

Methylmercury Regulations and DWR

MWQP Face to Face, July 30, 2014

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Mercury Monitoring and Evaluation Section

Outline

- What is a TMDL?
- Background of Delta Methylmercury TMDL
 - What is a TMDL?
 - Why is Mercury a problem?
 - The Delta TMDL and DWR
- Future Regulation
 - Proposed Statewide Mercury Policy and Mercury Control Program for Reservoirs
 - Scope
 - Cost
 - Timeline

What is a TMDL?

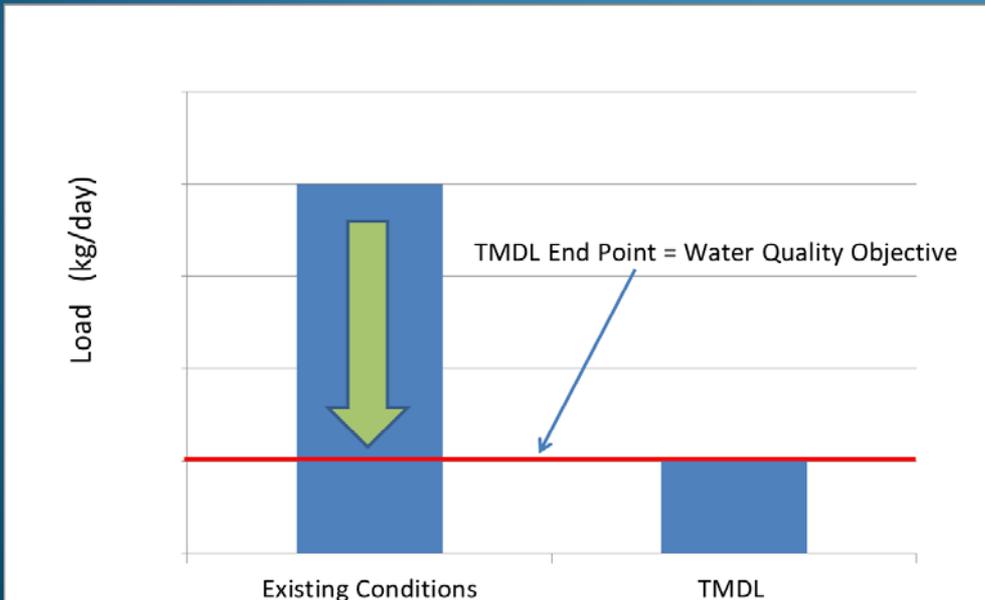
TMDL =s Total Maximum Daily Load

Determines the maximum amount (or load) of a pollutant that a waterbody can receive without violating water quality standards that maintain its beneficial uses.

Load \neq concentration!!!!!!

What is a TMDL?

$TMDL = L_1 + L_2 + L_3 + \text{a few margin of error terms}$



Delta Methylmercury TMDL is a bit of a misnomer.....actually an annual load reduction.

Where are we now?

- Sacramento-SJ Delta placed on 303 (d) list in April 1990—Impaired for fish consumption due to Hg.
- April 2010 the Regional Board adopted amendments to the Sacramento River and San Joaquin River Basin Plan to establish the **Delta Mercury Control Program (aka Delta TMDL)**.
- October 2011 the USEPA approved the amendments (TMDL) and Director received letter that Dept. must comply.

Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Methylmercury and Total Mercury in the Sacramento-San Joaquin River Delta Estuary (Attachment 1 to Resolution No. R5-2010-0043)

Revise Chapter II (Existing and Potential Beneficial Uses), Table II-1 for Sacramento San Joaquin Delta, to add as follows:

Yolo Bypass (8)

Sacramento San Joaquin Delta (8,9)

Addition to Table II-1 Footnote (8) under existing text:

COMM is a designated beneficial use for the Sacramento San Joaquin Delta and Yolo Bypass waterways listed in Appendix 43 and not any tributaries to the listed waterways or portions of the listed waterways outside of the legal Delta boundary unless specifically designated.

Addition to Table II-1 Footnote (9) under existing text:

COMM is a designated beneficial use for Marsh Creek and its tributaries listed in Appendix 43 within the legal Delta boundary.

Revise Chapter III (Water Quality Objectives), under “Methylmercury”, to add as follows:

For the Sacramento-San Joaquin Delta and Yolo Bypass waterways listed in Appendix 43, the average methylmercury concentrations shall not exceed 0.08 and 0.24 mg methylmercury/kg, wet weight, in muscle tissue of trophic level 3 and 4 fish, respectively (150-500 mm total length). The average methylmercury concentrations shall not exceed 0.03 mg methylmercury/kg, wet weight, in whole fish less than 50 mm in length.

Revise Chapter IV (Implementation), under “Mercury Discharges in the Sacramento River and San Joaquin River Basins”, to add as follows:

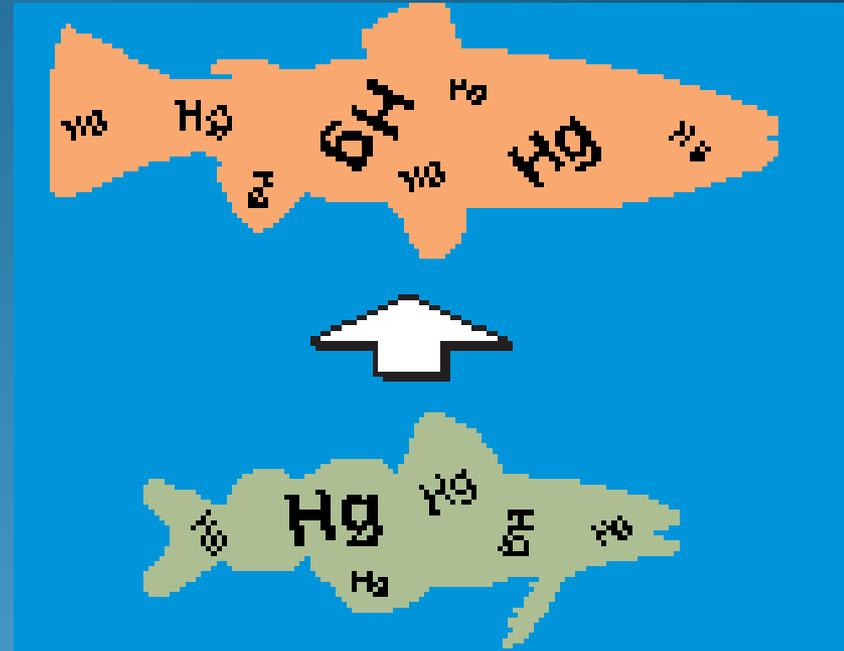
Delta Mercury Control Program

The Delta Mercury Control Program applies specifically to the Delta and Yolo Bypass waterways listed in Appendix 43.

This amendment was adopted by the Regional Water Quality Control Board on 22 April 2010, and approved by the U.S. Environmental Protection Agency on 20 October 2011. The Effective Date of the Delta Mercury Control Program shall be 20 October 2011, the date of U.S. EPA approval.

Where are we now?

- Numeric targets developed for large (T3 and T4) and smaller T2 fish.
 - T3 & 4 = 150-500 mm total length
 - T2 = < 50 mm total length
 - Examples include: carp, salmon, catfish, bass.
- Avg. MeHg concentrations not to exceed 0.08 and 0.24 mg MeHg/kg (T3&T4) and 0.3 mg MeHg/kg (T2), wet weight in muscle tissue.
- Designed to protect humans eating 1 fish meal/week (8oz) and protective of wildlife consuming smaller fish.



Why is Mercury a Problem?

Why is Hg a Problem?

- For purposes of this TMDL, primary exposure route is through fish consumption—Not drinking water!
- Potent Neurotoxin
 - Toxic form-Methylmercury (MeHg).
 - Orders of magnitude more toxic than Hg.
 - Prevalent form in the body (>90% of Hg in fish is MeHg).
 - Forms strong chemical bonds with biologic proteins.
 - Able to cross cell-membranes.
 - Long half-life (~ 2 years in fish).
 - Loss of muscle control
 - Blindness
 - Paralysis
 - Birth defects and death
 - Children more vulnerable than adults
 - Impaired learning
 - Reduced social and behavioral abilities
 - Similar toxicological affects in fish and wildlife



Why is Hg a Problem?

In the Delta:

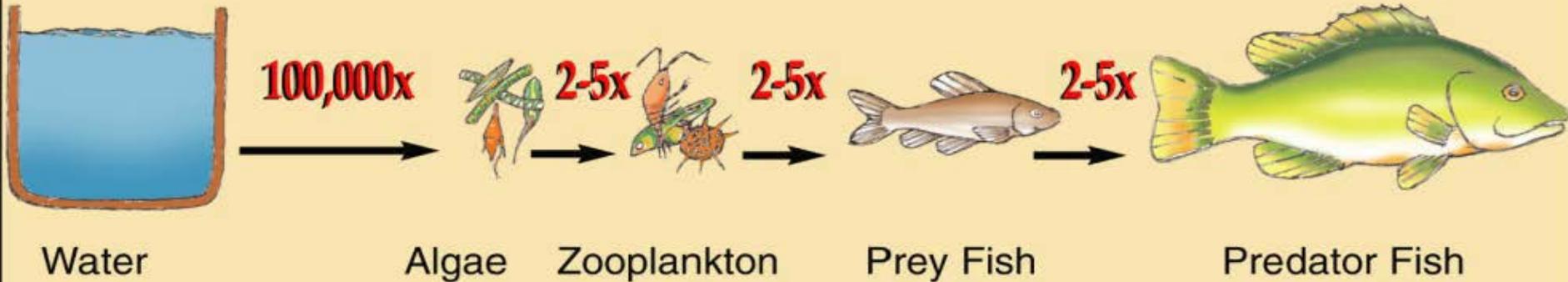
- ~ 300,000 licensed sport and subsistence anglers/year use the Delta.
- Unknown number of unlicensed anglers.
- Multiple ethnicities, communities, & income levels.
- 5% of fish consumers in Northern Delta have Hg intake 10Xs above the safe dose.



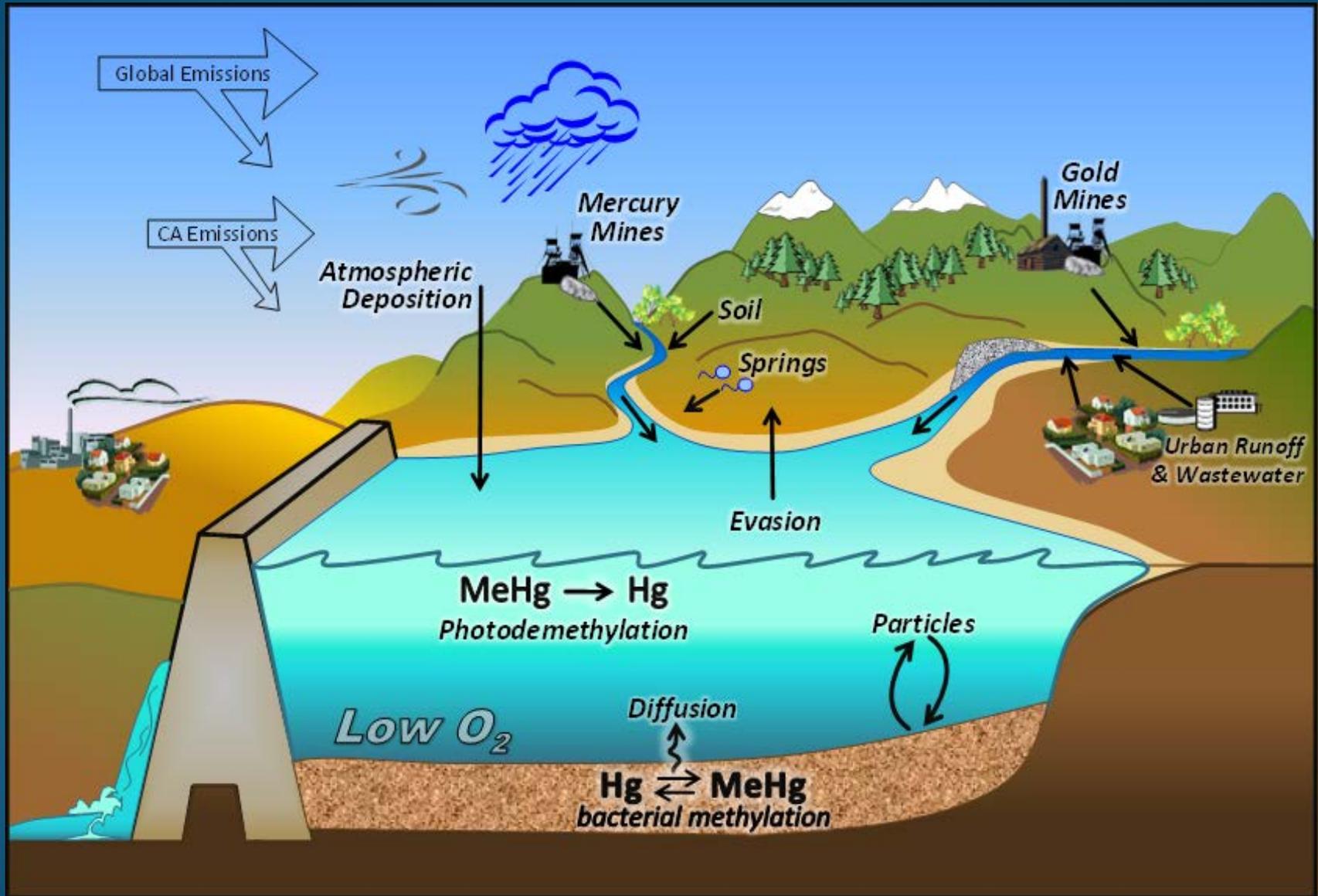
Why is Hg a problem?

Bioaccumulation and Biomagnification

Example Magnification Per Step

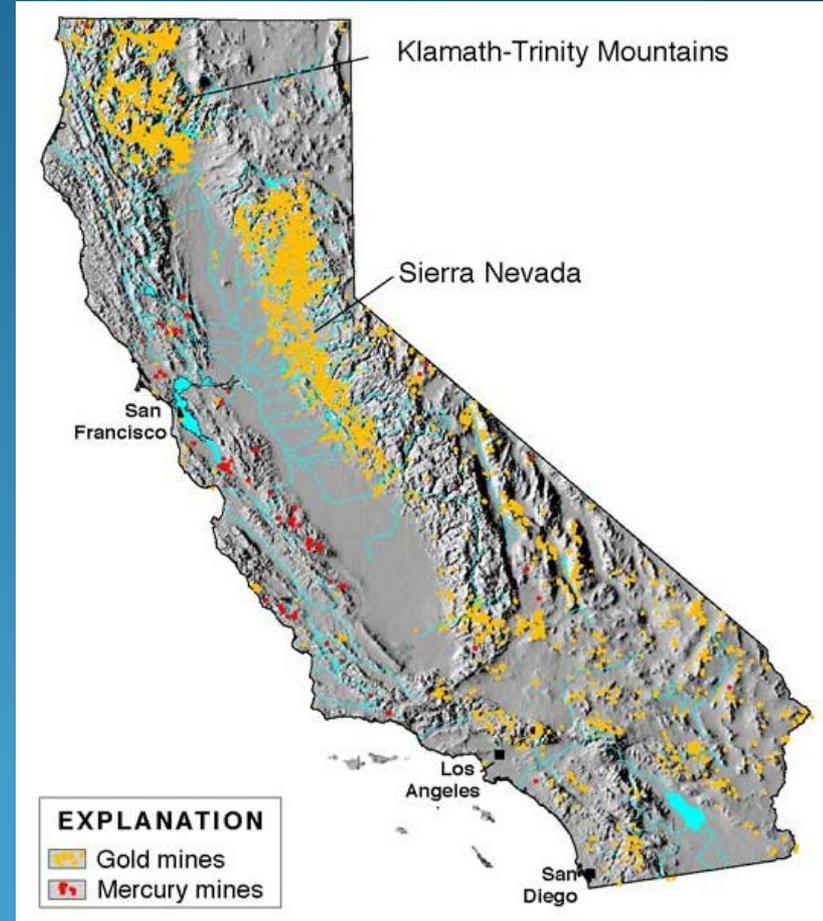


Sources

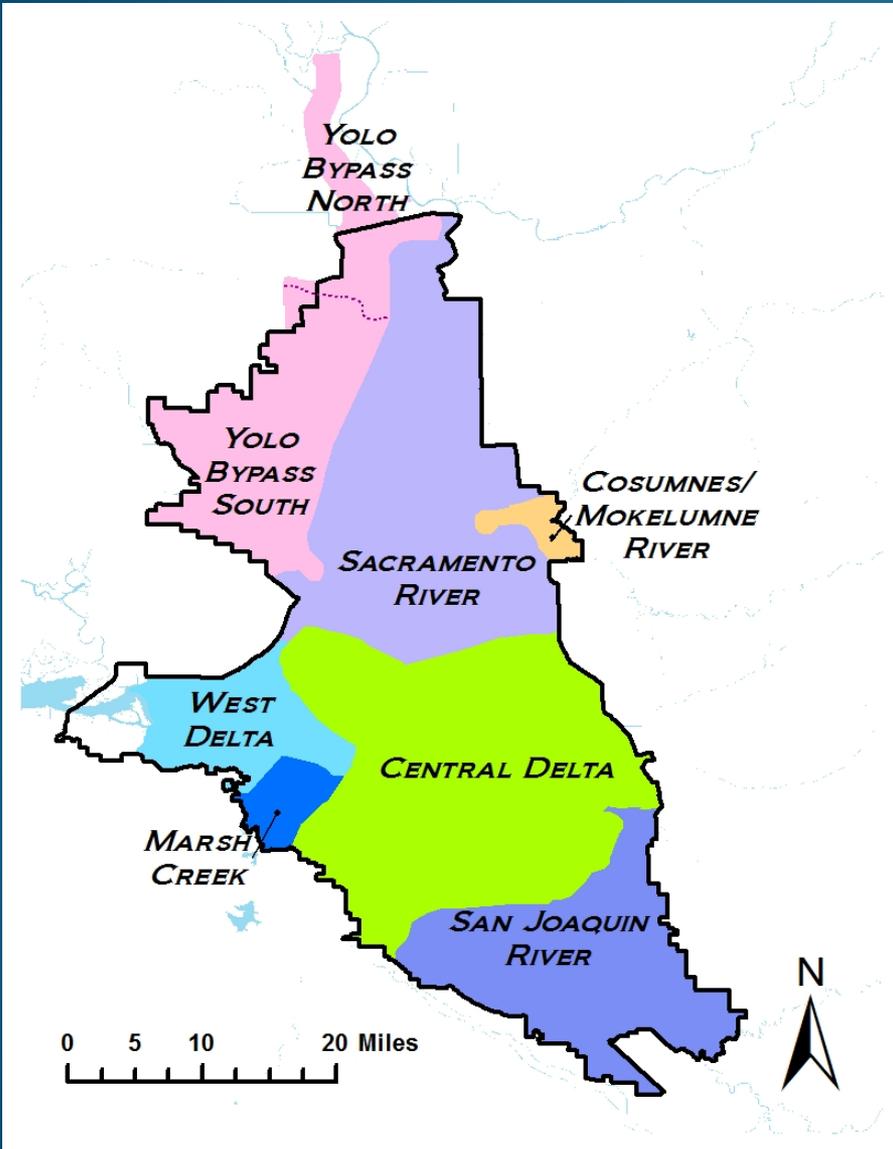


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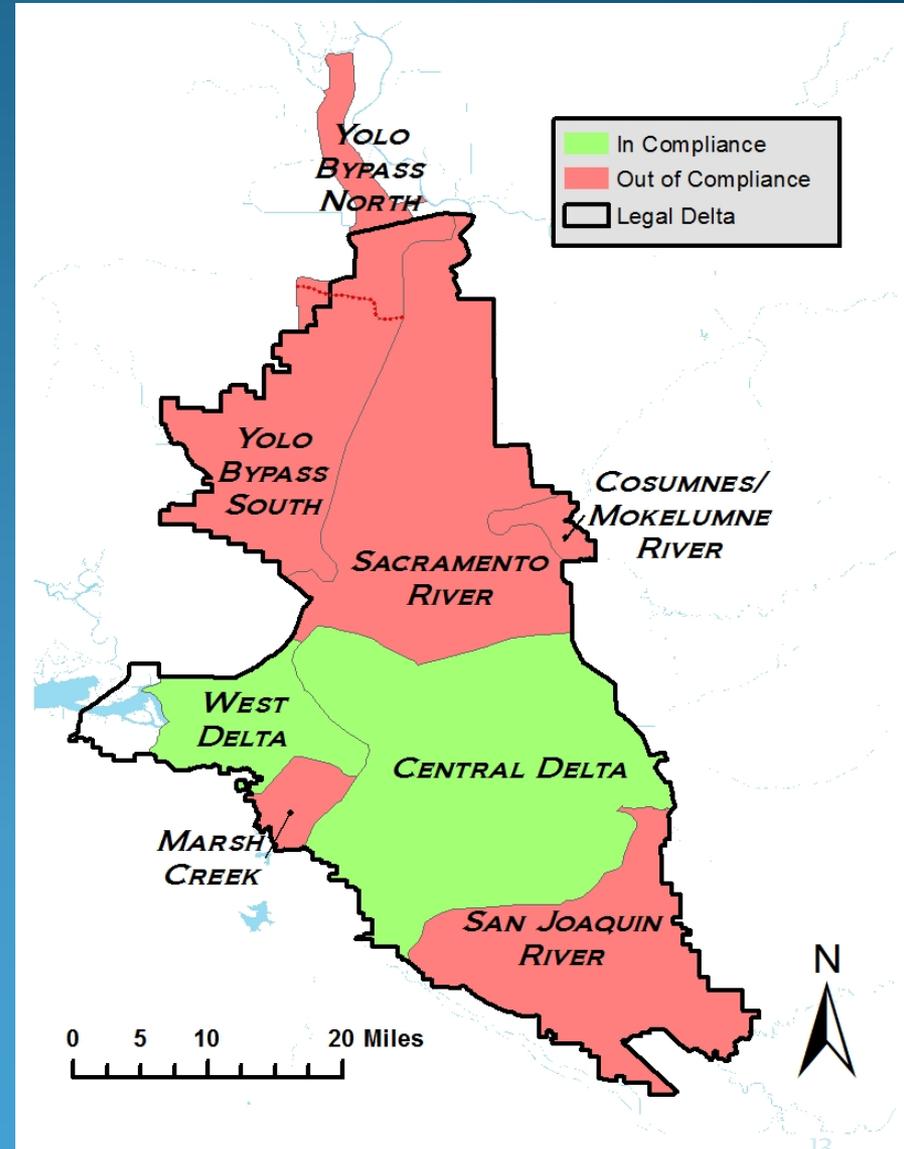
- 47,000 abandoned mines in California.
 - Coast Range-Hg mines
 - Sierra Nevada-Au mines
- Legacy gold and mercury mine waste continues to enter the Delta through tributaries.



What areas are affected?

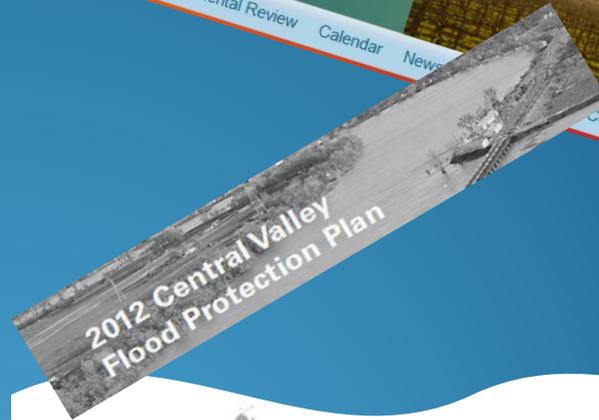
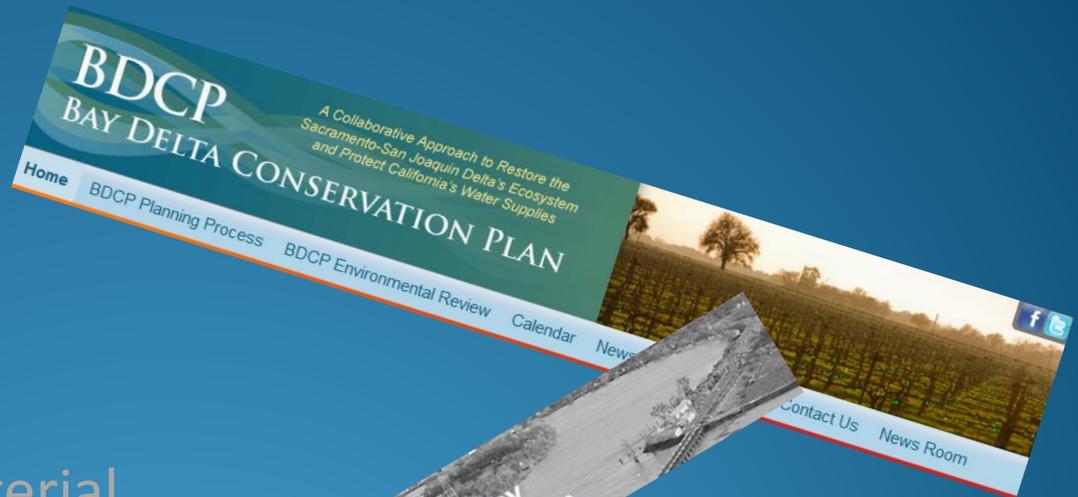


What areas require load reductions?



How is DWR affected?

- Wetlands
- Open Water
- Irrigated Agriculture
- Dredging and Dredge Material Reuse
- Mercury Exposure Reduction Program



How is DWR affected?—Control Studies



Q: What BMPs will reduce MeHg discharges from each of the regulated activities?



A: Develop Workplans to conduct Control Studies to determine BMPs.

➔ **Goal—**Use control study results to adjust allocations and implement control strategies in Phase 2

How is DWR affected?—Control Studies

- Wetlands
 - Are tidal wetlands sources or sinks of MeHg?
- Open Water
 - How do current or proposed operations affect MeHg production and what are the important drivers of methylation?
 - Will use modeling to examine this question.
 - For the Delta---DSM2-Hg model
 - For the Yolo Bypass---Dynamic Mercury Cycling
 - Field collection-Yolo Bypass
- Irrigated Agriculture
- Dredging and Dredge Material Reuse
- Mercury Exposure Reduction Program
 - Graphical support

How is DWR affected?

Phase 1
2011

TMDL Review
2020

Phase 2
2020

2030

- MeHg Control Studies
- MERP
- Pollution prevention for Hg
- Develop upstream TMDLs
- Development of Hg offset program

Reassess allocations & schedules

- Implement BMPs from MeHg Control Studies
- Continue MERP?
- Continue pollution prevention for Hg
- Begin compliance monitoring
- Begin implementing upstream TMDLs

Compliance

Future Regulation

Proposed Statewide Mercury Policy and
Mercury Control Program for Reservoirs

Future Regulation

Three SWRCB interrelated programs under development simultaneously:

- A statewide Mercury Policy.
- A statewide control program for mercury impaired reservoirs.
- A statewide methylmercury fish tissue objective.

Future Regulation

Statewide Mercury Policy

- Provides a framework for Hg control programs in CA inland waters. It will guide:
 - Adoption of water quality objectives.
 - Development of general implementation requirements.
 - Development of control plans for Hg impaired water bodies.

Future Regulation

Fish Tissue Objective

- Objective developed to protect people and wildlife that eat fish.
- May include provisions for site specific objectives and exemption for existing TMDLs.
- Proposed target level is 0.2 mg/Kg.

A Healthy Guide to Eating Fish from Lake Oroville
Women 18- 45 years and children 1-17 years

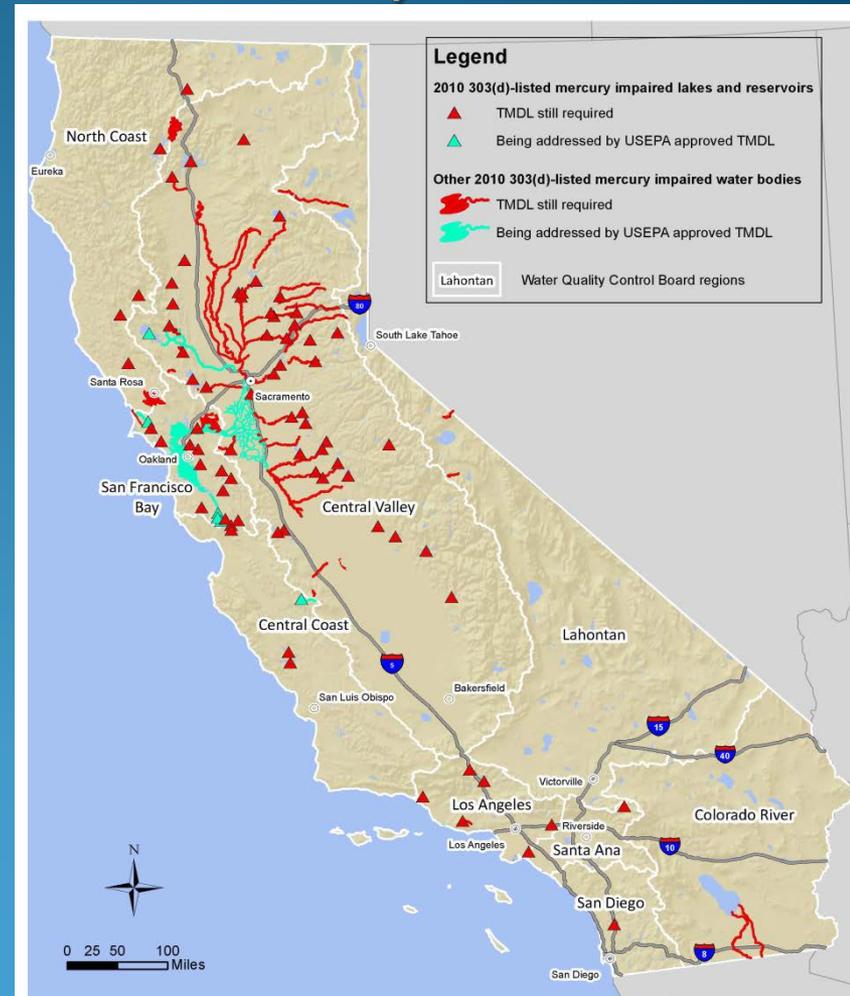
| Low | Medium | High |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chemical Meter | Chemical Meter | Chemical Meter |
|  Bluegill |  Carp |  Largemouth, smallmouth, redeye, or spotted bass |
|  Green sunfish |  Coho salmon  |  Channel catfish |
| | |  White catfish |
|  = High in Omega-3s | | |
| 2 servings a week | OR | 1 serving a week |
| Eat only the skinless fillet. PCBs are in the fat and skin of the fish.  <ul style="list-style-type: none">• Remove and throw away the skin before cooking.• Cook thoroughly and allow the juices to drain away. | What is a serving?  For Adults For Children The recommended serving is the size and thickness of your hand. Give children smaller servings. | Why eat fish? Eating fish is good for your health. Fish have Omega-3s that can reduce your risk for heart disease and improve how the brain develops in unborn babies and children. What is the concern? Some fish have high levels of mercury and PCBs. PCBs can cause cancer. Mercury can harm the brain, especially in unborn babies and children. |
| California Office of Environmental Health Hazard Assessment • www.oehha.ca.gov/fish.html • (916) 327-7319 or (510) 622-3170 | | |

Future Regulations-Scope

Statewide Control Program for Mercury Impaired Reservoirs (Reservoir TMDL)

- *Will address the 74 currently identified mercury-impaired reservoirs.
- Another 70 or so added in next 303(d) listing cycle.
- ~1000 reservoirs in CA
- ~ 50% are impaired

*May include exemptions for existing TMDLs.



Future Regulation-Scope

- Current 303d reservoir listing

- Castaic Lake
- Del Valle
- O'Neill Forebay
- Oroville
- Pyramid
- San Luis
- Thermalito Afterbay

- Next set of reservoirs to be listed*

- Castaic Lake
- Elderberry Forebay
- Los Banos Reservoir
- Silverwood

* Educated guess based on fish tissue data

Future Regulation-Scope

Proposed Management Practices

- Source Control (including sediment removal or capping of contaminated sediments, erosion control BMPs, clean-up of abandoned mines, clean-up of dredge spoils, mineral spring treatments, settling basins)
- Water Chemistry (to reduce methylation)
 - Reduce anoxia with artificial circulation or hypolimnetic oxygenation (HO), or adjust redox potential by adding nitrate.
 - In reservoirs with low pH, increase pH by adding lime or reducing air emissions that produce acid rain.
- Fisheries and Food Web Management
 - Adding nutrients to oligotrophic reservoirs to increase productivity at the food web base (bloom dilution).
 - Manipulating the food web (e.g. intensive fishing to increase growth rates of remaining fish)(somatic dilution).
 - Restoring native anadromous fisheries, which tend to bioaccumulate less MeHg.
 - Changing stocking regimes to decrease the number of predatory fish.

Future Regulation-Cost

Estimated cost for management practice

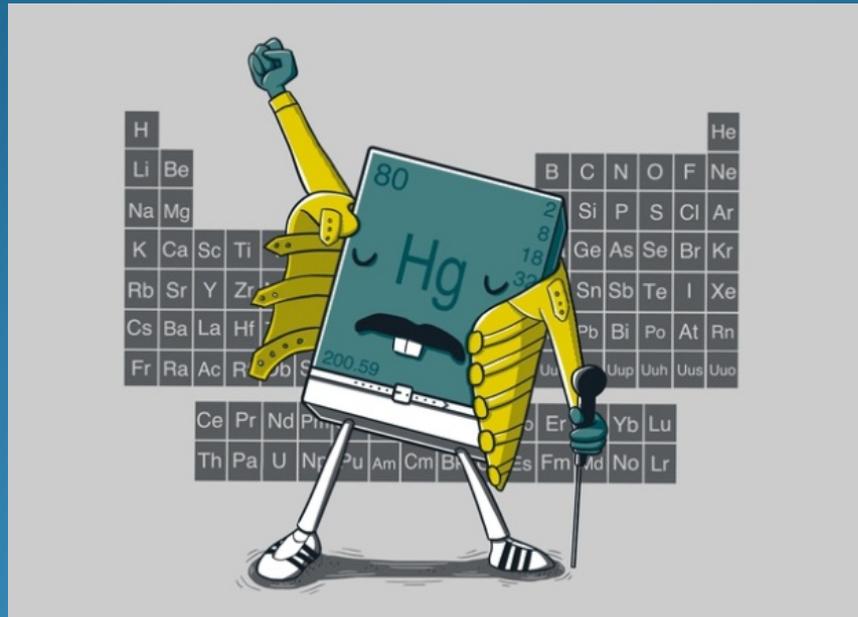
| Method | Cost | Comment |
|-----------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Source Control | ? | Depends on management practice |
| Water Chemistry | | |
| Oxygenation | \$80,000 | In-house oxygenation system used at Lake Perris |
| Hypolimnetic Oxygenation | \$2M-\$5M + | Cost depends on size & complexity of reservoir |
| CaNO ₃ Additions | \$1M/year + | Cost depends on size & complexity of reservoir. Cost estimate from 106,000 acre-foot lake |
| Nutrient Additions | \$2,000-\$600,000;fertilizer \$80,000-\$300,000; labor, eqpt., data analysis, etc. | Cost depends on size of reservoir. |
| Fisheries Management | ? | DWR responsible for fisheries management at Lake Oroville only. |

Future Regulation-Timeline

Adoption Schedule (as of June 2014)

| Milestone | Estimated Date |
|---------------------------------------------------------------------------------------------------------------------|----------------------|
| Focus group meetings (reservoir operators, fisheries agencies, environmental groups, Tribes, permitted dischargers) | May – September 2014 |
| Publicly available draft regulation and technical staff report | Fall 2014 |
| Scientific peer review and staff responses | Fall/ Winter 2014 |
| Draft substitute environmental documentation (i.e., project alternatives, environmental impacts, economic factors) | Fall/ Winter 2014 |
| Public comment period: Draft regulation, staff reports, and draft substitute environmental documentation | Spring 2015 |
| Board Workshop | Summer 2015 |
| Board Adoption | Fall 2015 |

Questions?



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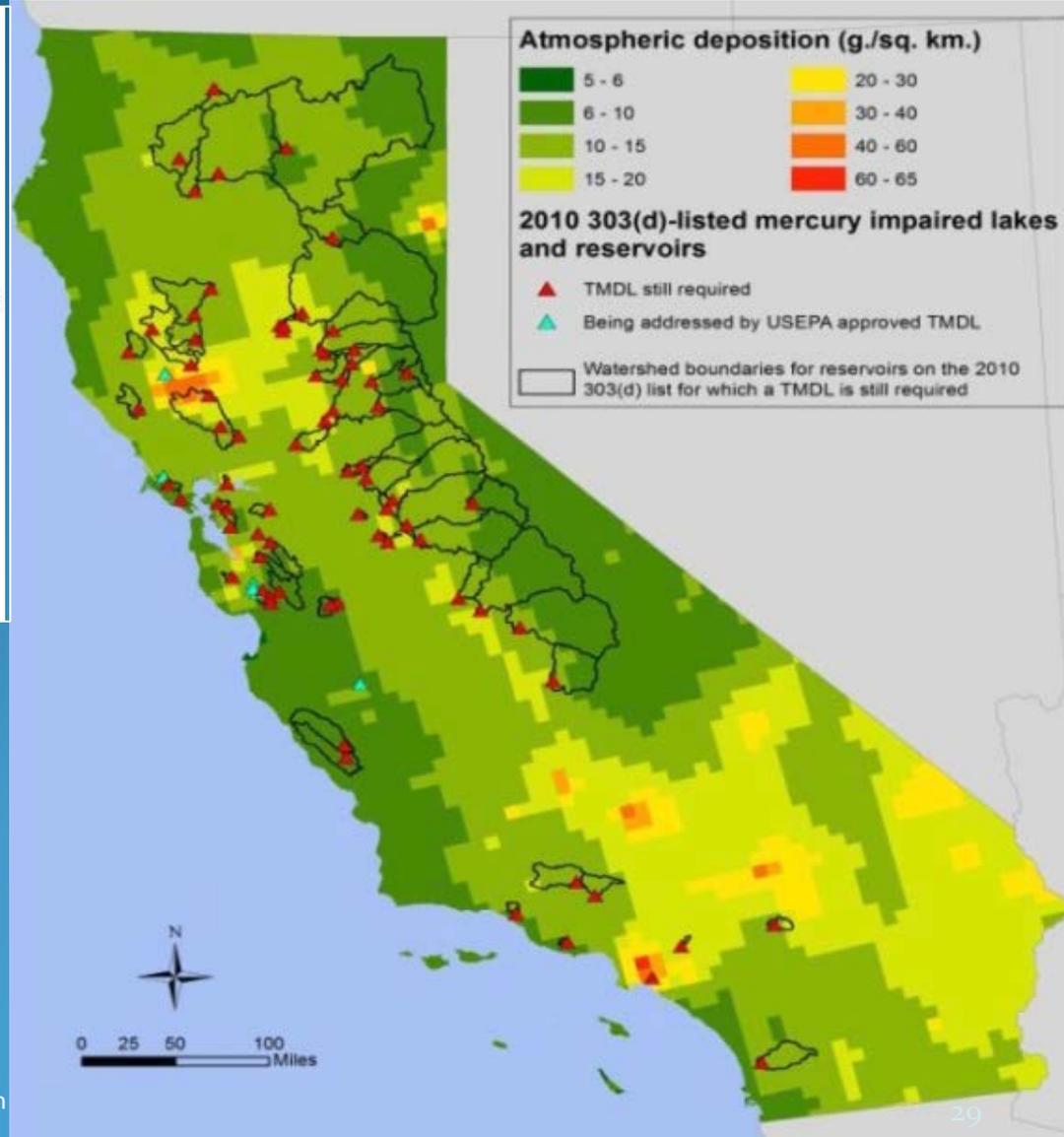
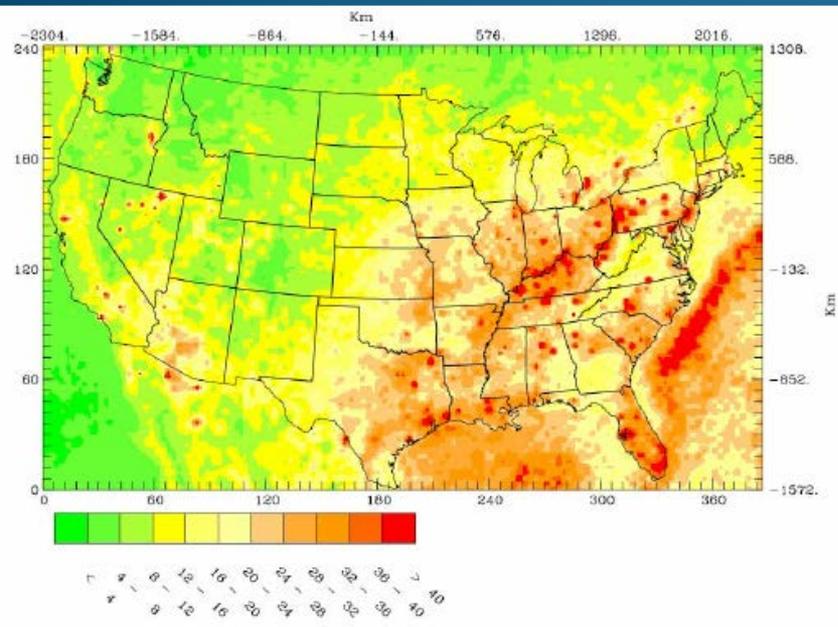
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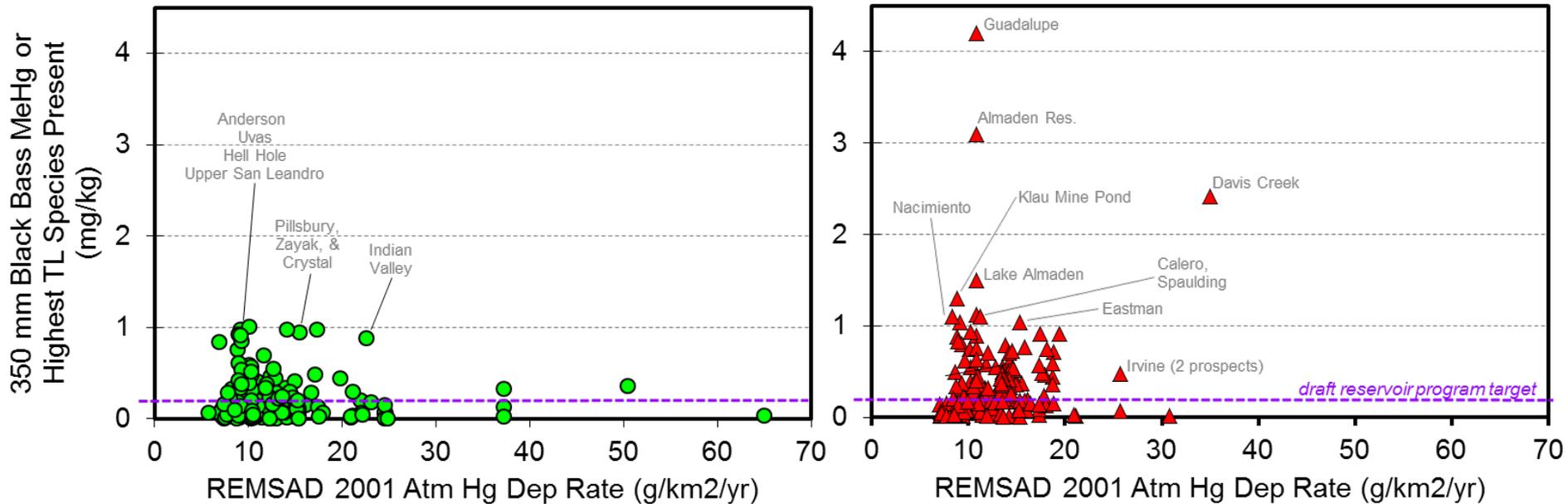
Extra Slides

USEPA's REMSAD 2001 model output for atmospheric Hg deposition throughout the U.S.



- Overall, atm dep rates low in CA
- Some limited areas rival atm dep rates in eastern U.S.

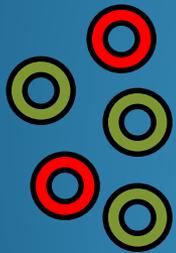
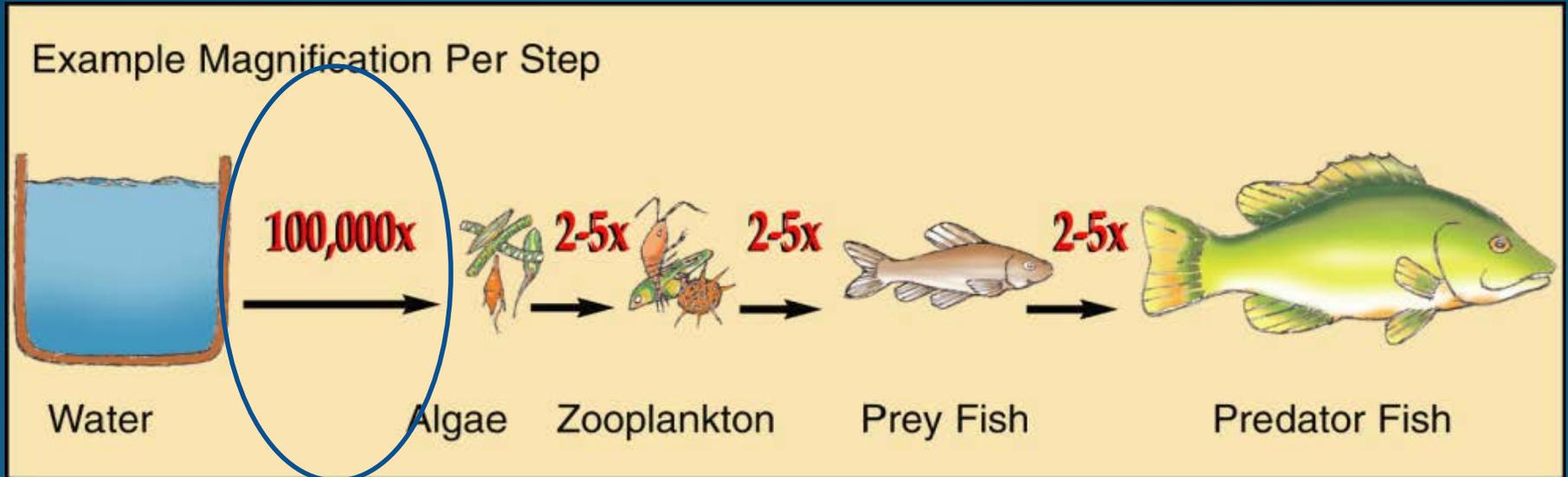
Reservoir fish MeHg compared to modeled 2001 atmospheric Hg deposition rate



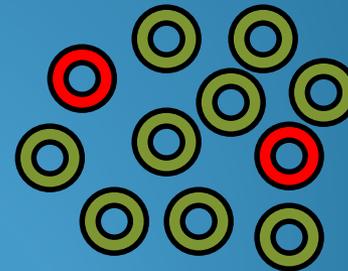
Multiple Factors

- Can have high fish MeHg but low atm dep and no mines
- Can have low fish MeHg but very high atm Hg dep
- Very highest fish MeHg associated with extensive mining

Algal Bloom Dilution



No Bloom Dilution



With Bloom Dilution