Within Delta Conveyance: Environmental Water Quality Issues

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Goals

- There is a great deal we do not know or understand
  - Basic processes
  - Interactions among processes
- Conceptual framework to examine water quality issues

WDC = Changing operations and/or infrastructure

Hydrodynamics (Monsen, Cloern and Burau, 2007, SFEWS)

- Transport routes change
- Source mixtures change
- Flushing times change

The Top Issues…

- Salinity
- Drinking water quality
- Dissolved Oxygen
- Pesticides
- *Selenium*
- *Mercury*
- Toxicity of Unknown Origin
- *Endocrine disrupters & other emerging issues*

Delta Water Quality issues summary &

State of the Science: Water quality

Challenges

- Intersect multiple beneficial uses
- Large scale, persistent, difficult
- Cross jurisdictional lines
- Multiple contributing factors
- Raise contradictions among CALFED goals
- Not amenable to single agency solutions
- Current and historical origins

Delta Water Quality issues summary &

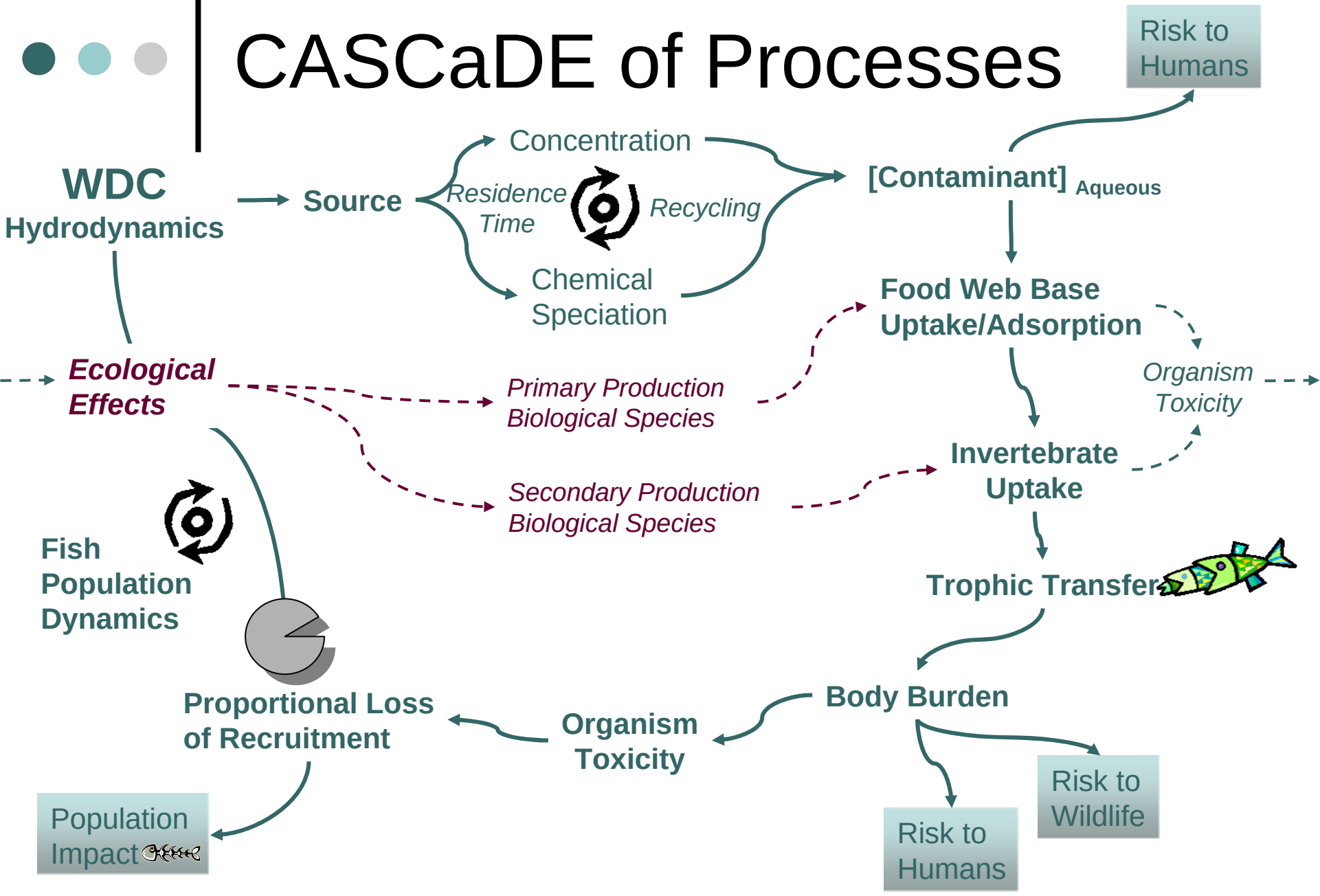
State of the Science: Water quality

How do we use science to address these issues?

- Review lessons learned from previously funded research - key processes
- Evaluate linked processes to identify range of potential outcomes and/or identify critical data gaps
- Continue to monitor and study

Many uncertainties, but not hopeless

CASCaDE of Processes



Examples

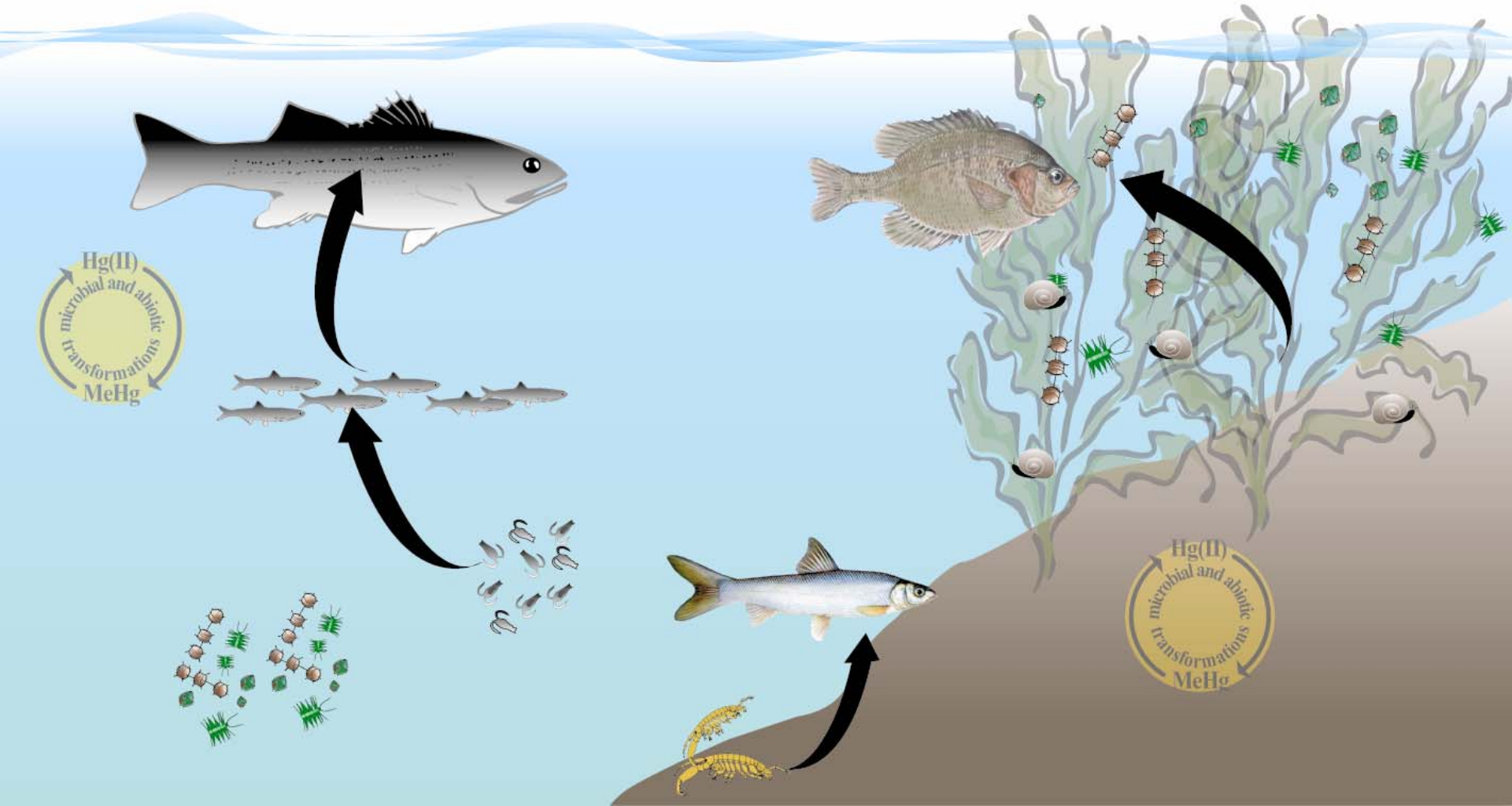
Pesticide issues may increase with increasing SJR influence

E.g. Pyrethroids (Weston et al 2004)

- 70 sediment samples were collected over a 10-county area in the Central Valley
- 42% of the locations with significant mortality to one test species
- 14% of the sites (two creeks and four irrigation canals) showed extreme toxicity (>80% mortality) on at least one occasion.
- Pyrethroids detected in 75% of samples
- Pyrethroid concentrations high enough explain 40% of toxicity to *C. tentans* and nearly 70% of toxicity to *H. azteca*.

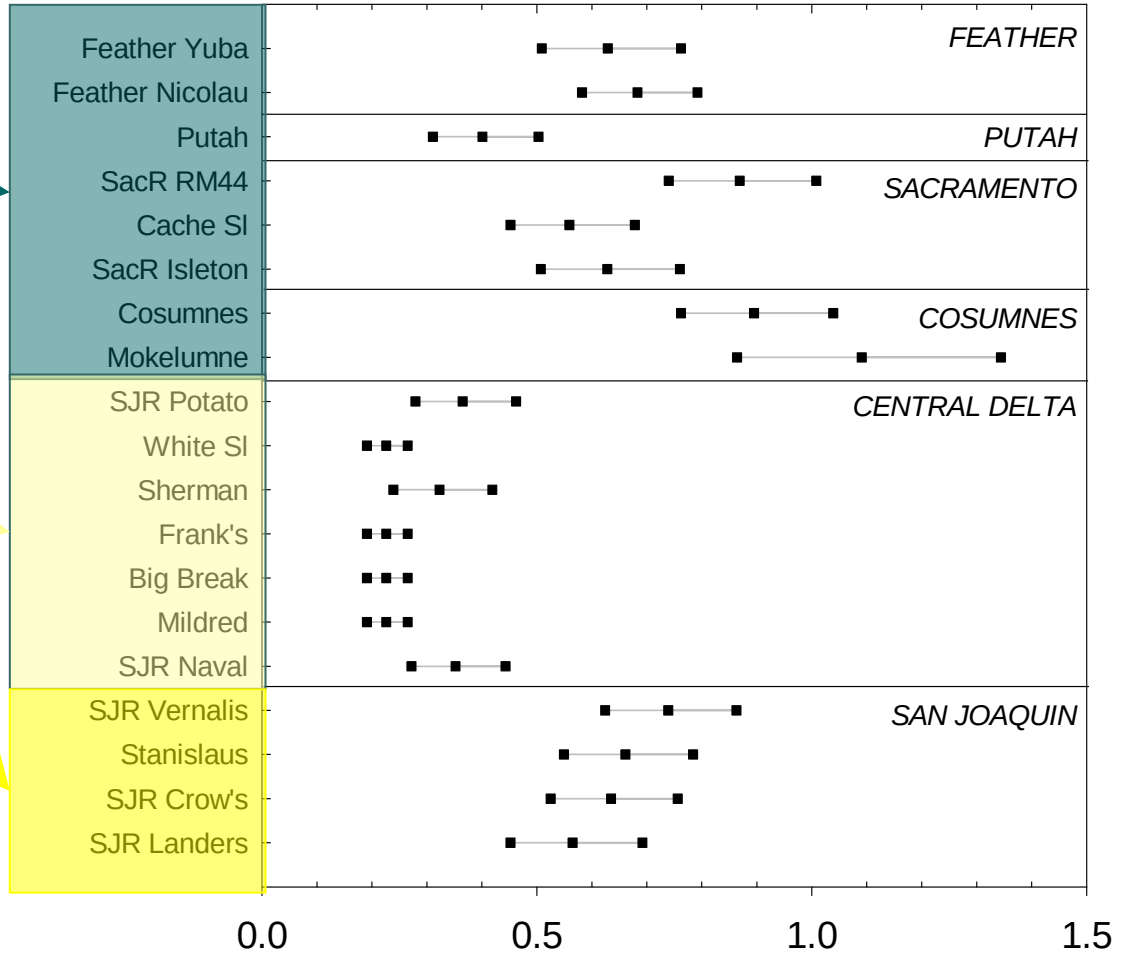
It is unclear how speciation/degradation might change during transport…we have limited information

Mercury outcomes are less clear, but will likely depend on changes to geochemistry and hydrology

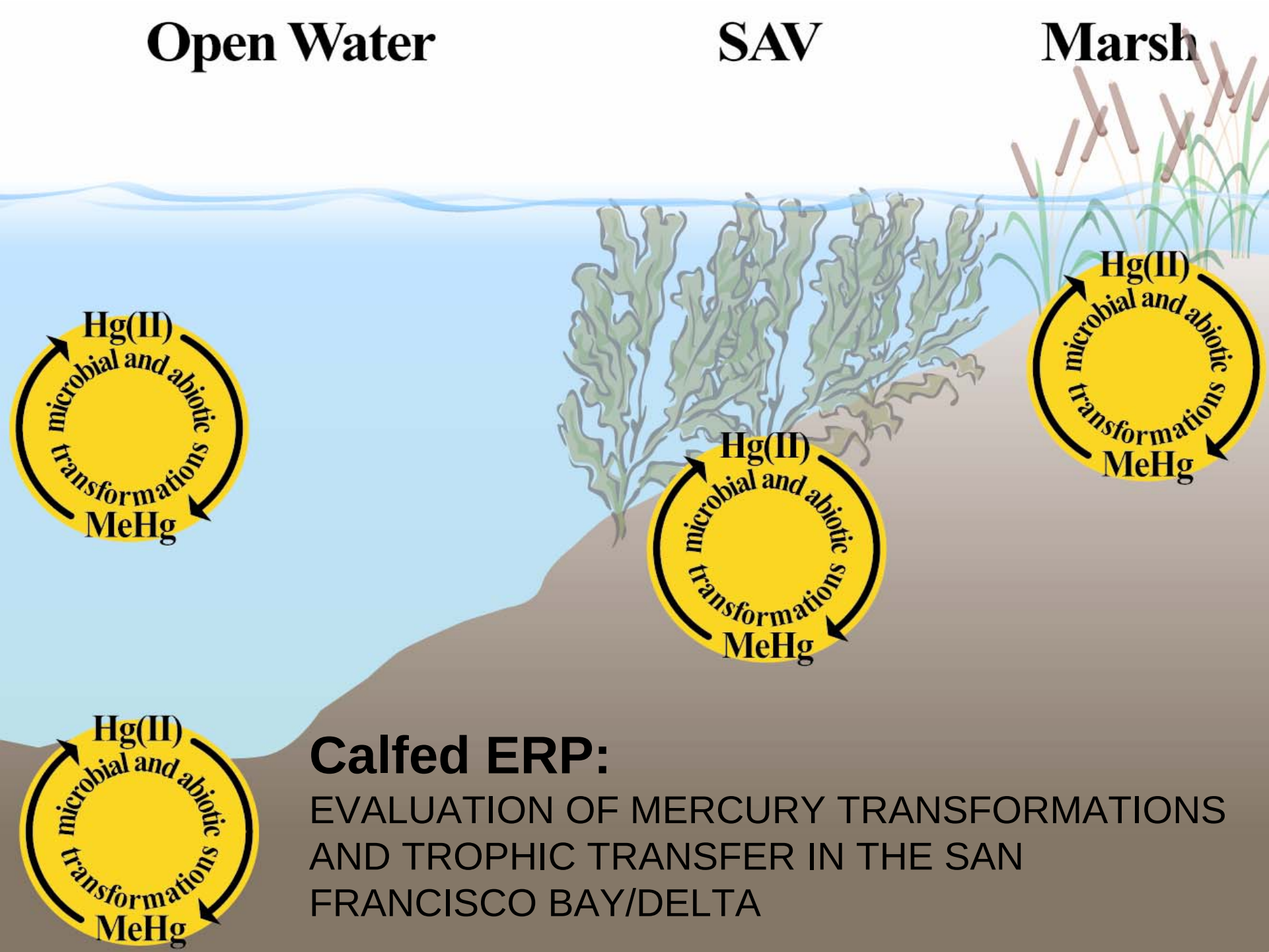


Mercury is higher in tributaries than in central delta

Mercury (ppm wet) at 350 mm (mean and 95%



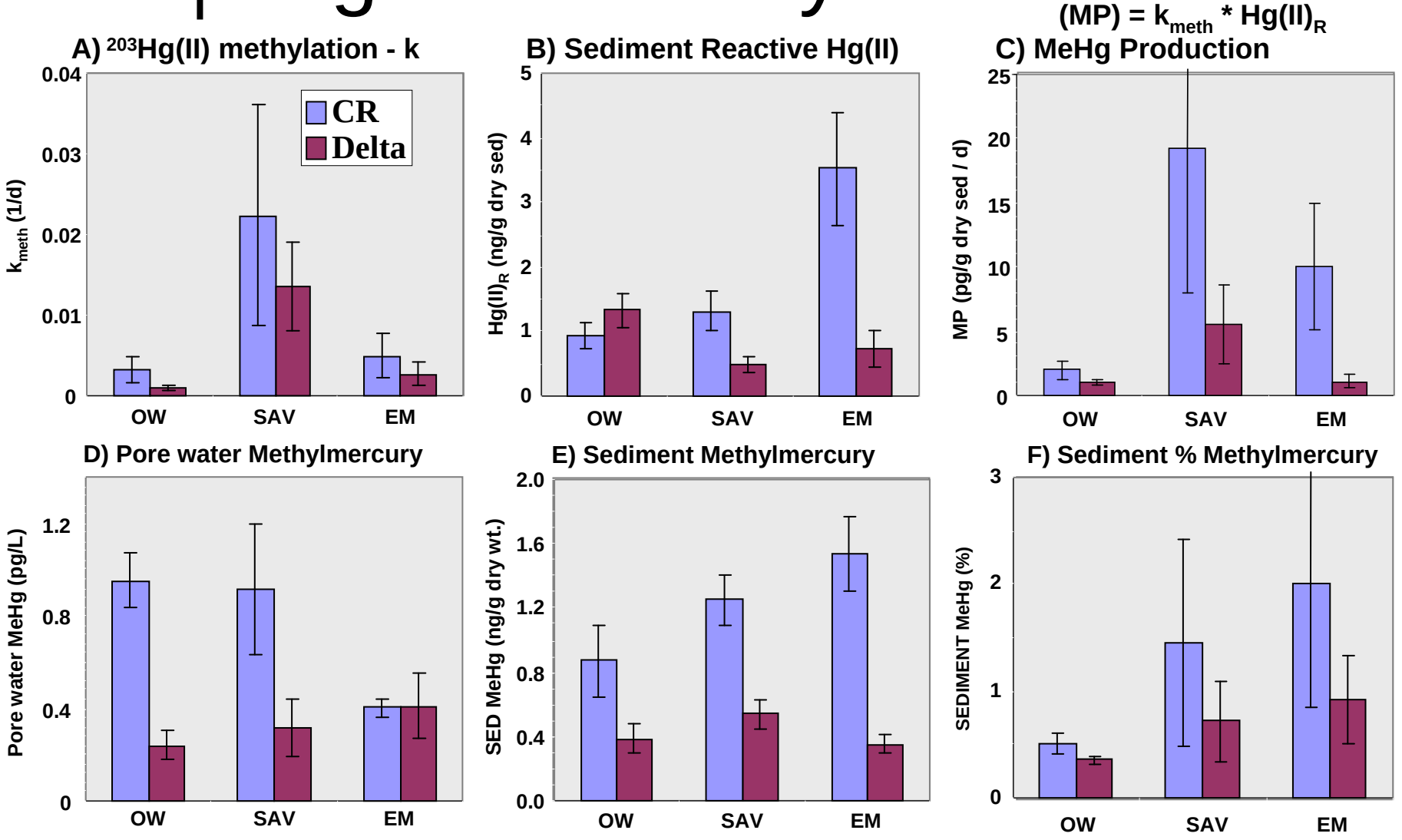
Jay Davis -



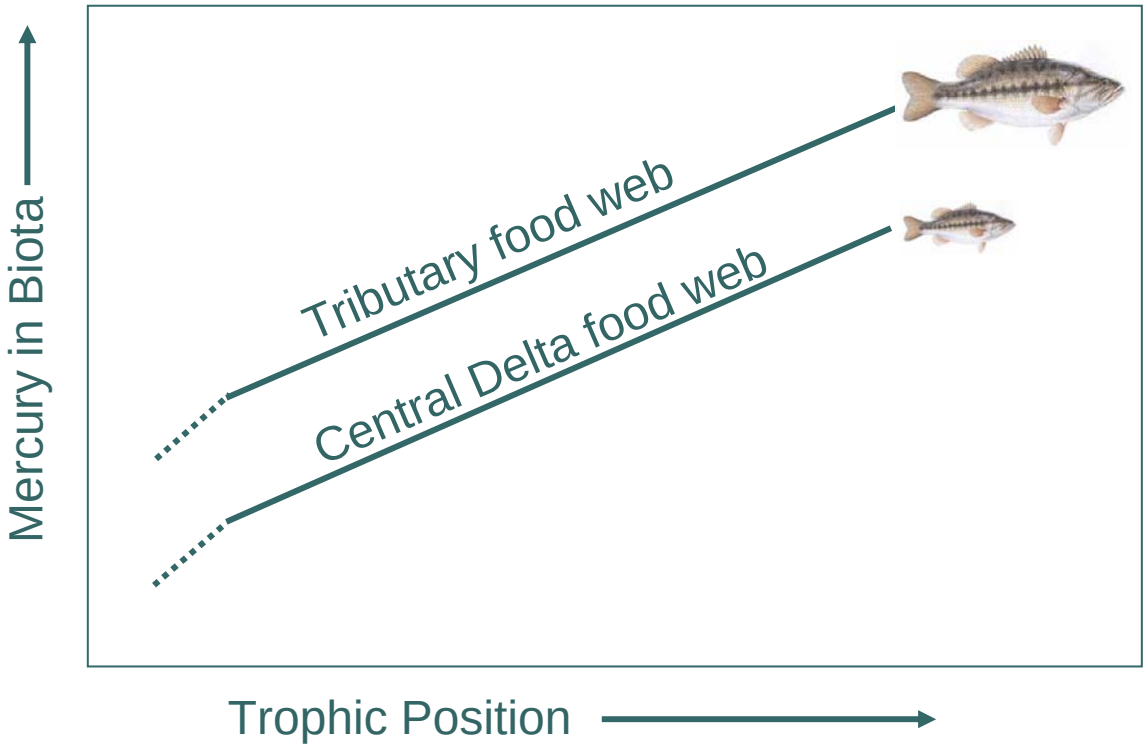
Calfed ERP:

EVALUATION OF MERCURY TRANSFORMATIONS AND TROPHIC TRANSFER IN THE SAN FRANCISCO BAY/DELTA

Regional-specific differences in geochemistry



Trophic enrichment of mercury in SAV food webs appears to be consistent among regions

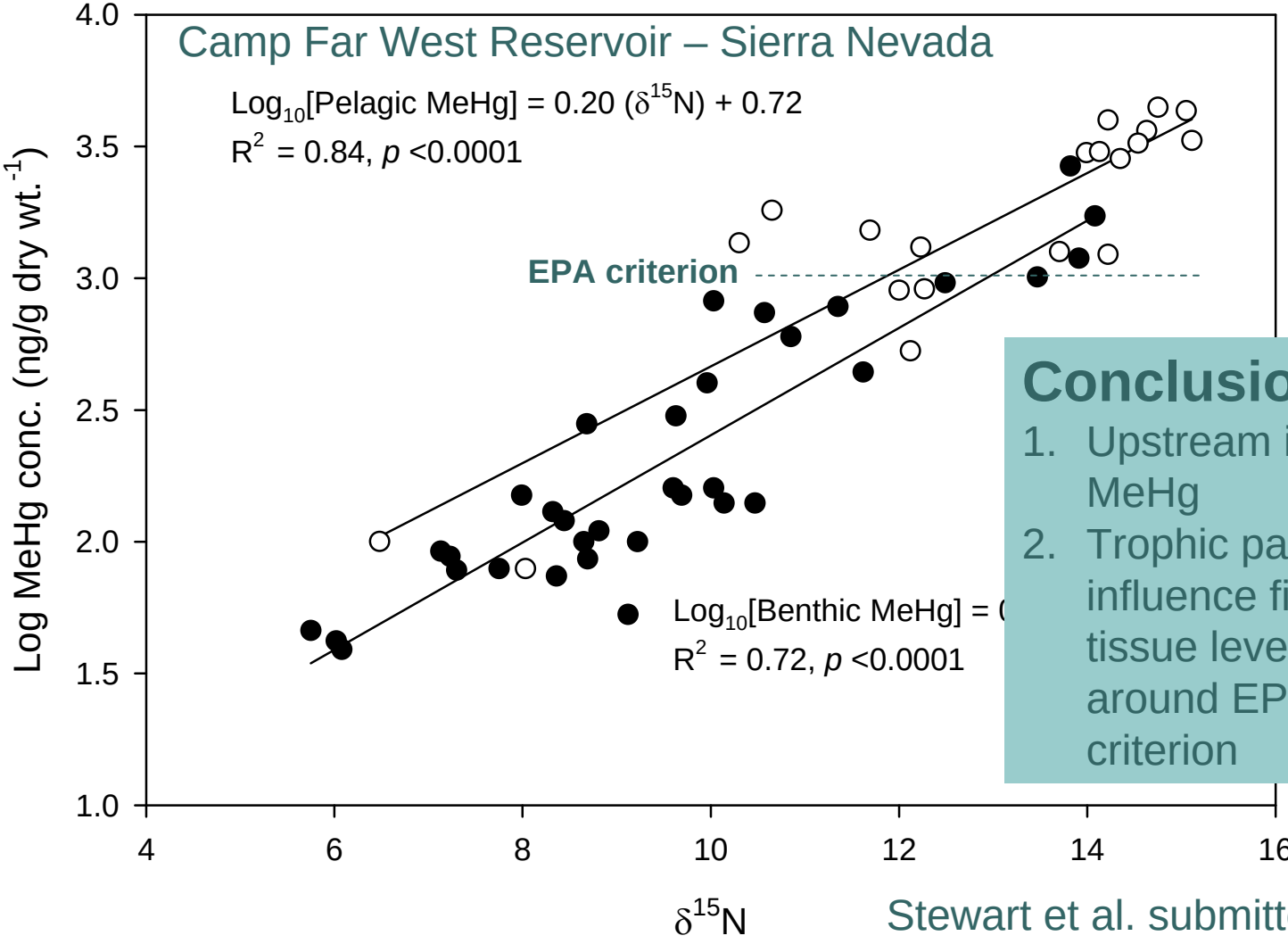


Predator Hg content determined by location and not food web dynamics

Baseline set by site-specific $MeHg_{aqueous}$ and MeHg bioavailability in primary food source

Stewart et al. in prep

Science can help guide regional management approaches



Conclusions

1. Upstream inputs of MeHg
2. Trophic pathways influence fish tissue levels around EPA criterion

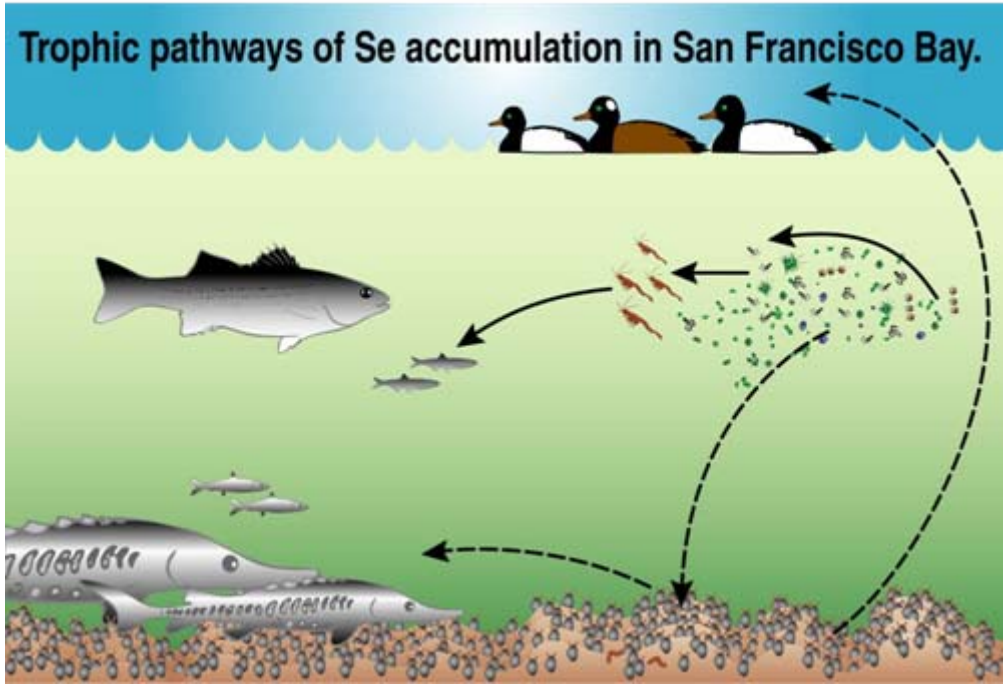
Stewart et al. submitted

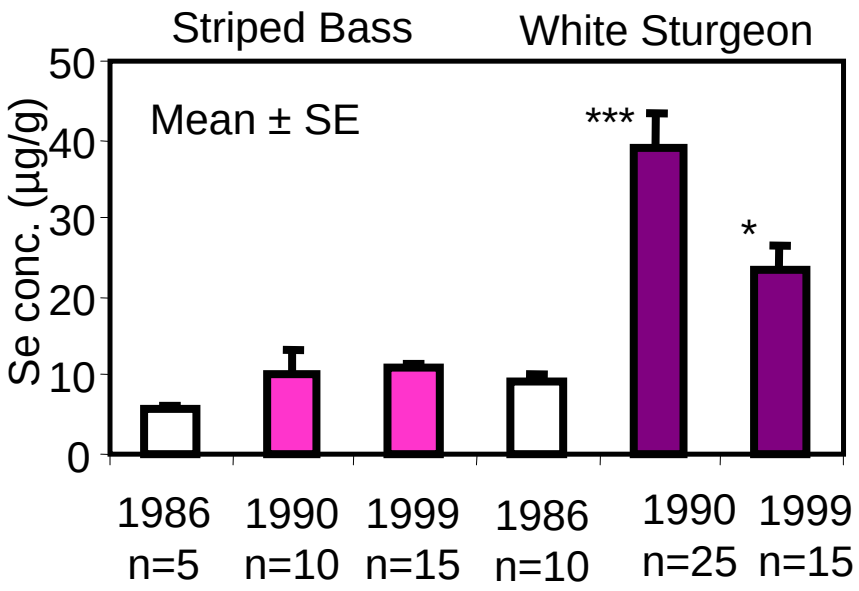
Selenium

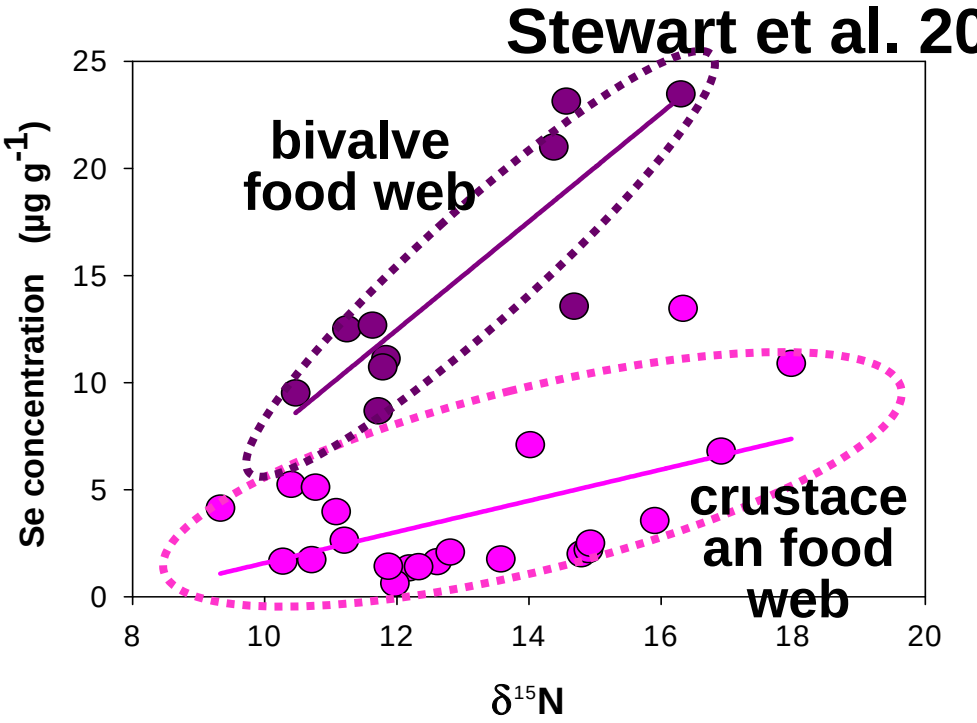
Outcome uncertain

Critical considerations

- Species-specific food webs and invertebrate physiology
- Invasive clam species

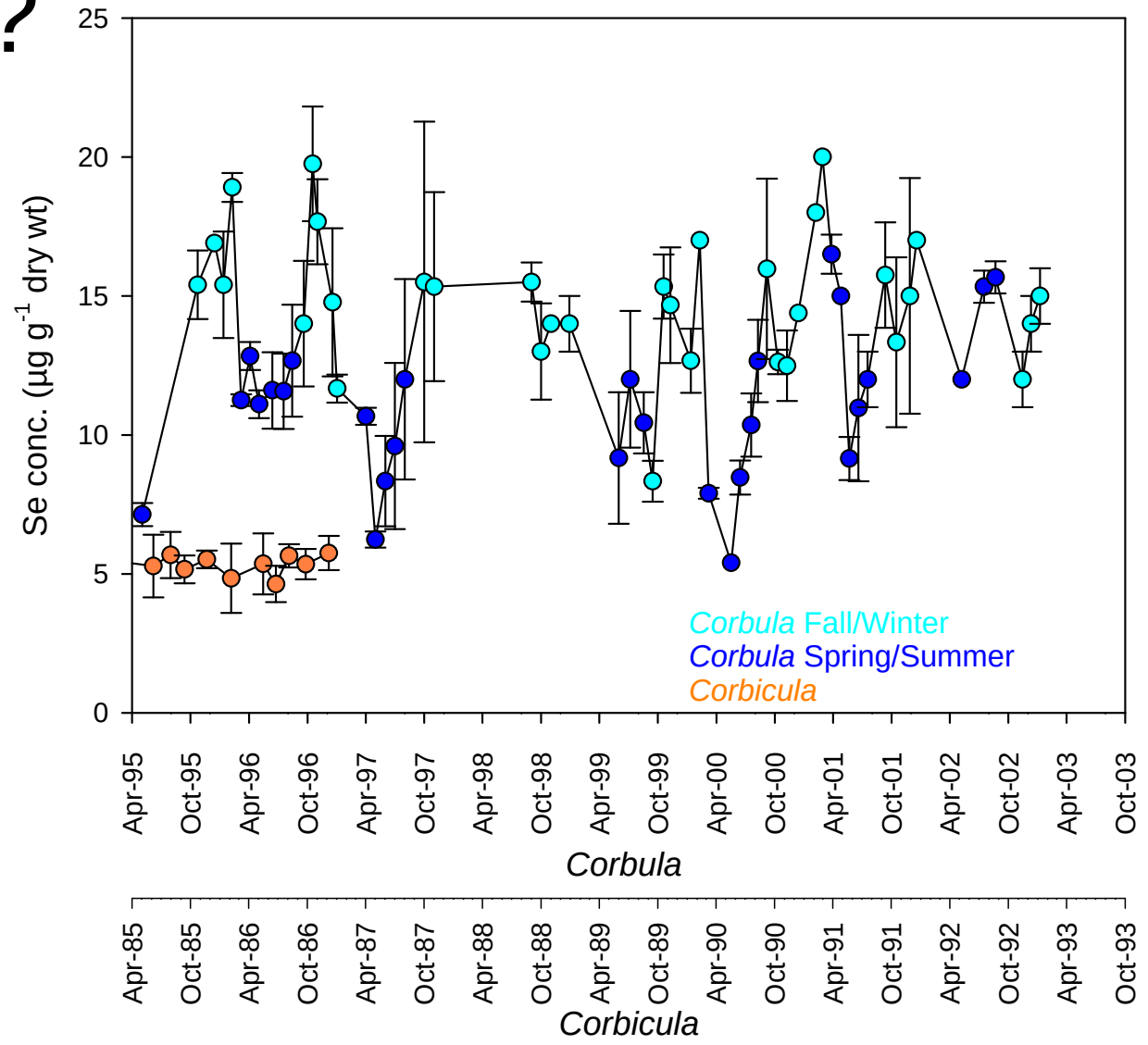


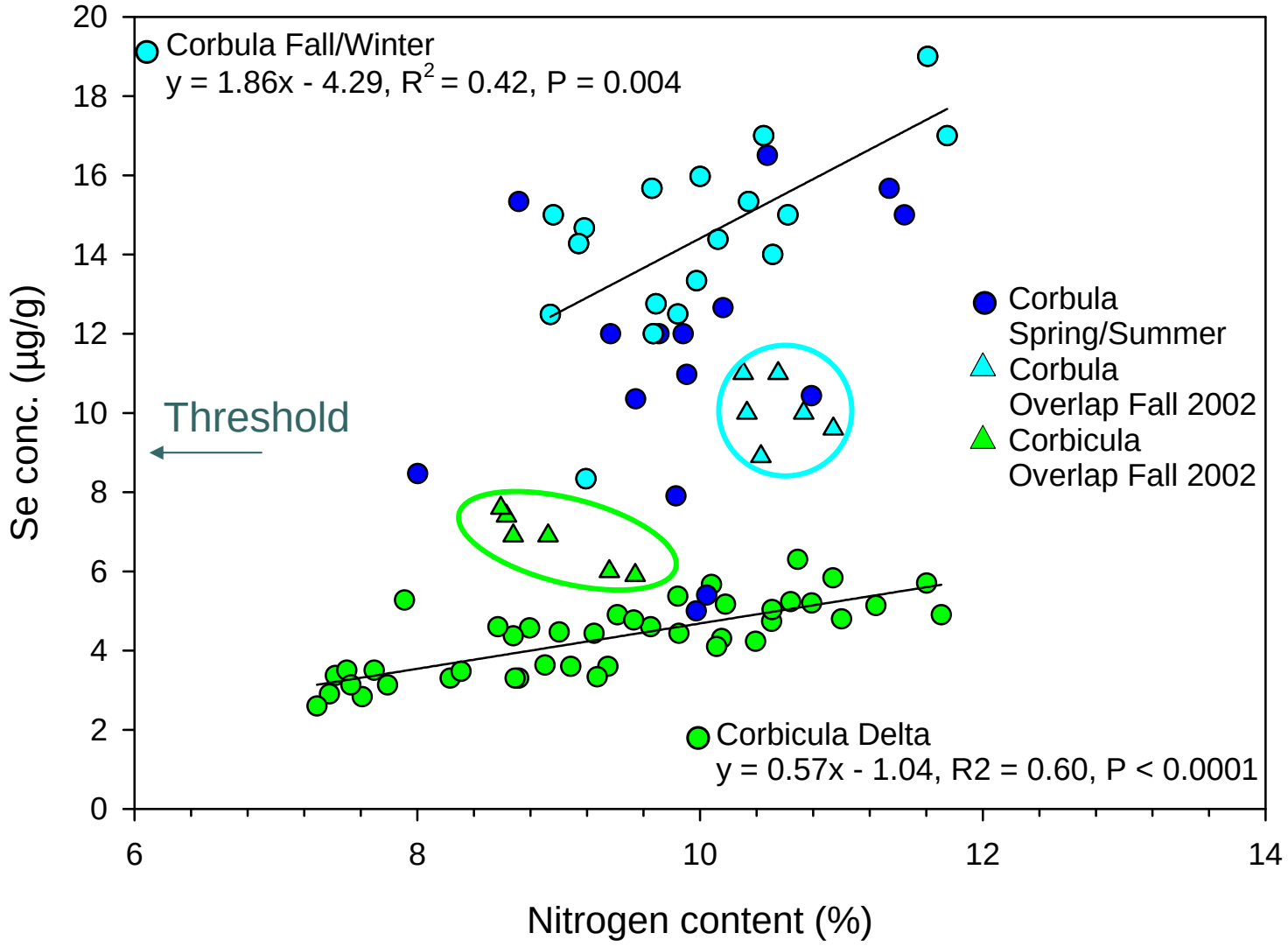




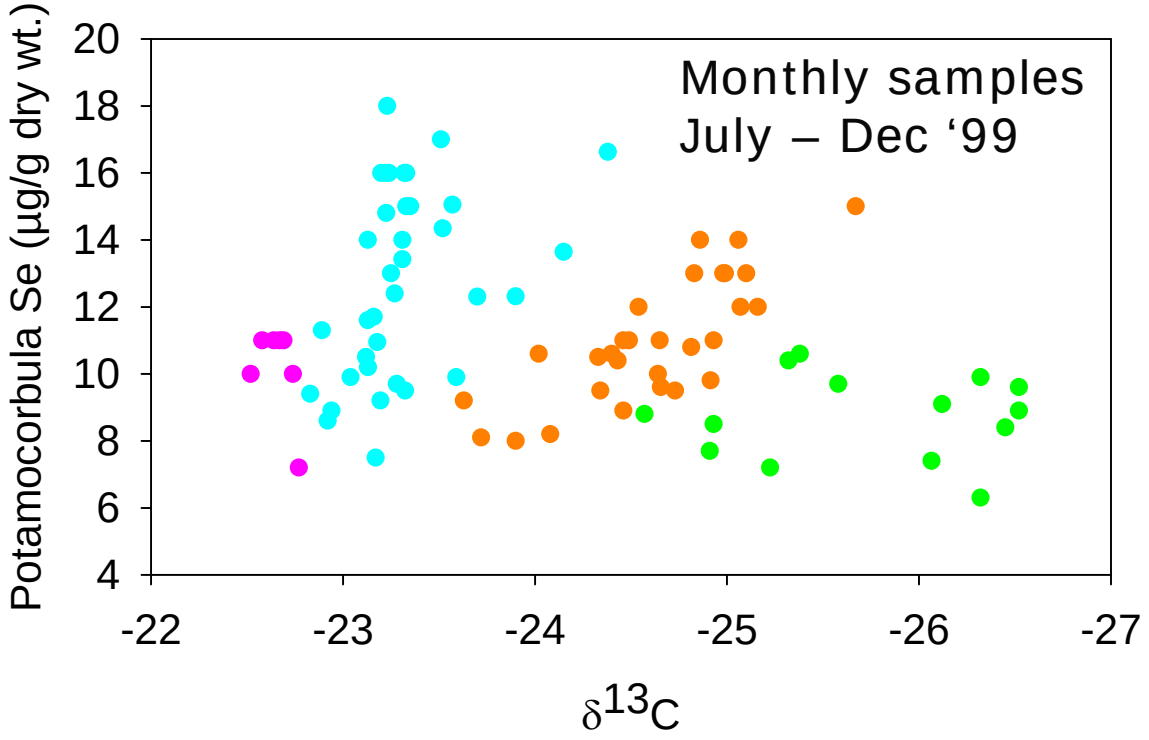
Source Water?

- [Se] higher in fall
- *Corbula* higher than *Corbicula*



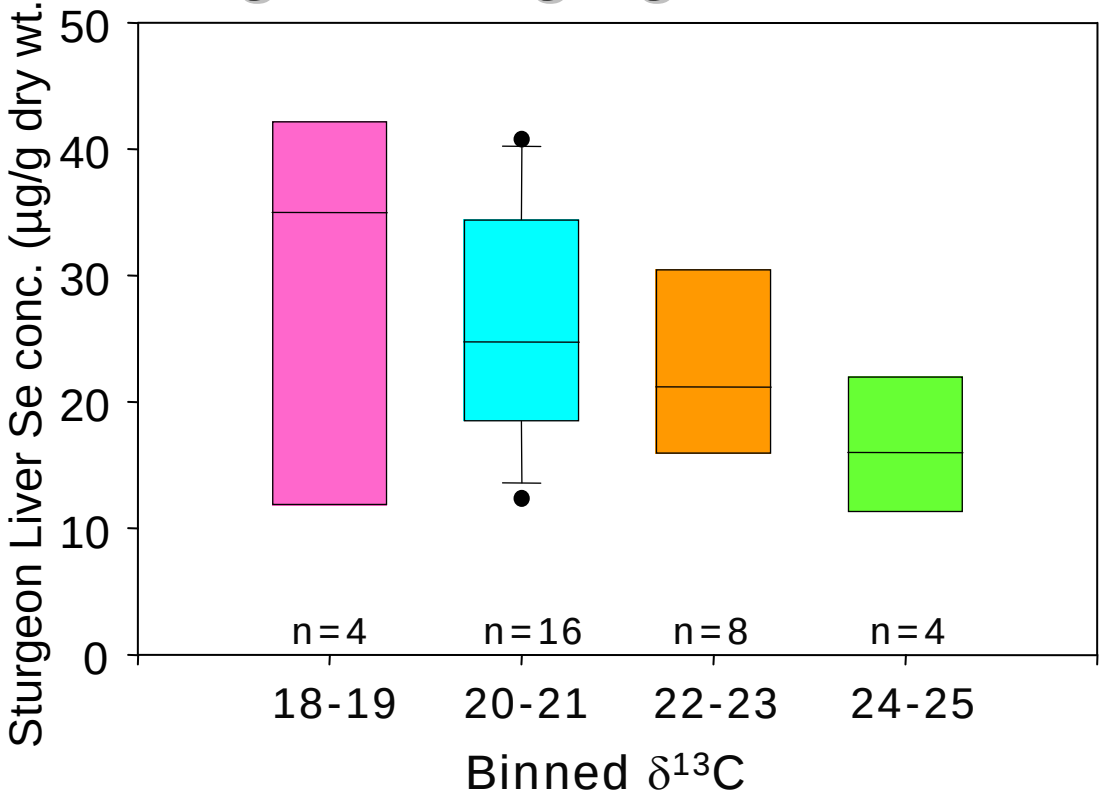

Corbula Fall/Winter
y = 1.86x - 4.29, R2 = 0.42, P = 0.004
Threshold
Corbula Spring/Summer
Corbula Overlap Fall 2002
Corbicula Overlap Fall 2002
Corbicula Delta
y = 0.57x - 1.04, R2 = 0.60, P < 0.0001
Se conc. (µg/g)
Nitrogen content (%)
0
2
4
6
8
10
12
14
16
18
20
6
8
10
12
14

Clam selenium concentrations differ along the salinity gradient



Higher salinities in Delta could extend *Corbula* range and extent of Sturgeon exposures

Mean Sturgeon selenium concentrations according to foraging location in estuary



Higher salinities in Delta could extend *Corbula* range and extent of Sturgeon exposures

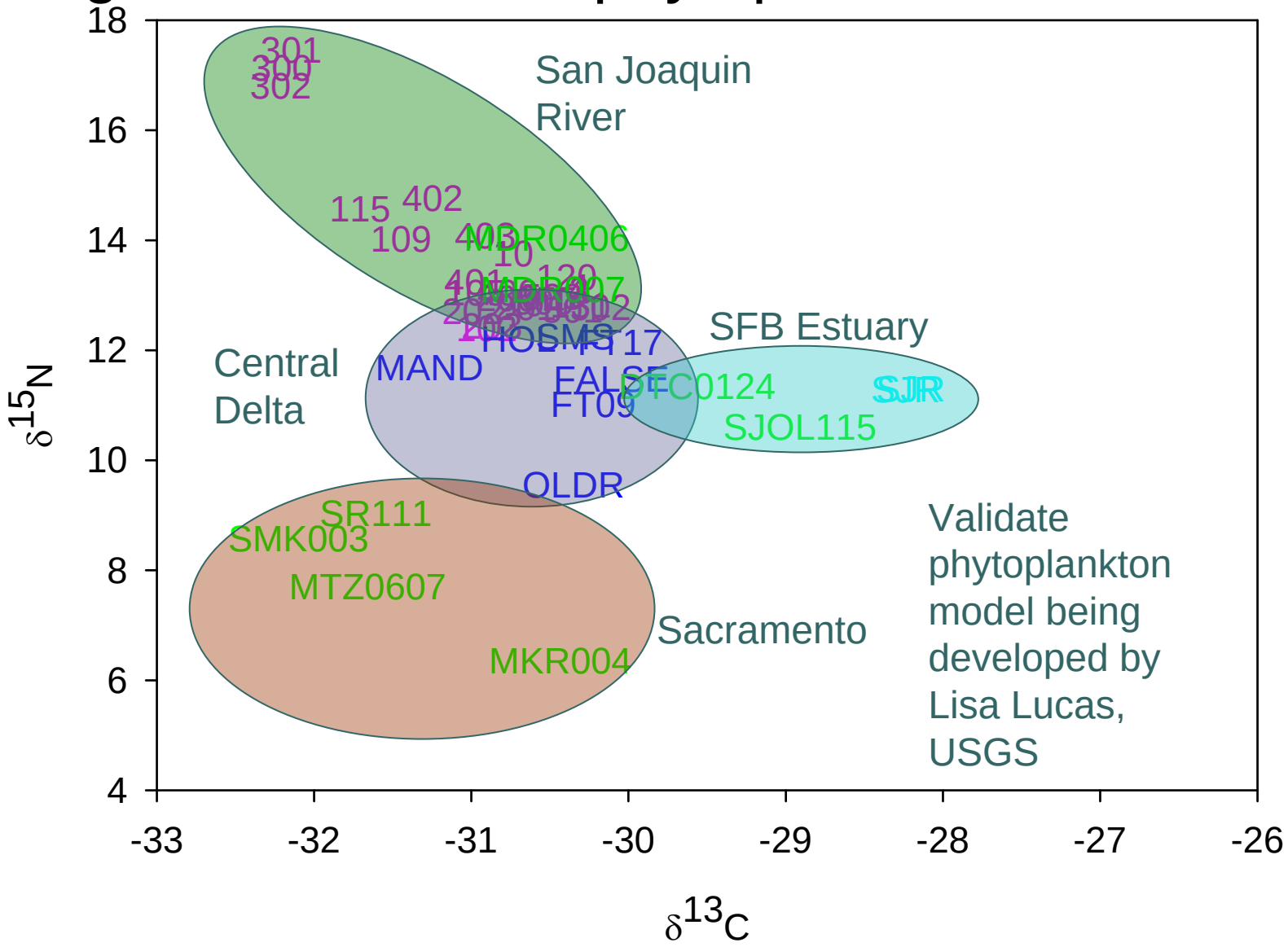
Se monitoring questions

- Need to resolve affect of increased input of selenate into Suisun Bay from SJR
  - Transformations
  - Uptake into estuarine phytoplankton species

Contaminants of concern: Dietary-based exposures

- *In situ* produced phytoplankton are primary forms of carbon to base of food web
- Need to understand how phytoplankton communities grow and are transformed throughout system and their relationship to water-borne contaminants

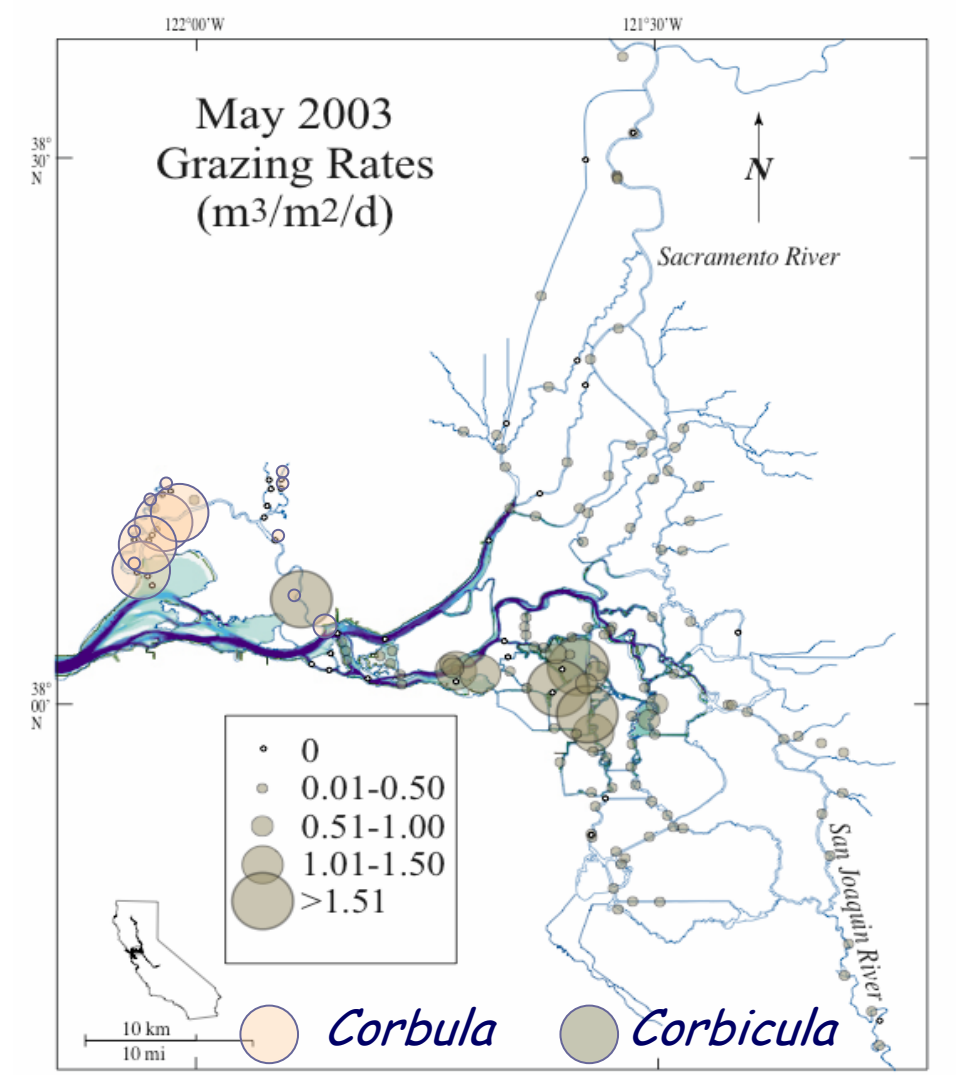
Corbicula isotopic signatures may identify regional sources of phytoplankton

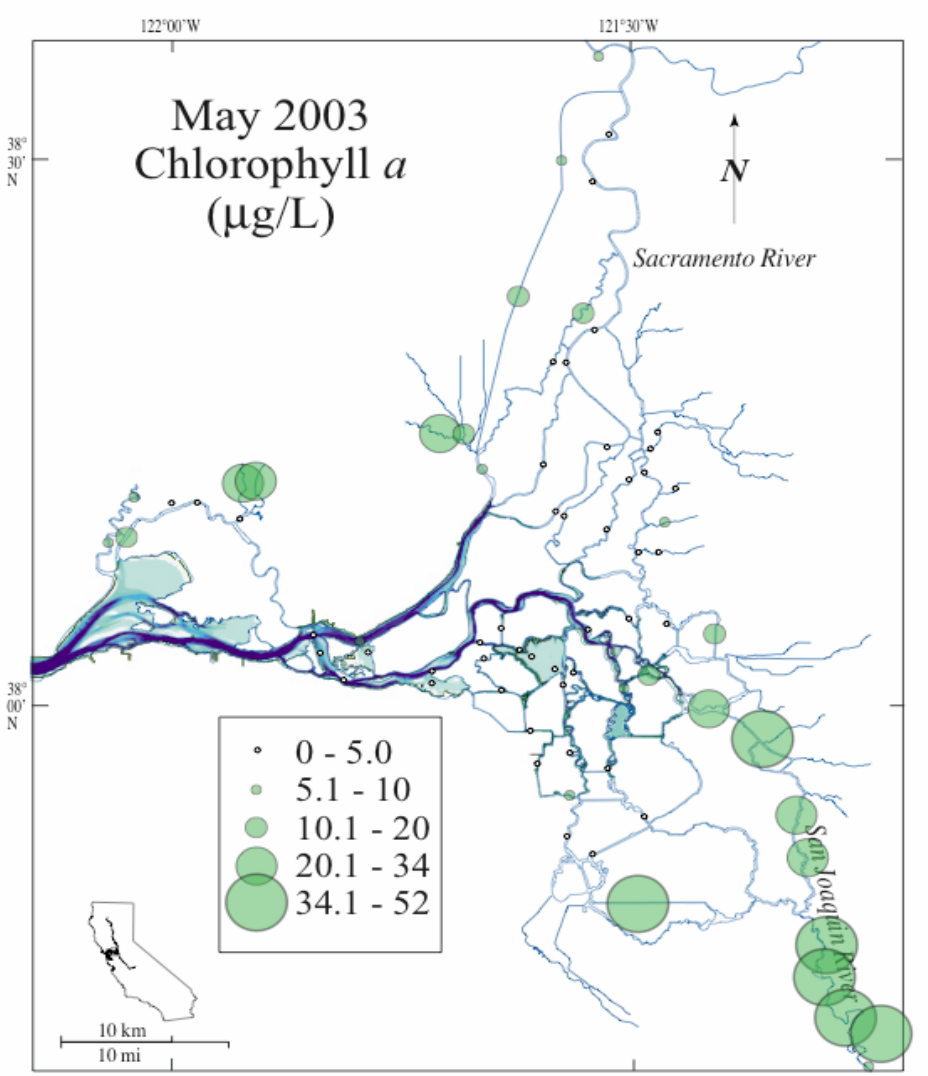


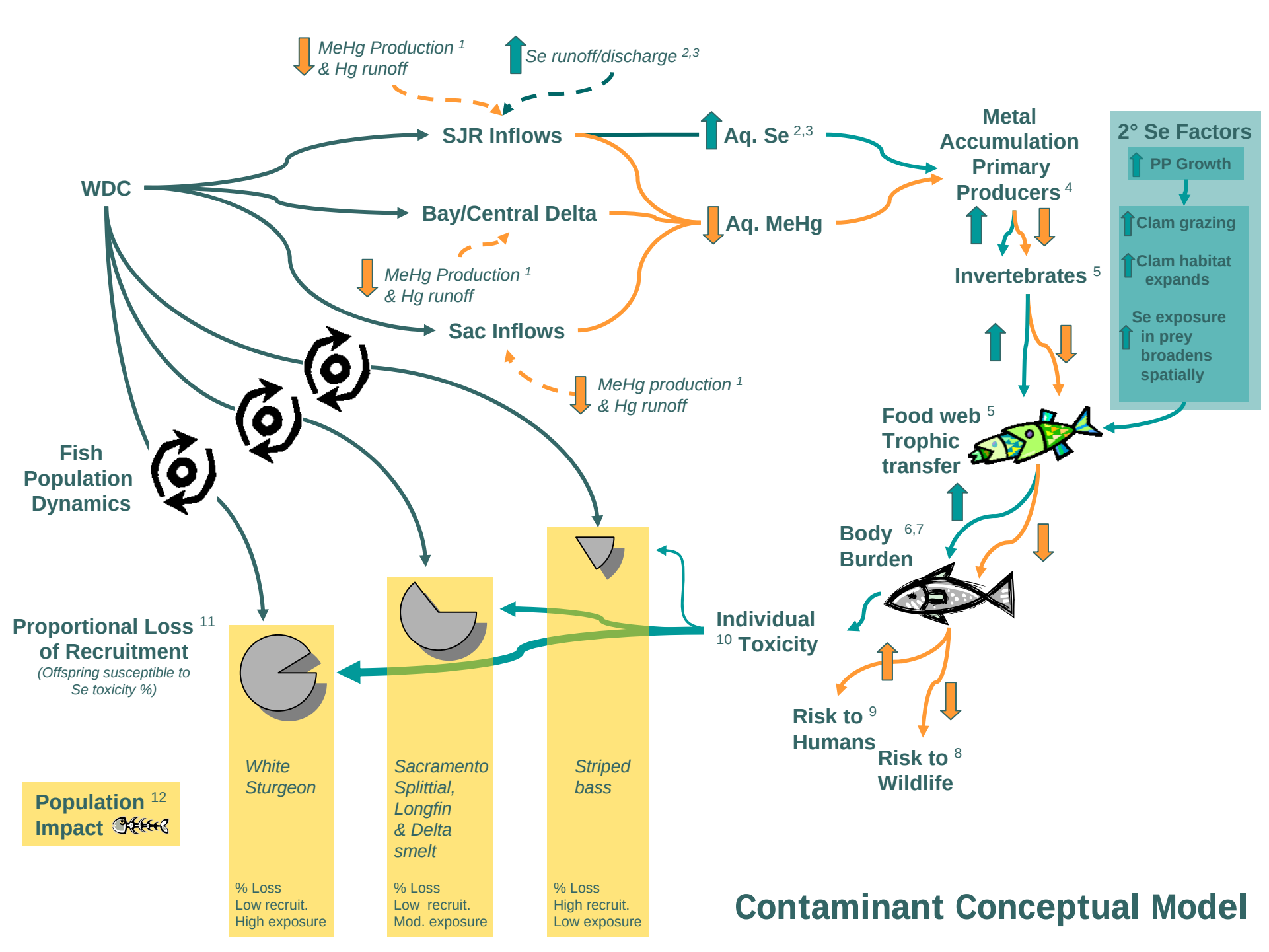
Next steps

- Evaluate available data for highest priority water quality issues
- Identify key data gaps
- Support further monitoring and studies to enhance scientific understanding of the system and its response to changes
- Understand that there will be mistakes, but be flexible in your response

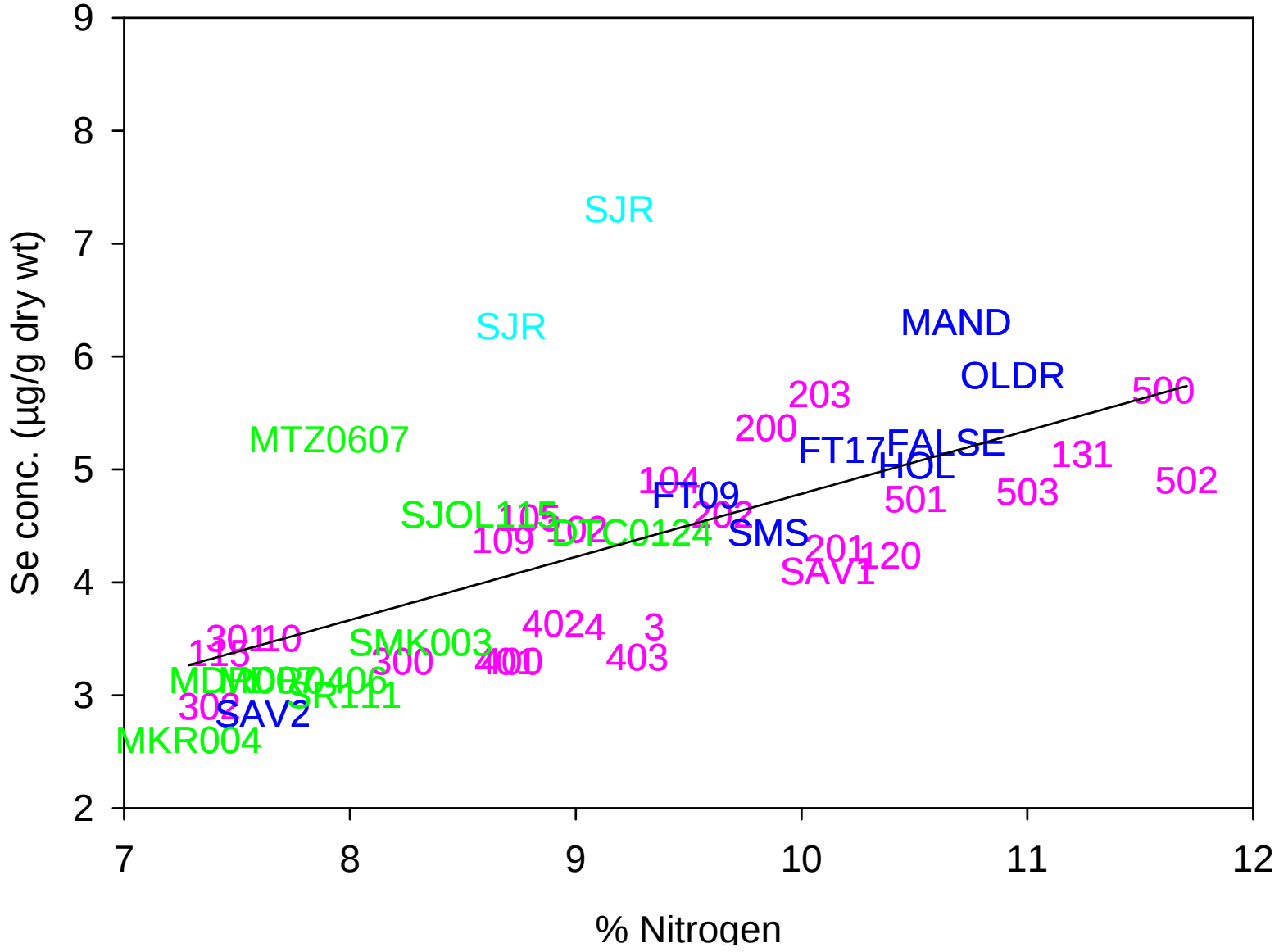
View change as an opportunity for increasing our understanding of this complex system


May 2003
Grazing Rates
(m3/m2/d)
122°00'W
121°30'W
38° 30' N
38° 00' N
N
Sacramento River
San Joaquin River
0
0.01-0.50
0.51-1.00
1.01-1.50
>1.51
10 km
10 mi
Corbula
Corbicula


May 2003
Chlorophyll a
(µg/L)
122°00'W
121°30'W
38° 30' N
38° 00' N
N
Sacramento River
San Joaquin River
0 - 5.0
5.1 - 10
10.1 - 20
20.1 - 34
34.1 - 52
10 km
10 mi



Contaminant Conceptual Model


Se conc. (µg/g dry wt)
% Nitrogen
9
8
7
6
5
4
3
2
7
8
9
10
11
12
SJR
SJR
MAND
OLDR
203
200
500
MTZ0607
FT17
FALSE
131
HOL
104
FT09
501
503
502
SJOL115
202
109
DTC0124
SMS
201
120
SAV1
4024
3
SMK003
403
300
SR111
SAV2
MKR004