Develop budget scenarios
- PCBs: sum of 55 congeners, skip Aroclors, no coplanars
- DDTs: sum of six isomers
- Dieldrin
- Chlordanes: sum of 5 compounds

Analytes in Tissue (continued)

- PBDEs?
- PFCs?
- Dioxins?
- Selenium?
- Omega-3s?
- Others?
- Ancillary parameters: lipid, moisture
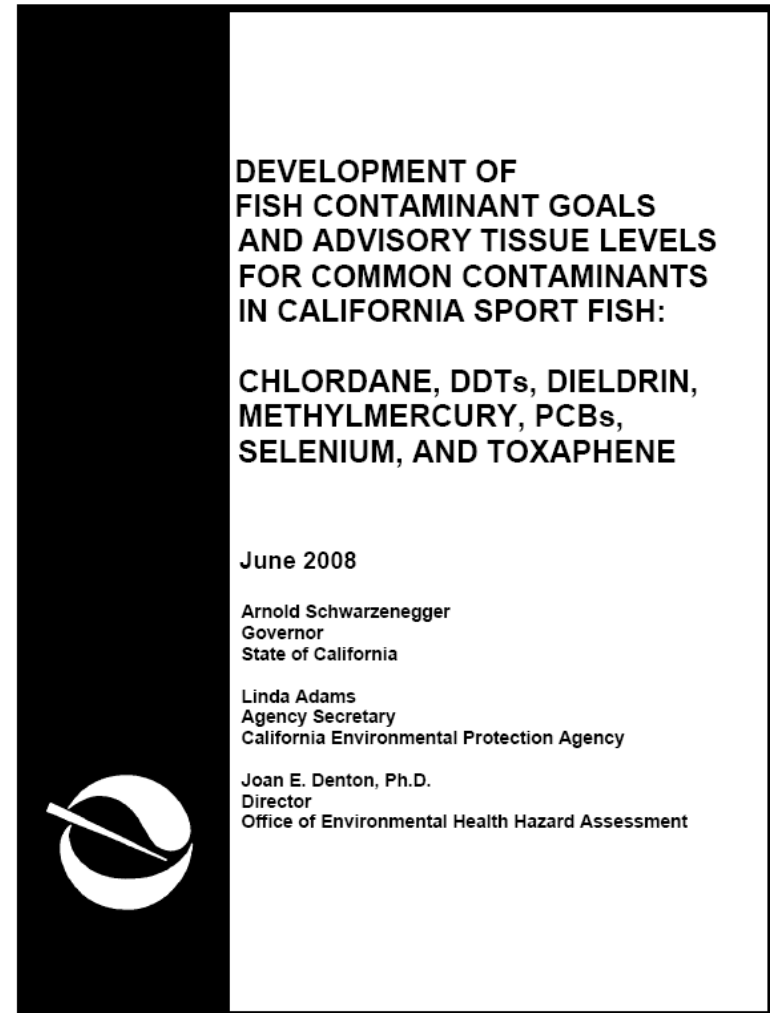
QA

- QAPP

Sampling Methods

- E-boat
- Nets
- Seining
- Hook and line

Ancillary water or sediment quality data?

- ??

Assessment Thresholds

- Advisory Tissue Levels
- FCGs
- State Board Mercury Objective?
- 303(d) Listing Thresholds?

DEVELOPMENT OF
FISH CONTAMINANT GOALS
AND ADVISORY TISSUE LEVELS
FOR COMMON CONTAMINANTS
IN CALIFORNIA SPORT FISH:

CHLORDANE, DDTs, DIELDRIN,
METHYLMERCURY, PCBs,
SELENIUM, AND TOXAPHENE

June 2008

Arnold Schwarzenegger
Governor
State of California

Linda Adams
Agency Secretary
California Environmental Protection Agency

Joan E. Denton, Ph.D.
Director
Office of Environmental Health Hazard Assessment

Archiving

- Tiered approach
  - Long-term archives
  - Short-term archives