

Delta Mercury Control Program Stakeholder Process

Scientific Foundation for TMDL Development & Basin Planning

** Part 1 **

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21 April 2009



Outline

- What are the “bricks” in the scientific foundation for the TMDL?
- How is this scientific information used in developing a Basin Plan amendment?

Please ask questions as they occur to you!

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6. Controllable Processes

7. Unknowns

5. Linkage Analysis

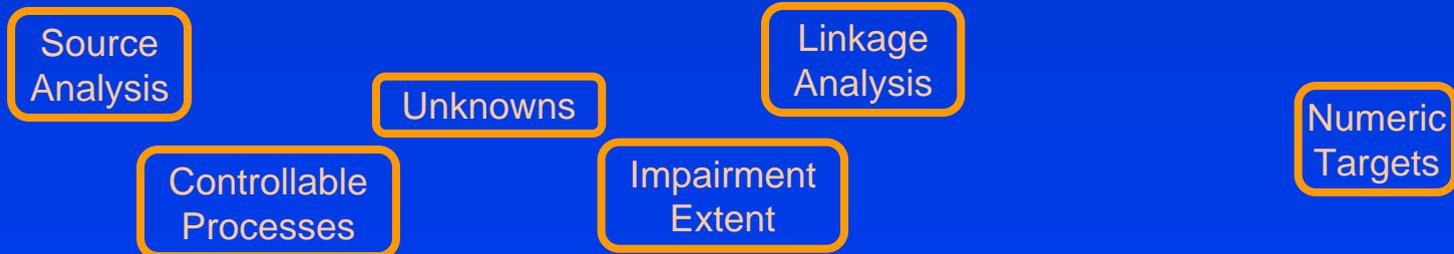
4. Source Analysis

2. Numeric Targets

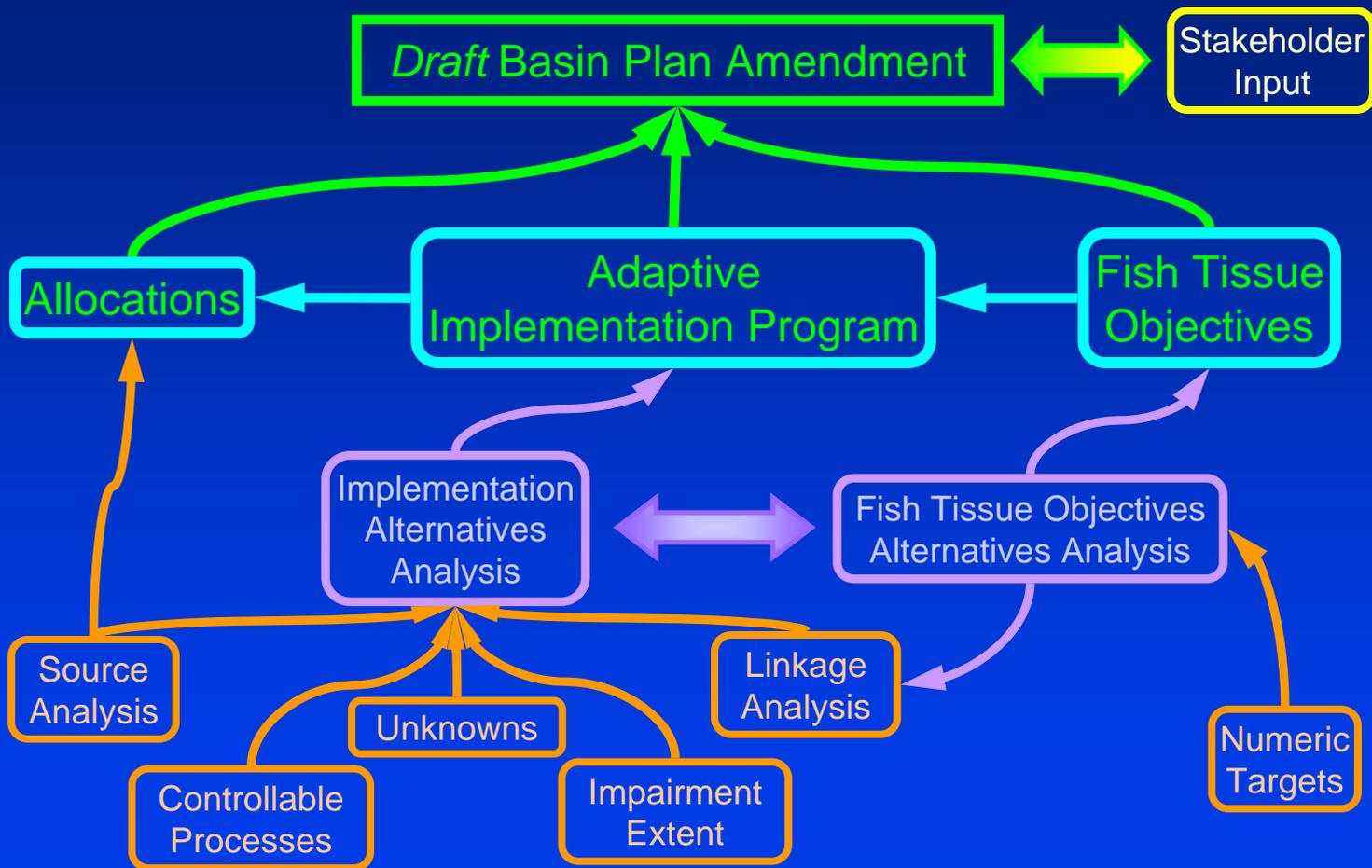
3. Extent of Impairment

1. Beneficial Uses

How the Scientific Information is Used



How the Scientific Information is Used



Scientific Foundation

May meeting

Controllable Processes

Unknowns

Linkage Analysis

Source Analysis

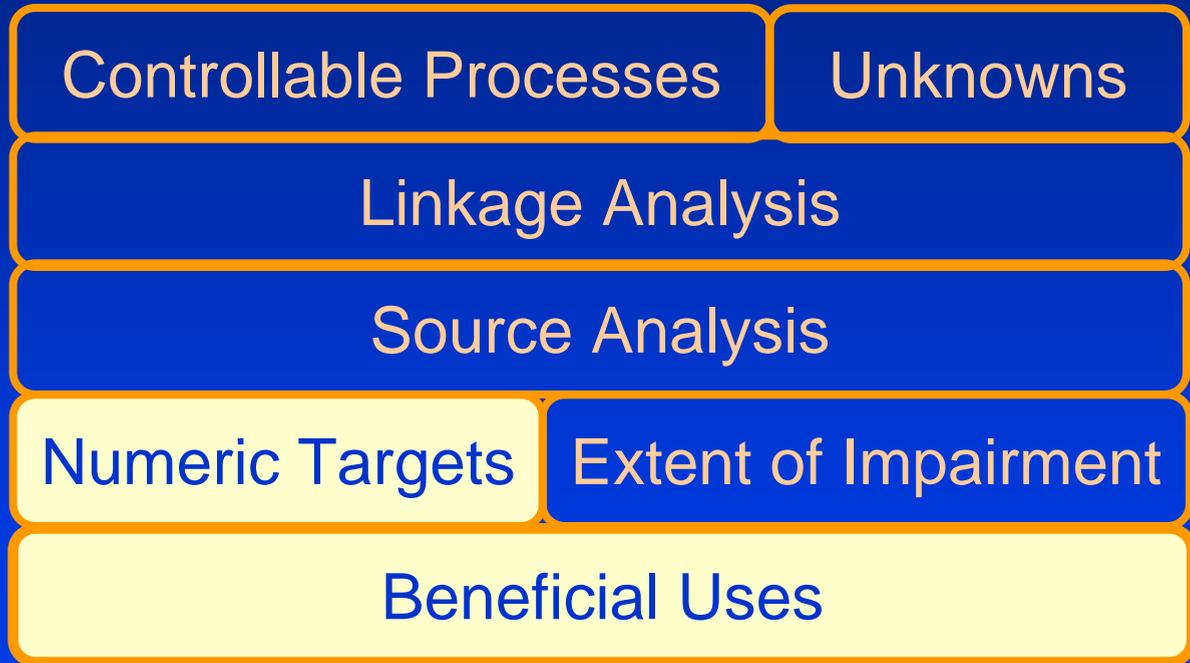
Numeric Targets

Extent of Impairment

Beneficial Uses

Today

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Delta Beneficial Uses

↑ High mercury levels



- Fish consumption advisories for human consumption
- Freshwater & wildlife habitat

Numeric Targets: Safe Levels for Wildlife

TL3:
carp & bluegill

TL4:
bass & catfish

Species	Trophic Level Food Group		Target (mg/kg)
Bald eagle	150-500 mm	TL4 Fish	0.31
		TL3 Fish	0.11
Osprey	150-350 mm	TL4 Fish	0.26
		TL3 Fish	0.09
River otter	150-350 mm	TL4 Fish	0.36
Western grebe		TL3 Fish	0.08
Common merganser		TL3 Fish	0.09
Kingfisher		TL2-3 Fish	0.05
Mink	50-150 mm	TL2-3 Fish	0.08
Double-crested cormorant		TL2-3 Fish	0.09
California least tern	<50 mm	TL2 Fish	0.03
Western snowy plover		TL2 Fish	0.10



Safe Level for Wildlife

Delta fish-eating wildlife are expected to be protected with a mercury concentration of 0.3 mg/kg in bass and catfish



Numeric Targets: Safe Levels for Humans

Targets vary based on how many meals/week and what types of fish are consumed...

Numeric Target (catfish & bass, mg/kg)	# of Meals per Week	Consistent with USEPA Criterion for Sport Anglers	Consistent with USFWS Recommendations	Consistent with S.F. Bay WQOs	Consistent with USEPA Criterion for Subsistence Fishers
0.58	0.5 (mix)	✓			
0.29	0.5 (just bass & catfish)	✓	✓		
0.24	1 (mix)	✓	✓	✓	
0.05	4 (just bass & catfish)	✓	✓		✓

How low can we reasonably go?

*“Mercury concentration in fish from streams and rivers throughout the western U.S.”**
provides useful information about regional conditions...

- 2,707 large TL3 and TL4 fish
- 626 streams and river segments
- Used a probability design

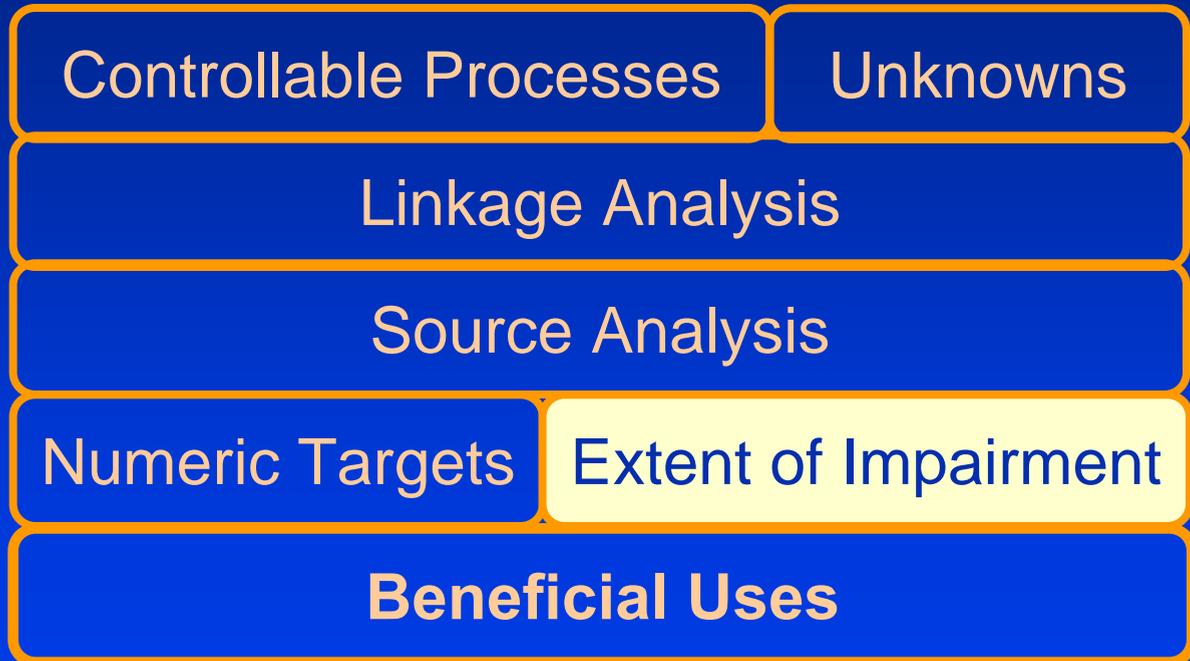
* Peterson, S.A., J. Van Sickle, A.T. Herlihy, and R.M. Hughes. 2007.
Environmental Science & Technology, 41(1): 58-65.

How low can we reasonably go?

(Peterson *et al.*, 2007)

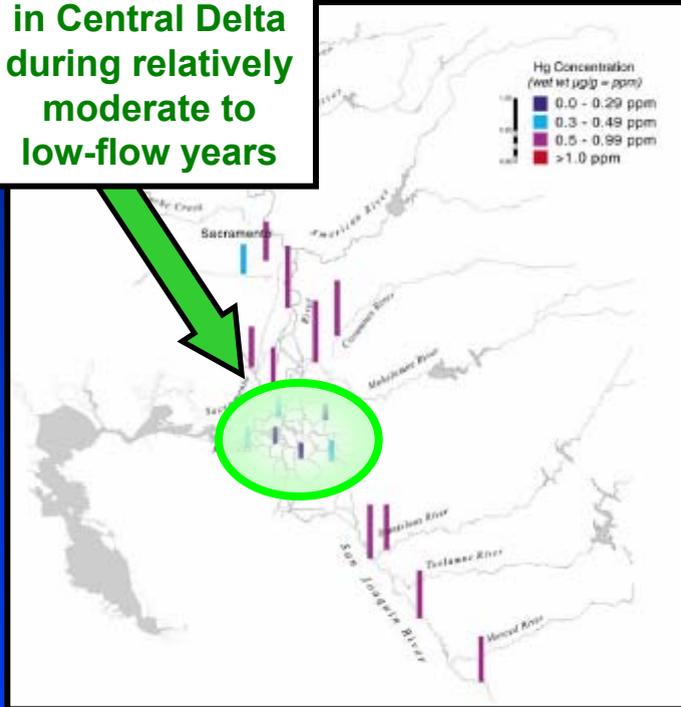
- None of the study waterways had fish populations with MeHg as low as 0.05 mg/kg in large fish like bass
 - ◆ A target based on 4 meals/week of catfish & bass may not be attainable
- About 30% to 40% had fish populations with MeHg lower than 0.24 mg/kg in large fish like bass
 - ◆ A target based on 1 meal/week of a mix of species is likely to be attainable

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CalFed Mercury Program Fish Sampling

Lower fish Hg
in Central Delta
during relatively
moderate to
low-flow years

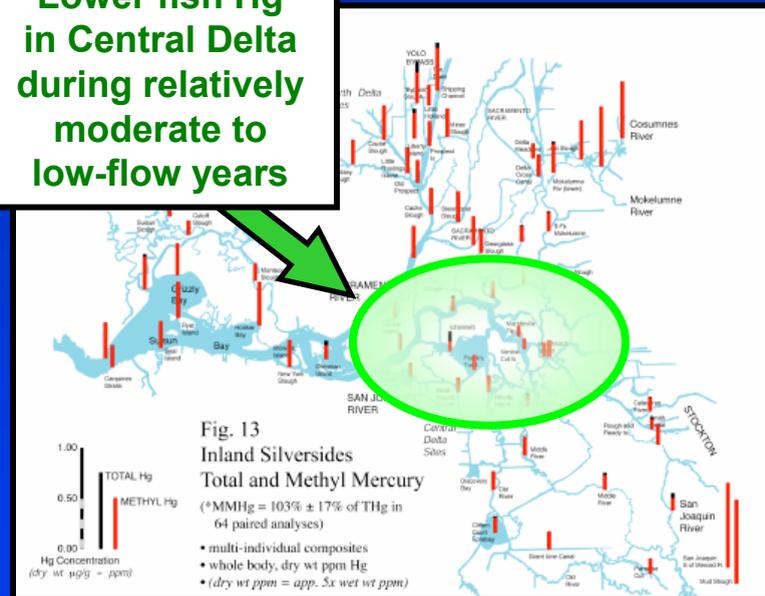


Average Hg Concentrations in
largemouth bass, 2000
(Davis *et al.*, 2003)

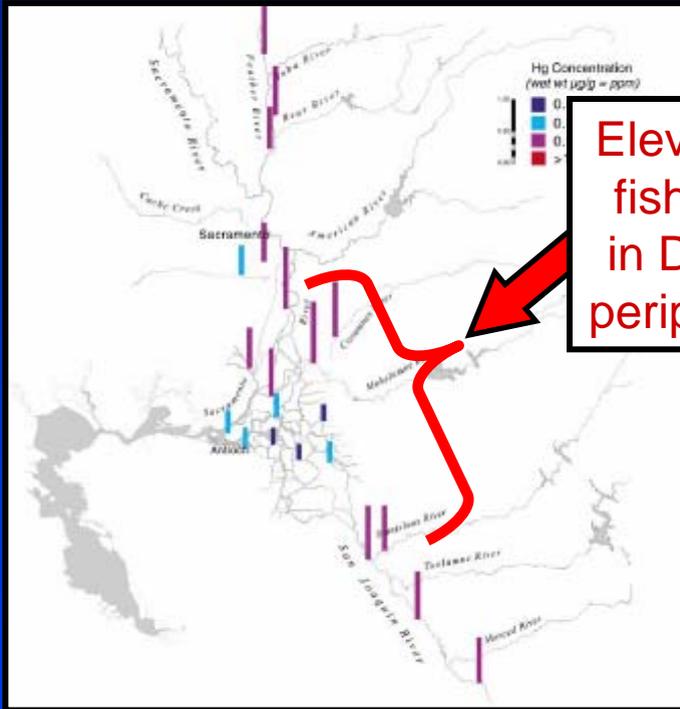
Fish Sampling

Inland silverside Hg & MeHg
Concentrations, Fall 1999
(Clotter *et al.*, 2002)

Lower fish Hg
in Central Delta
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moderate to
low-flow years

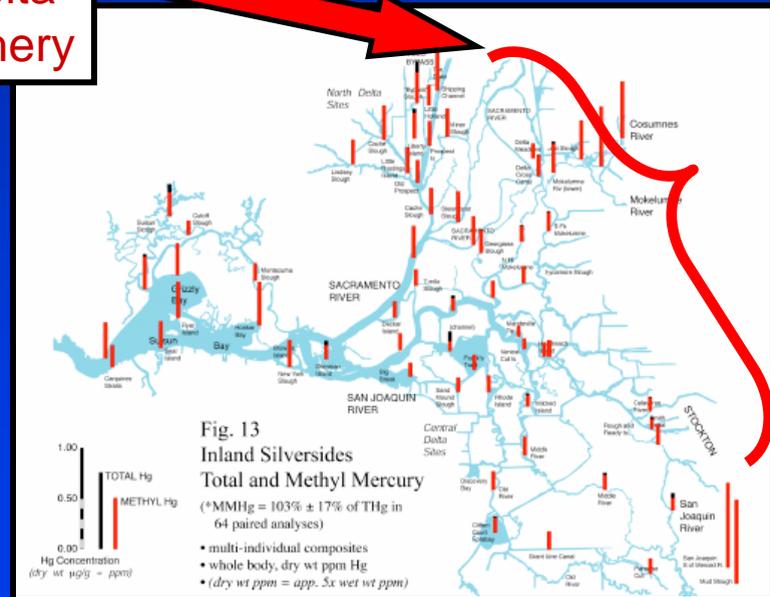


CalFed Mercury Program Fish Sampling

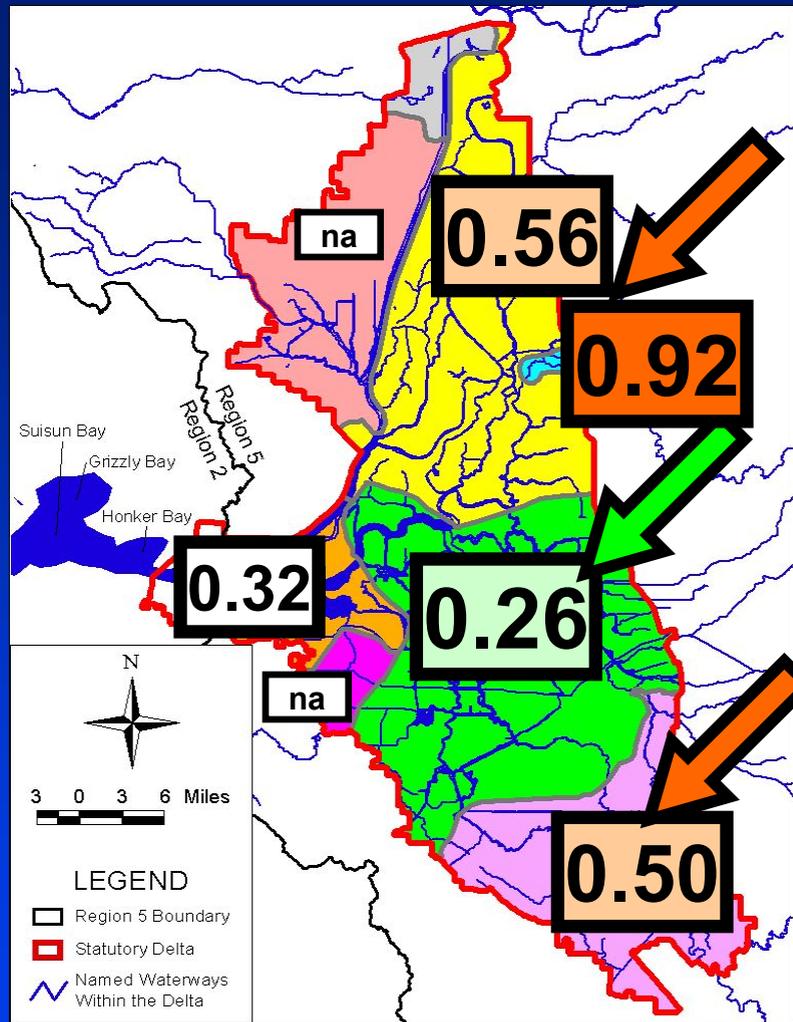


Elevated fish Hg in Delta periphery

Inland silverside Hg & MeHg Concentrations, Fall 1999 (Slotton et al., 2002)



Average MeHg Levels in Large Bass & Catfish (mg/kg)



How do we reduce fish mercury levels?

- Almost all Hg in fish is in the form of *methylmercury (MeHg)*.
- Local & nationwide studies:
Most important, single factor in determining how much MeHg is in fish is water MeHg concentration
- Most direct way to reduce fish MeHg:
Reduce the concentration of MeHg in water

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Controllable Processes

Unknowns

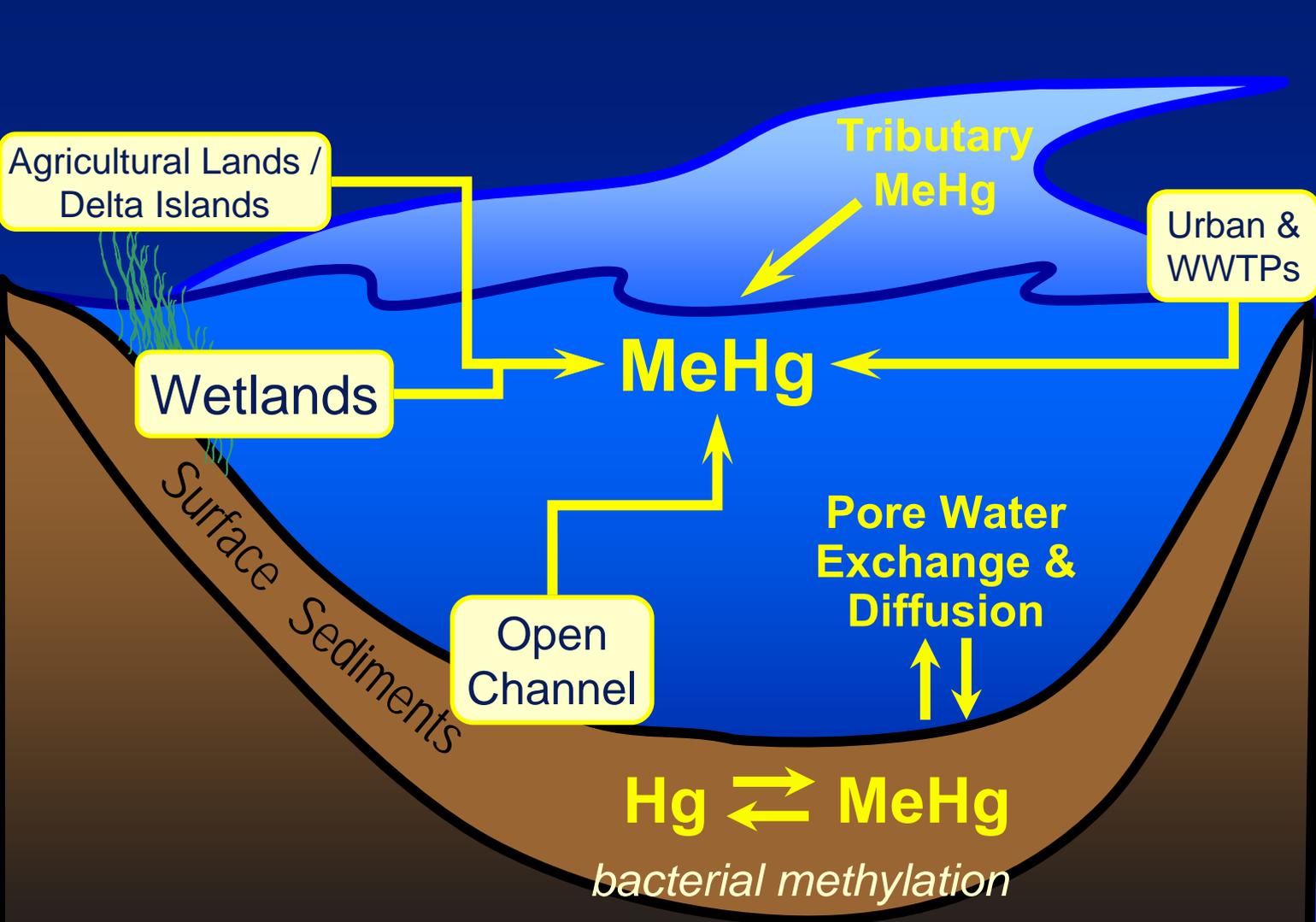
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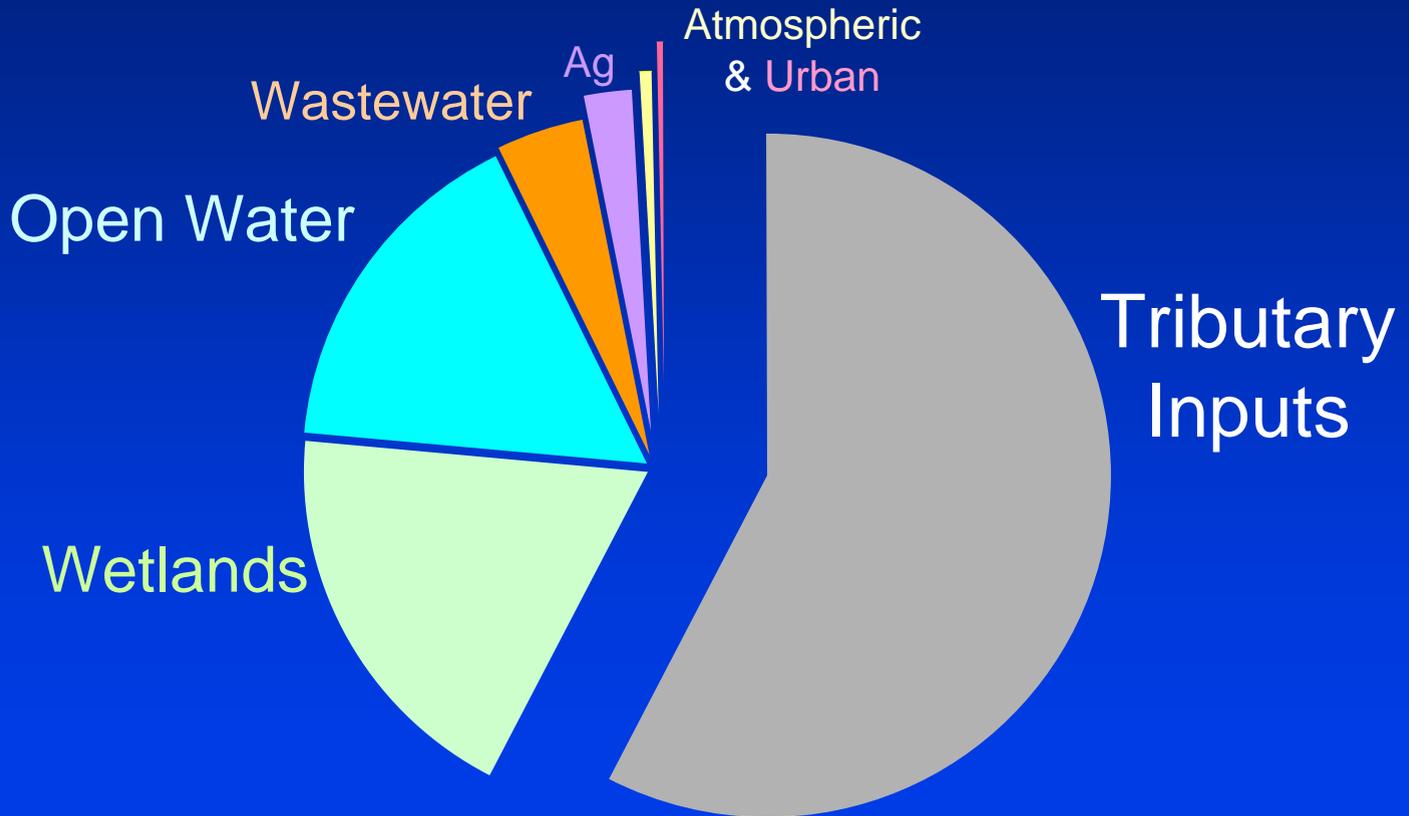
Numeric Targets

Extent of Impairment

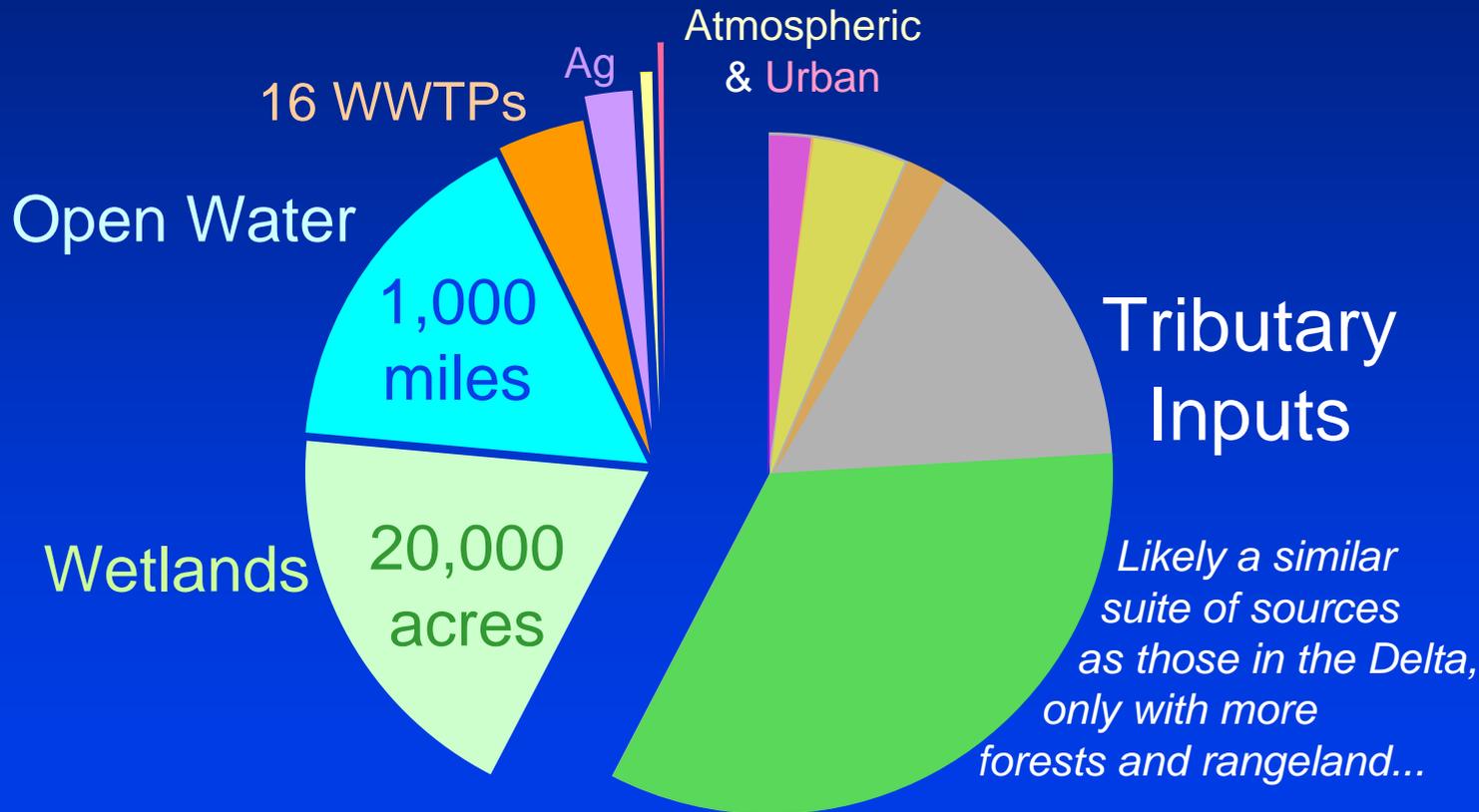
Beneficial Uses



MeHg Sources

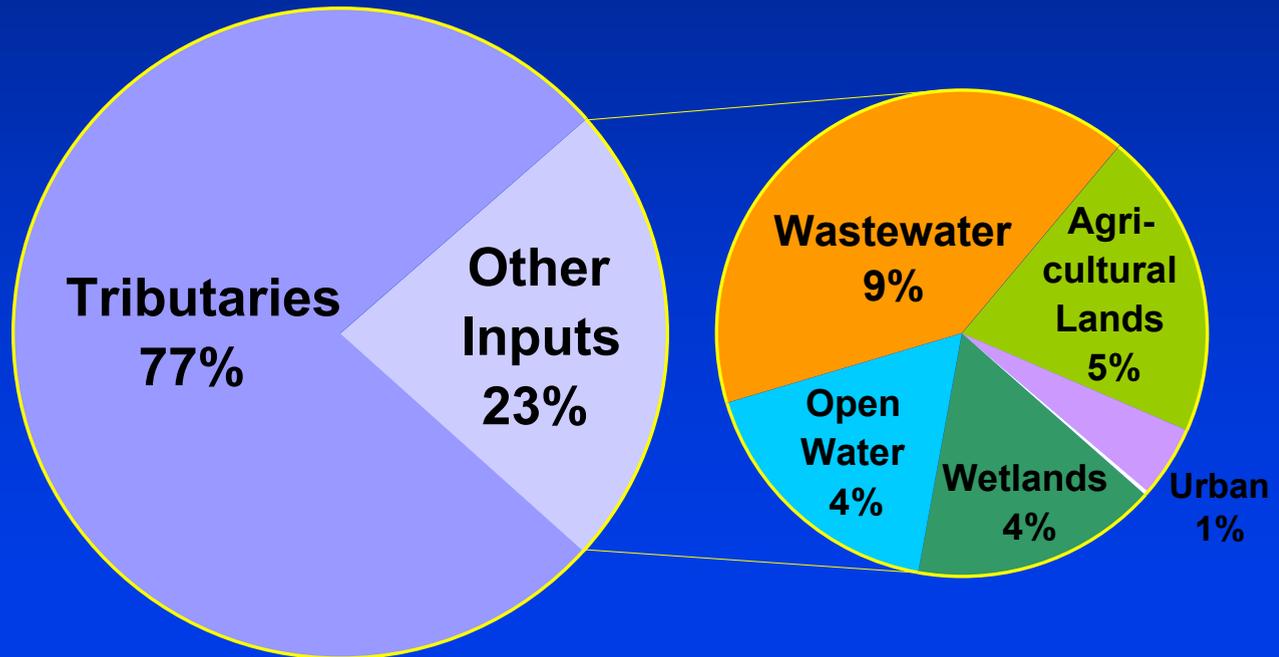


MeHg source categories are comprised of many individual discharges...



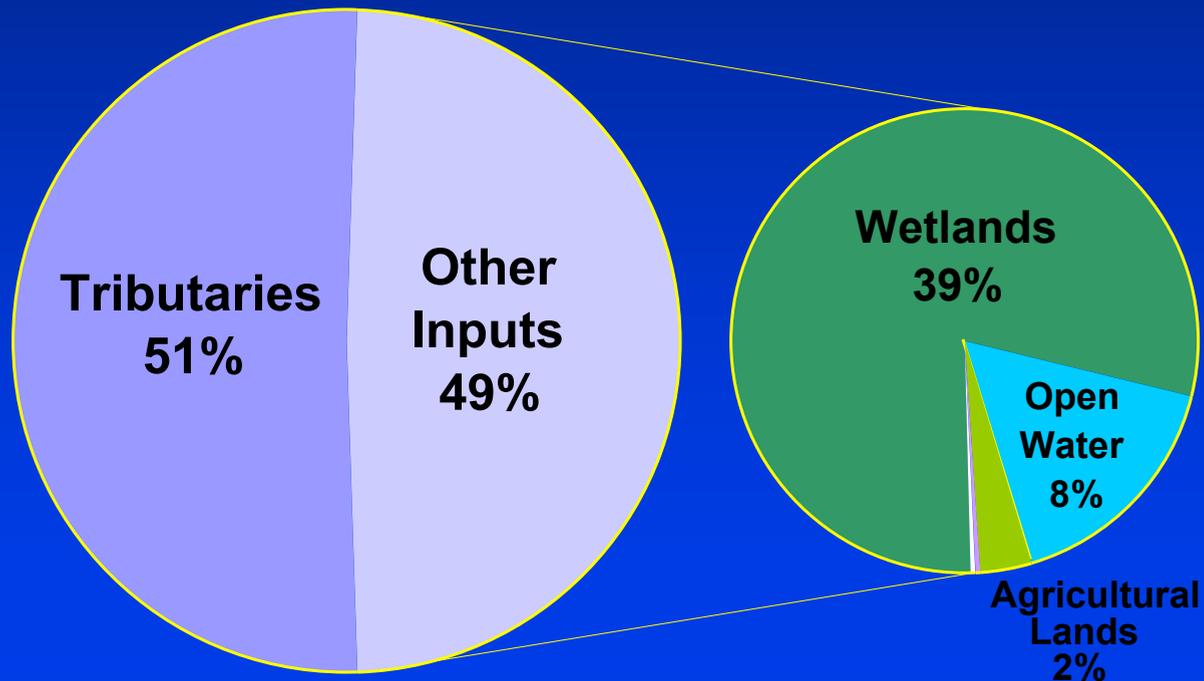
And different sources supply different areas of the Delta...

San Joaquin Area MeHg Sources



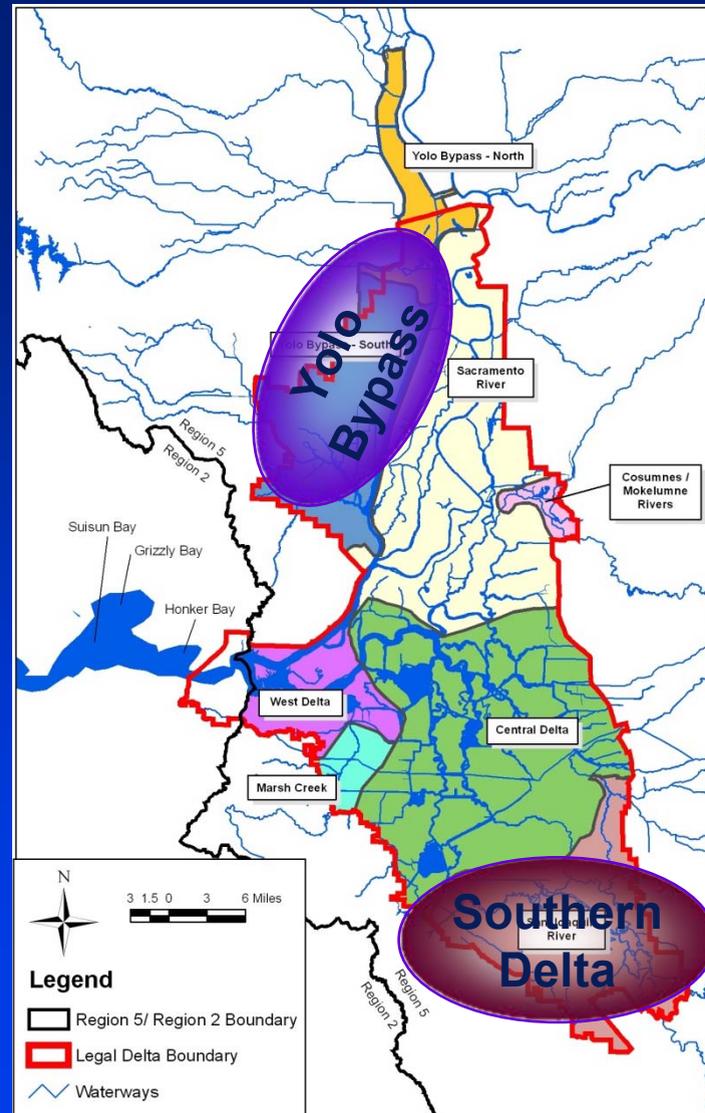
And different sources supply different areas of the Delta...

Yolo Bypass Area MeHg Sources



Seven Control Programs in One...

...because different
areas of the Delta
are dominated by
different
MeHg sources



***How do we know how much
we need to reduce
MeHg sources to each area?***

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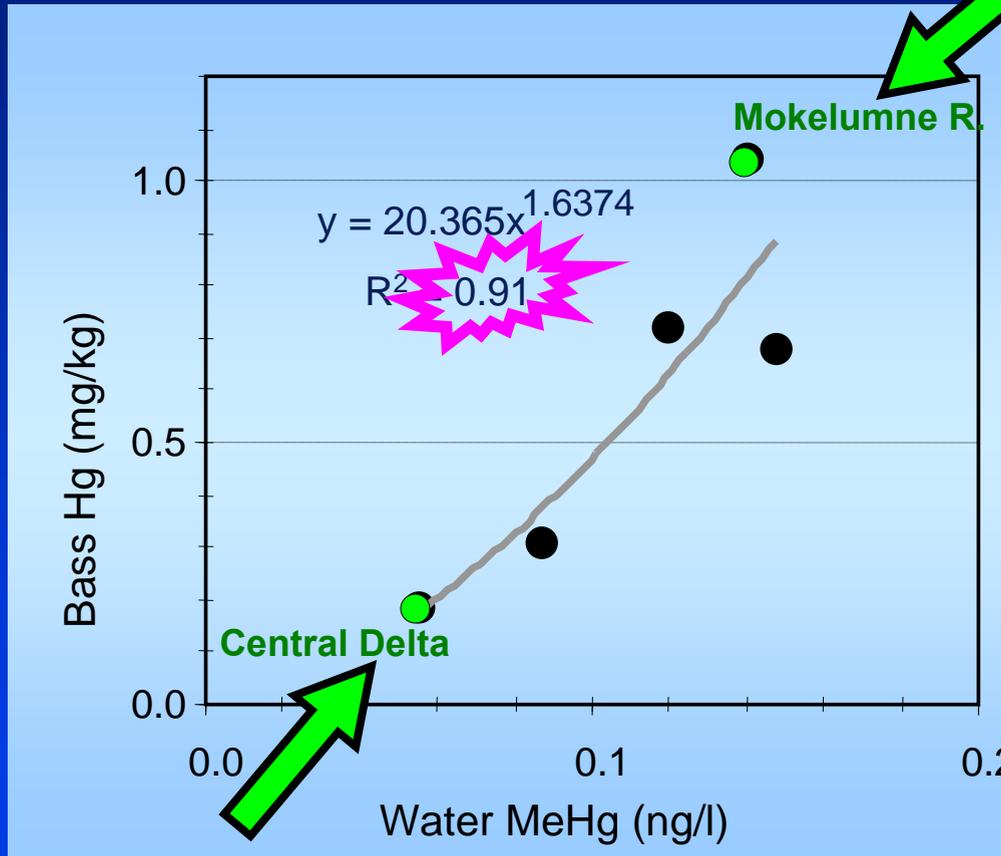
Beneficial Uses

What is a linkage...

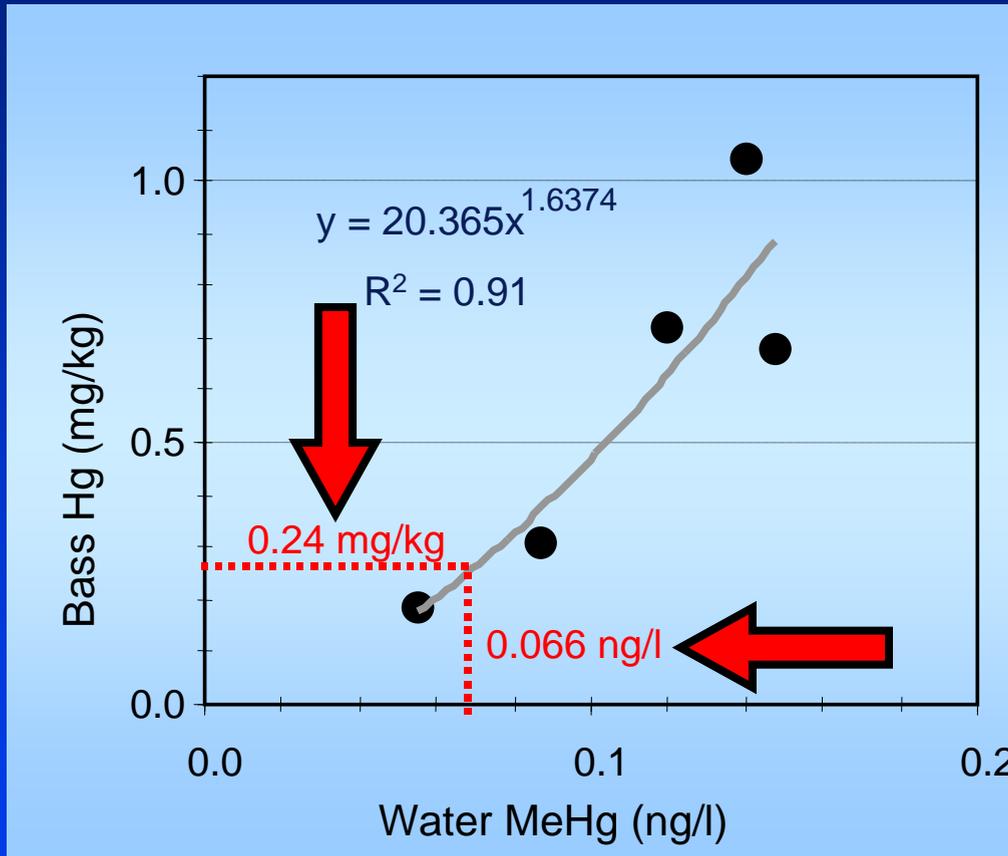
... a Delta-specific mathematical relationship between fish MeHg & water MeHg

so we know how much we need to reduce MeHg sources to fix the impairment...

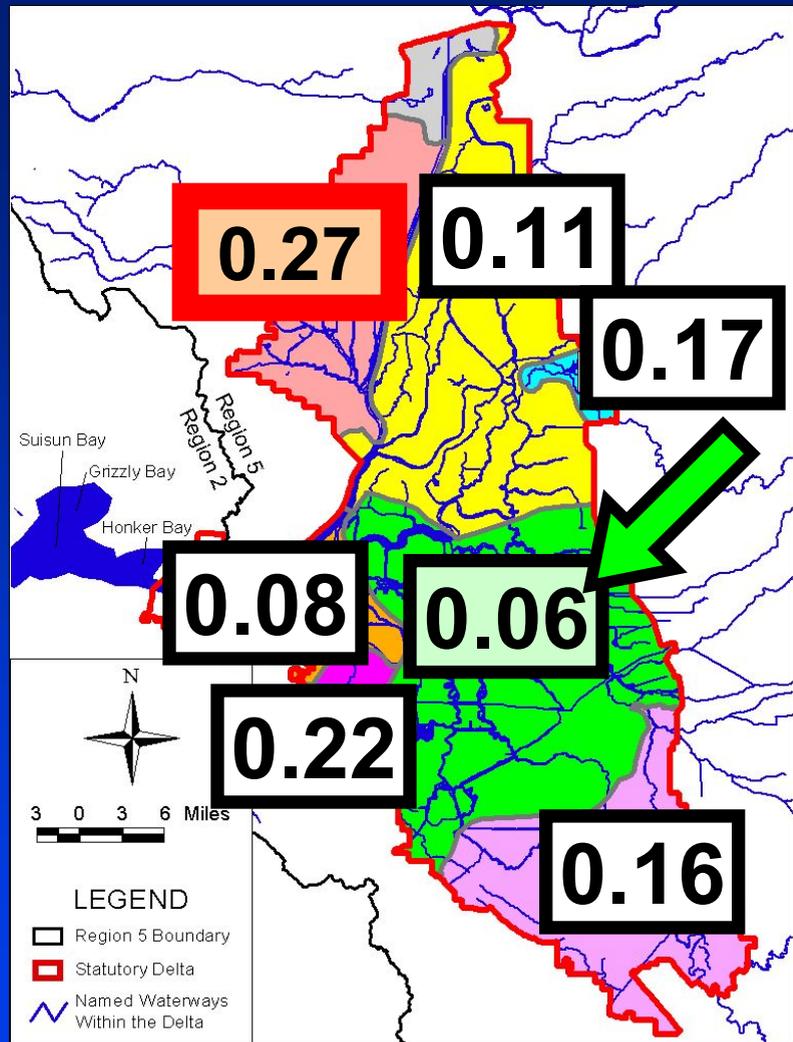
MeHg Linkage: Largemouth Bass & Average Water MeHg



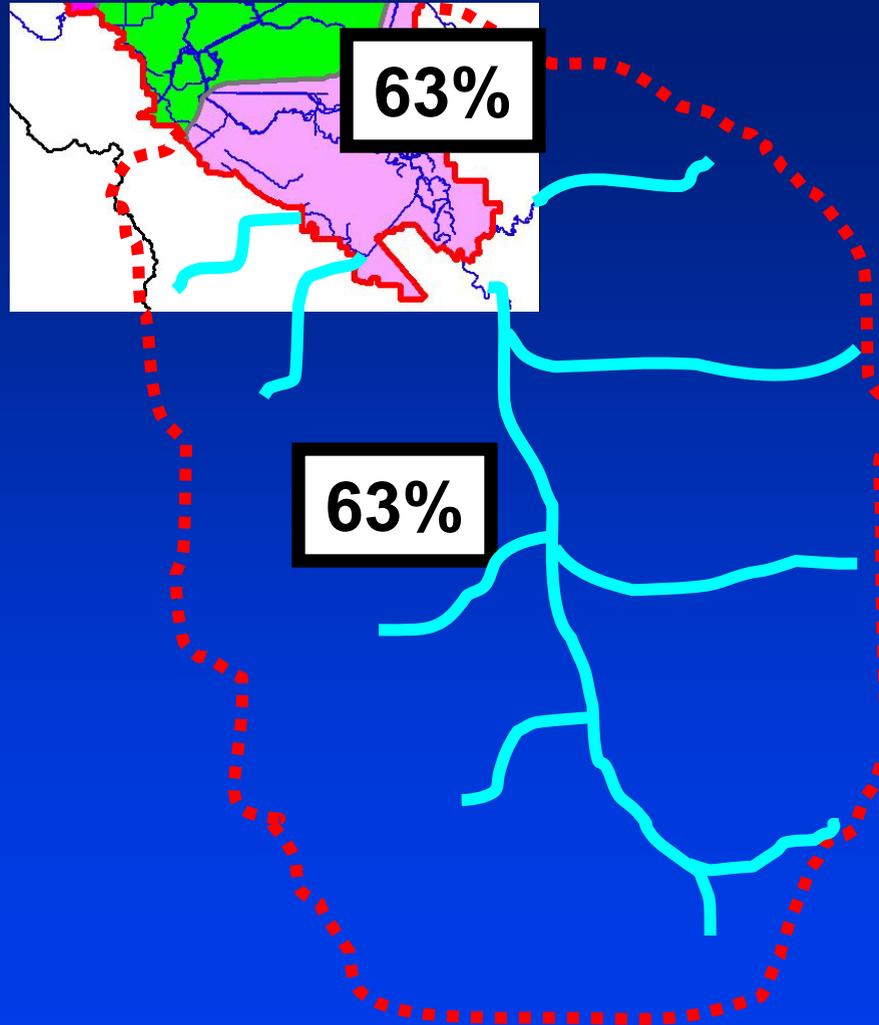
MeHg Linkage: Largemouth Bass & Average Water MeHg



Average Annual Ambient MeHg Levels in Water (ng/l)



For example,
need to reduce
the sum of all
sources in the
south Delta &
San Joaquin
watershed by
63% to achieve
the Fish Tissue
Objective



Results from Other Studies Bracket the MeHg Concentration Predicted by the Delta Linkage...

- National survey of 106 stations from 21 basins (Brumbaugh *et al.*, 2001) :
 - ◆ One-time unfiltered MeHg water samples collected during the fall season were also positively correlated with largemouth bass tissue levels.
 - ◆ A MeHg concentration of 0.058 ng/l in water was predicted to produce three-year old LM bass with 0.3 mg/kg mercury tissue concentration.
- Cache Creek watershed (Slotton *et al.*, 2003):
 - ◆ A MeHg concentration of 0.14 ng/l in unfiltered water corresponded with 0.23 mg/kg MeHg in large fish

Recent Delta studies' results support linkage...

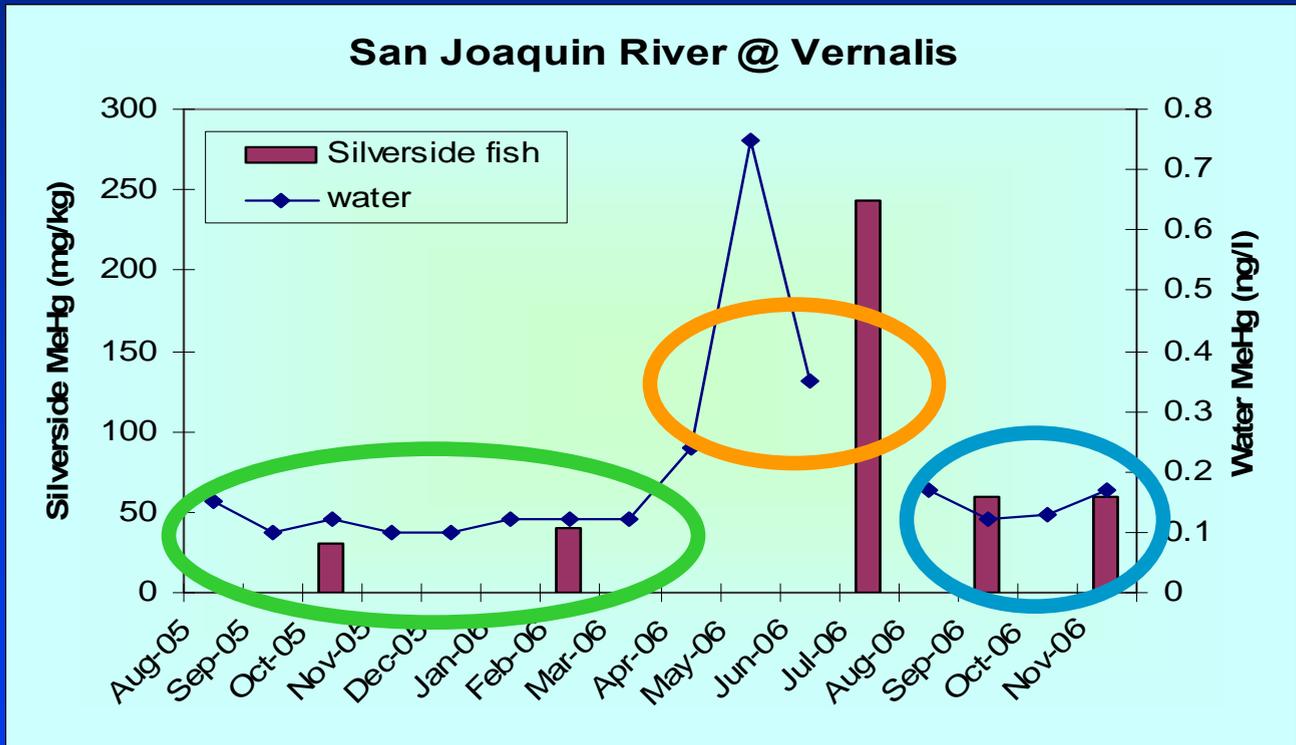
Sacramento River Local Bioaccumulation Study

(Larry Walker Associates & SRCSD, 2008)

- WWTP discharge contributed ~10% of river MeHg load during study period
- Short-lived biosentinel fish species downstream of the WWTP had MeHg concentrations about ~10% greater than upstream fish

Recent Delta studies' results support linkage...

Floodplain Inundation on the San Joaquin River: MeHg Before & After (Slotton *et al.*, 2008; Foe *et al.*, 2008)



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May meeting

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Questions?



