

## **1a) Revisit Lakes That Were Inadequately Characterized**

### **Rationale**

This work would address objective D1. The data would address Management Questions 1 – statewide condition - and 2 – 303(d) listing – from the Lakes Survey. We didn't fully address the objectives and management questions we articulated for the Lakes Survey because of incomplete sampling of some lakes. In other words, in some lakes we did not get the "bad boys". Deeper high elevation lakes are the biggest problem, where planted rainbow trout aren't representative of bioaccumulation in larger resident fish. In these cases, the data from the screening survey can be quite misleading. Donner Lake is a prime example for PCBs. Follow up work by SFPUC at Hetch Hetchy has shown this nicely for brown trout and rainbow trout. Information gained from this effort would also be useful in accurately scoping future surveys that adequately characterize all lakes.

### **Study Plan**

- 15 high elevation lakes
- sample two species per lake
- sample one location per lake
- mercury in both species
- PCBs in one species
- \$140,000

### **Pros**

- Fills a major gap left from initial survey
- Valuable to managers for 303d, advisory development
- Better baseline for trends in these lakes
- Helpful in designing and scoping future sampling
- Will help with sustainability by getting more lakes on 303d list

### **Cons**

- Won't make for an interesting new report

## **1b) SWAMP/EPA Probability Survey**

### **Rationale**

This work would address objective D1. The data would address Management Questions – statewide condition - from the Lakes Survey. Probabilistic surveys are important for lakes in California because of the large number of discrete water bodies. Probabilistic sampling is needed to answer the proportion-oriented assessment questions under objective D1. Periodic repetition of these surveys will provide updates of these estimates, which is one form of trend assessment. These random surveys also increase understanding of the extent and magnitude by covering new water bodies. The ancillary data available for these lakes from USEPA will be valuable in understanding drivers of MeHg bioaccumulation. USEPA does these surveys every 5 years.

### **Study Plan**

- 40 random lakes (1 ha cutoff versus 4 ha cutoff in the earlier SWAMP survey, no weighting scheme to skew sampling toward larger lakes)
- sample two species per lake at low elevations, large residents at high elevations – bad boys
- mercury in both species
- PCBs in one species
- THg in sediment at one location
- \$148,000

### **Pros**

- Fills need for periodic probabilistic assessment of statewide condition
- Suite of ancillary data will help in evaluating driving factors for mercury in fish
- Will expand dataset for sediment:fish mercury correlations for lakes sampled for largemouth
- Cost-effective
- Nice partnership with USEPA
- Nice material for a report
- Will this help with sustainability?

### **Cons**

- Not exactly the draw of lakes we would want – likely skewed to Sierra lakes, some lakes may not have fish
- Low value with regard to control plans
- May be better to wait until 2017 and have the probability surveys on a 10 year cycle

## **1c) Determining Mercury Concentrations in Fish Species from Representative California Reservoirs**

### **Rationale**

This work would address objectives D1 and A1. The more thorough characterization of species in representative lakes would provide a deeper understanding of status that supports TMDL development and implementation. Wildlife exposure would be included through sampling of small fish. The small fish sampling would help ensure that targets based on sport fish are indeed protective of fish-eating wildlife. See separate writeup for more background.

### **Study Plan**

- 9 lakes from 3 biogeographic regions (high Sierra, low Sierra, northern coast range)
- includes multiple species per trophic level
- individuals for 2 predator species
- composites for lower trophic level species
- includes small fish in multiple size classes
- includes Hg in sediment
- includes MeHg in water
- no organics
- \$120,000

### **Pros**

- Supports an effort (statewide TMDL) that will lead to sustainable long-term monitoring by TMDL parties
- High value to managers
- Helps ensure the TMDL is protective of wildlife
- Somewhat interesting reporting product

### **Cons**

- Somewhat interesting reporting product

## **1d) Establish Time Series for Sport Fish at Selected Lakes**

### **Rationale**

This work would address objectives D2 and D4. Assessment of temporal trends is a crucial element of any long-term water quality monitoring program. Trend assessment is closely related to assessing the effectiveness of management efforts at a local or regional scale. Power to detect interannual trends is a function of the interannual frequency of sampling. After 5 or 6 sampling intervals trends, if present, may start to become apparent, if interannual variation is not too great. Understanding baseline conditions is an essential starting point. Food web mercury concentrations can change even in the absence of TMDL-related management actions, due to factors such as climate change, reservoir aging, other reservoir management practices, food web shifts, etc.). Information on regional background trends in lakes is needed to interpret trends observed in lakes where management actions will be taken.

### **Study Plan**

- Same design as original Lakes Survey, but including sampling of large residents at high elevation
- 18 lakes – 2 per water board region – trend lakes (primary and secondary) were identified by each region in 2007 – these are the primary trend lakes
- includes Hg in small fish in multiple size classes
- includes Hg in sediment
- includes MeHg in water
- includes PCBs in sport fish only, one species per lake
- \$267,000

### **Pros**

- Addresses lack of trend monitoring in the program to date, and over the long-term for the state in general
- High value to managers
- Begins to characterize baseline conditions and interannual variation which are crucial to assessing trends and the effectiveness of management
- Follows through on trend lake designation made in 2007
- Somewhat interesting reporting product

### **Cons**

- Perhaps some risk of investing in lakes that aren't picked up later by TMDL parties
- Simply waiting for TMDL parties to pick this up may be an option

## **1e) FWS BAF Study**

### **Rationale**

This work would address objective A1. The data collected would be useful for refining BAFs for use in statewide or impaired water body objective development. It would also help sampling needs for future TMDL development or monitoring. See separate writeup for more background.

### **Study Plan**

- 16 representative lakes of eight different types
- Piscivorous bird eggs
- Omnivorous bird eggs
- Small fish 50mm-200mm, and
- Benthic inverts
- appropriate water quality data
- \$220,000?

### **Pros**

- Supports an effort (statewide TMDL) that will lead to sustainable long-term monitoring by TMDL parties
- High value to managers
  - Helps ensure the TMDL is protective of wildlife
  - Supports site-specific fish tissue objectives for Clean Water Act TMDLs in the lakes and watersheds where the samples are collected;
  - Guidance on determining statewide and site-specific fish tissue objectives for Clean Water Act TMDLs in California and elsewhere;
  - Determine an appropriate level of biota monitoring needed to address TMDL development and implementation as well as long-term trends in mercury concentrations in fish and piscivorous wildlife, and
  - Provide data for assessing impacts to trust species for Federal Energy Regulatory Commission (FERC) relicensing, Endangered Species Act section 7 consultations, and recommendations under the Fish and Wildlife Coordination Act.
- Interesting reporting product
- Partnering with USFWS, perhaps USGS – interagency collaboration is a plus
- Supports sustainable, appropriate monitoring in the future by TMDL parties

### **Cons**

- Perhaps waiting for TMDL parties to do this would be another option