RECLAMATION

Managing Water in the West

Introducing Metropolitan Water District's Proposal for Estimating Cumulative Salvage Index Values for Adult Delta Smelt

U.S. Department of the Interior
Bureau of Reclamation

Context

- USFWS Biological Opinion
  - CVP/SWP jeopardize the continued existence of delta smelt (*Hypomesus transpacificus*)
  - result in adverse modification of critical habitat
- RPA Components 1&2
  - reduce exports, as indexed by Old and Middle River flows (OMR), when entrainment risk of delta smelt increases
- Incidental Take Statement
  - take anticipated under operations with the RPA
- Proposed model
  - Method for RPA-compliant CSI values based on historic OMR conditions
    - 18 years
  - Turbidity

RECLAMATION

Introduction

- Metropolitan Water District
  - Advancing a proposal to include
    - a wider range of interannual variation (more years)
    - factor turbidity into calculating the Cumulative Salvage Index (CSI)
- Technical assessment
  - U.S. Bureau of Reclamation
  - U.S. Fish and Wildlife Service
  - CA Department of Water Resources
  - CA Department of Fish and Wildlife
- Stakeholder Review
  - NGOs
  - RPA Annual Science Review

Process

- Reclamation
  - Considers feedback
    - State and Federal fish agencies
    - State and Federal water agencies
    - Non Governmental Organizations
    - Independent Review Panel
  - Based on comments Reclamation may submit proposal to USFWS for its consideration
    - November 15, 2014
    - Possible implementation in water year 2015

Estimating Expected CSI Values under the Adult Delta Smelt RPAs

David Fullerton, Metropolitan Water District
Lenny Grimaldo, ICF

November 6, 2014

Outline

- Factors Affecting Delta Smelt Entrainment
- What is CSI?
- Issues with CSI.
- Modeling CSI.
- Estimated RPA Compliant Values

Factors Affecting Delta Smelt Entrainment

Lenny Grimaldo
ICF International

Purpose

- Review what we know about delta smelt entrainment to inform the development of a revised and more robust cumulative salvage index (CSI) approach for the adult delta smelt Incidental Take Limit calculation

- Key question: Does the current method sufficiently capture variability in conditions that drive delta smelt entrainment?

Outcome

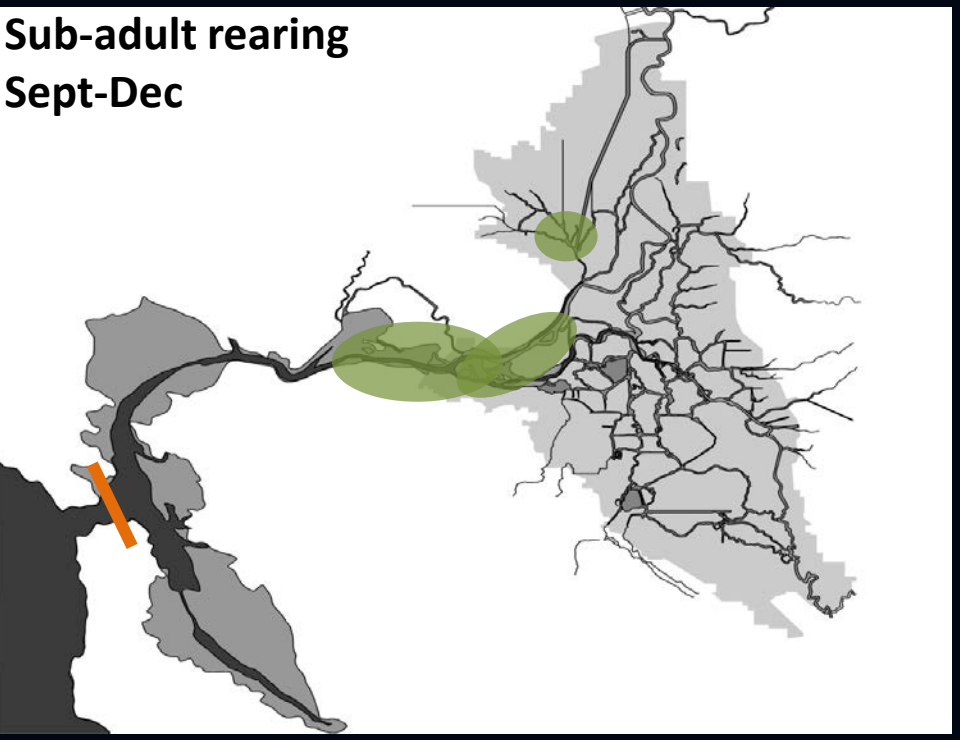
- Develop an approach that remains protective of the species (i.e., works hand-in-hand with the existing RPA Actions)

- Develop an approach that reduces management uncertainty while increasing flexibility of water operations

Not here today to….

- Revise the Incidental Take Limit (USFWS responsibility)
- Revise the existing RPA actions

Delta smelt complete their life cycle in the upper San Francisco Estuary



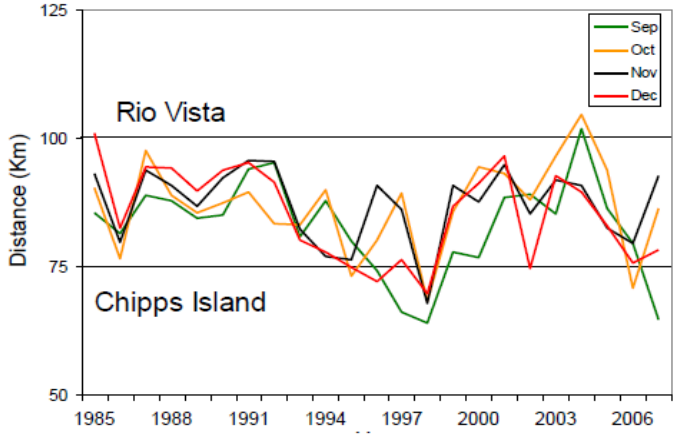
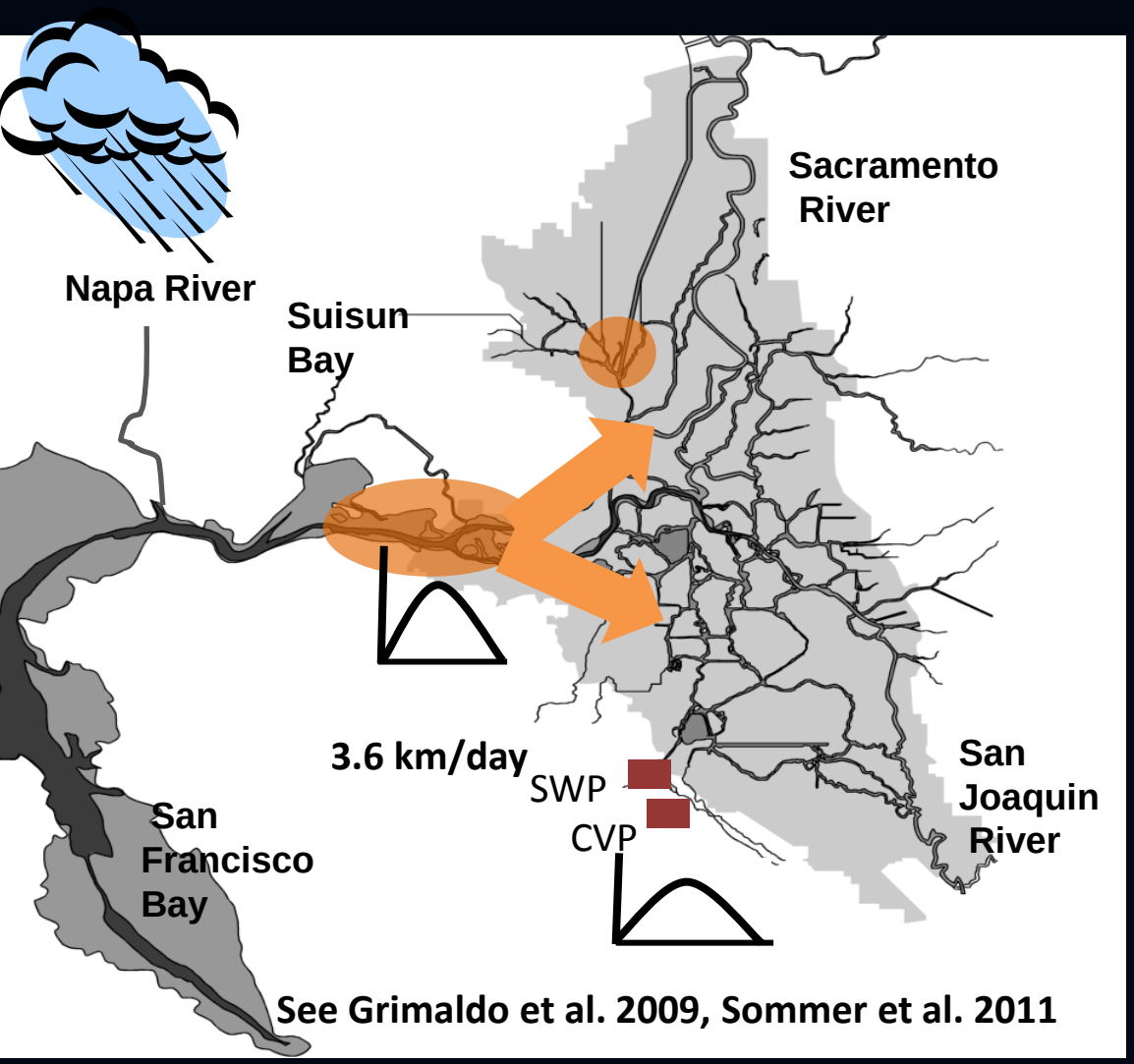


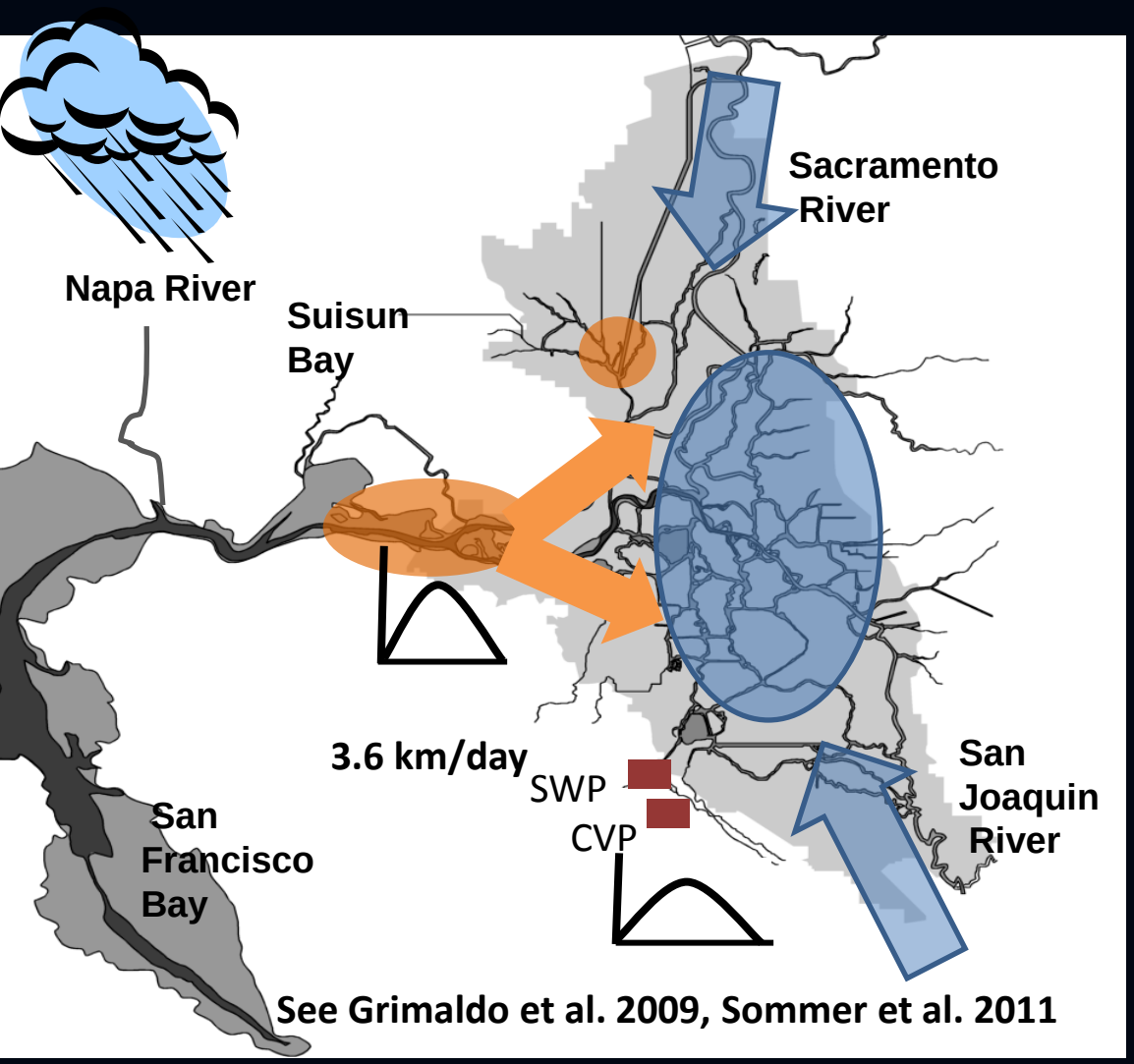
Figure 2 Monthly geographic distribution of delta smelt during the fall pre-migration season. The results are based on the centroid of the distribution from the FMWT using the method of Dege and Brown (2004). The distances were calculated as the number of kilometers from the Golden Gate Bridge. The west Delta is shown as the region between Rio Vista and Chipps Island, the downstream limit of the Delta.

Sommer et al. 2011

Adult delta smelt (generally) move upstream during “first flush” storms



Adult delta smelt (generally) move upstream during “first flush” storms

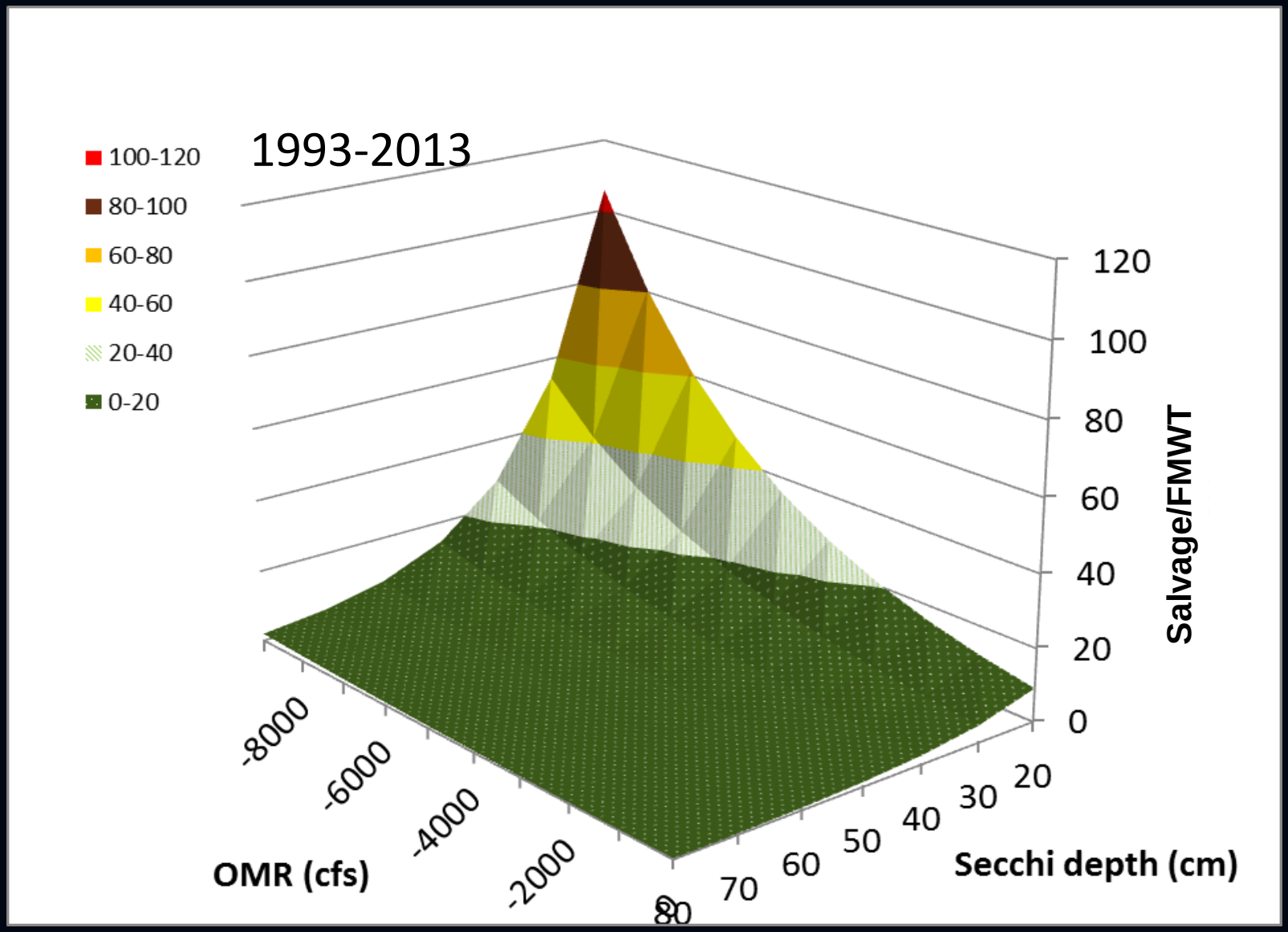


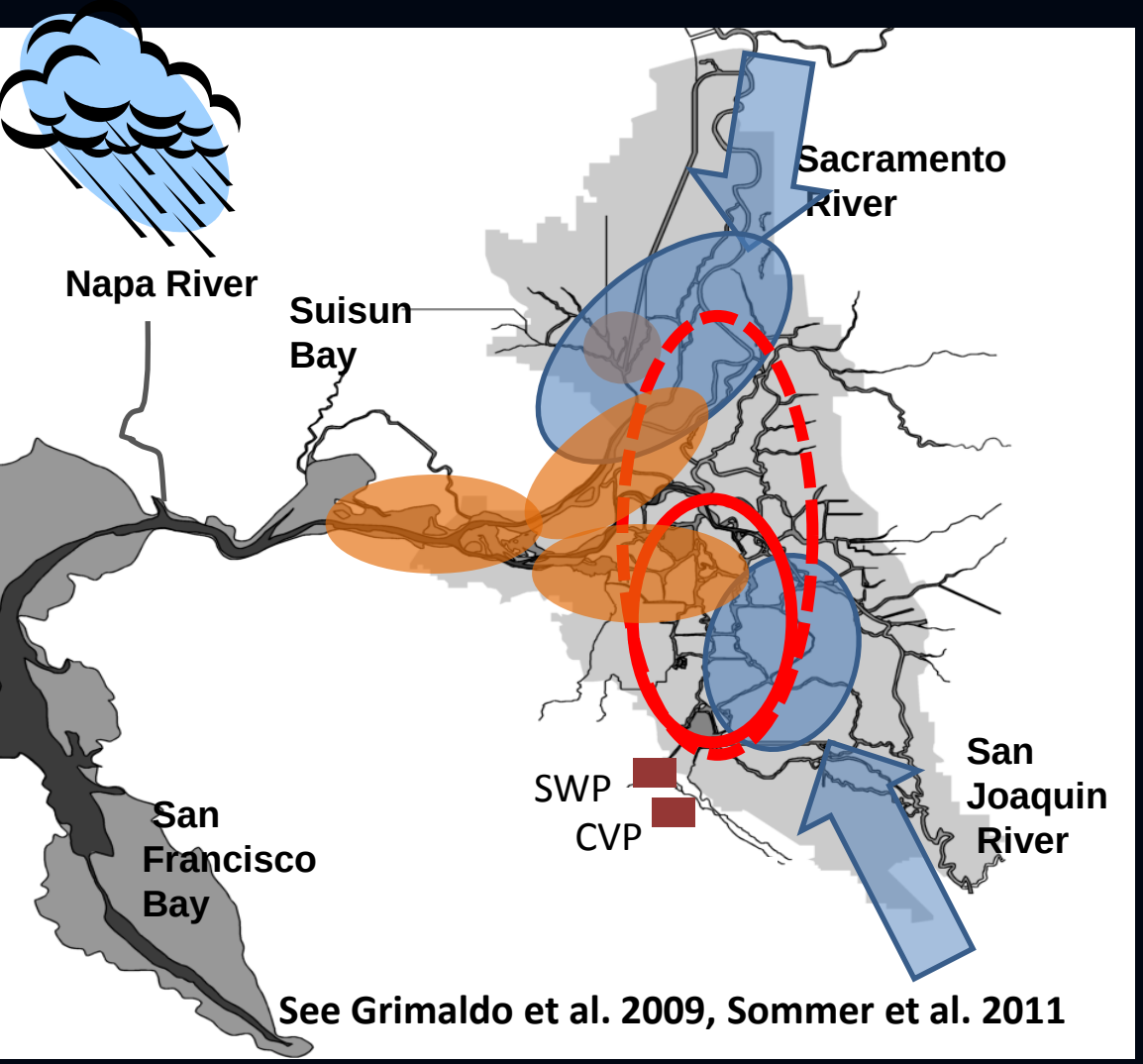
<u>First flush conditions</u>

Sediment load into Delta increases

Turbidity elevates throughout the upper estuary; especially in the south Delta

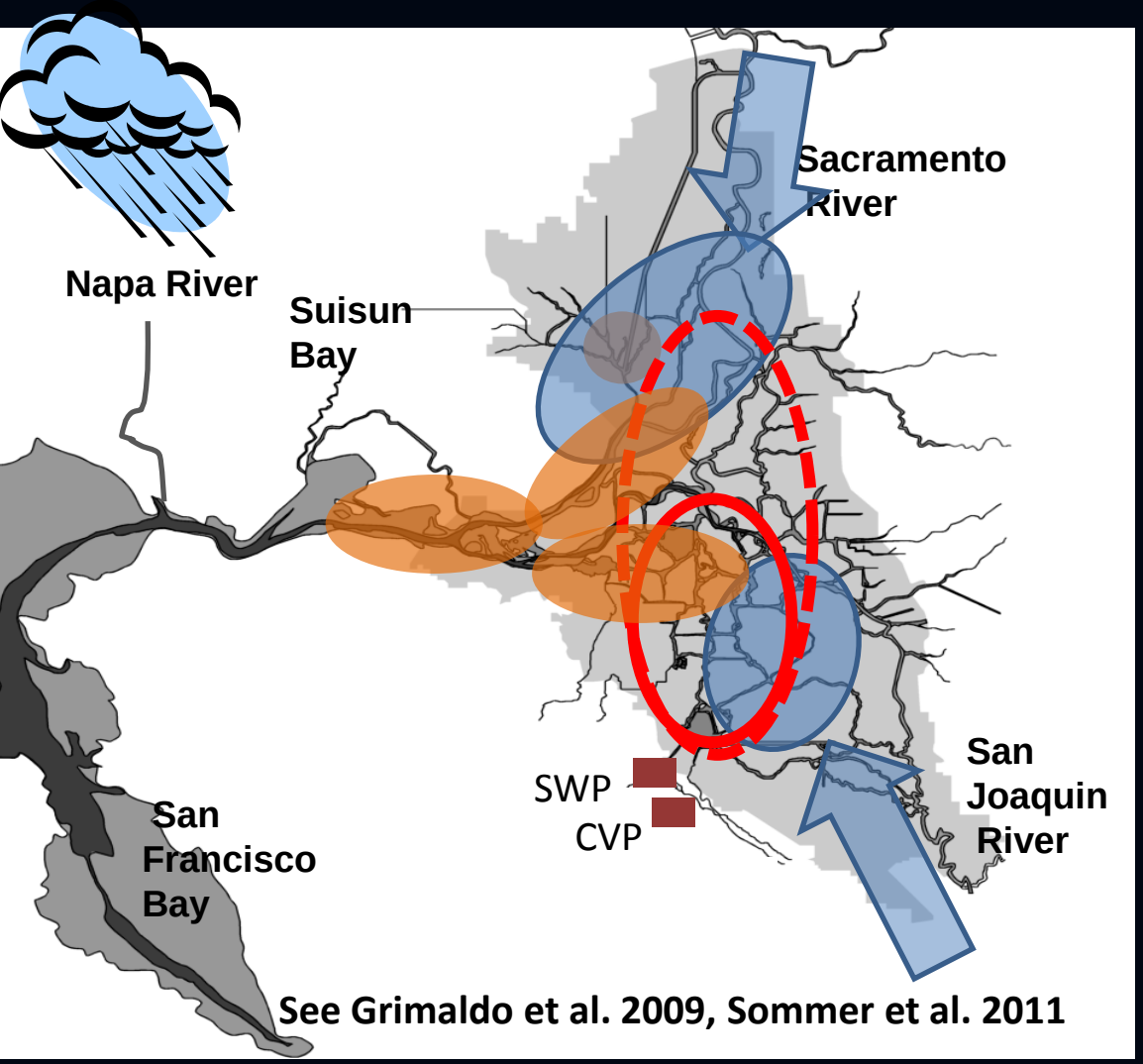
Historically, a period of high entrainment……depending on distribution of smelt post first flush


1993-2013
100-120
80-100
60-80
40-60
20-40
0-20
120
100
80
60
40
20
0
Salvage/FMWT
-8000
-6000
-4000
-2000
0
OMR (cfs)
80
70
60
50
40
30
20
Secchi depth (cm)



RPA Actions 1 and 2

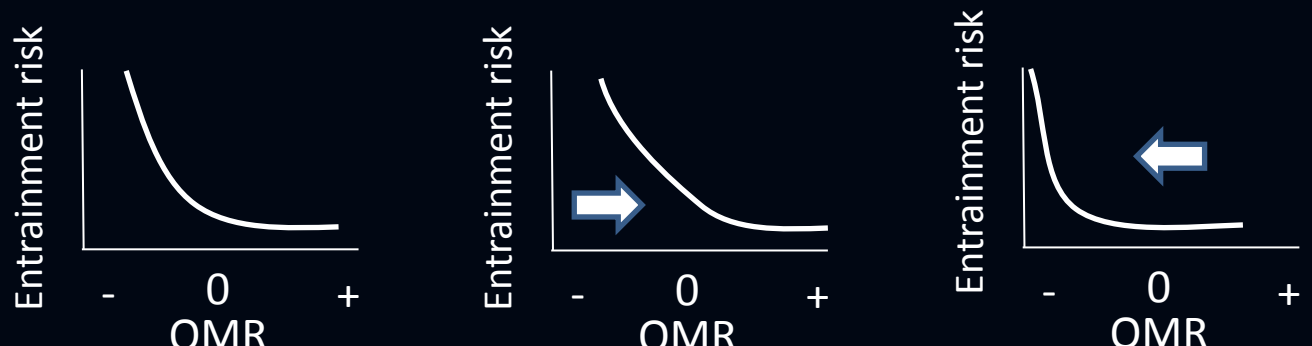
Designed to reduce entrainment and entrainment risk during the winter

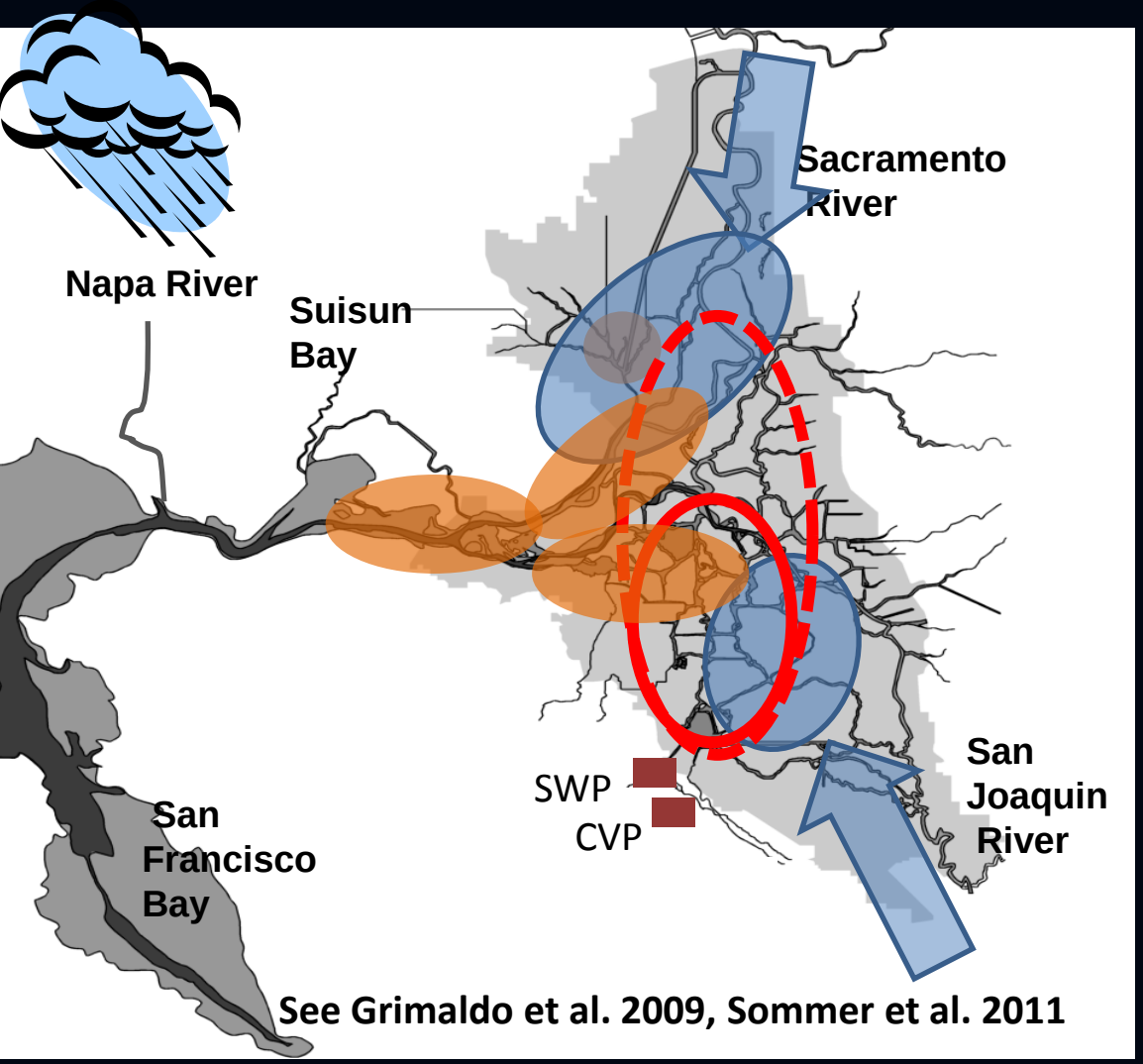


RPA Actions 1 and 2

Designed to reduce entrainment and entrainment risk during the winter

Why do smelt make that right turn?
-See Bennett and Burau (2014)





RPA Actions 1 and 2

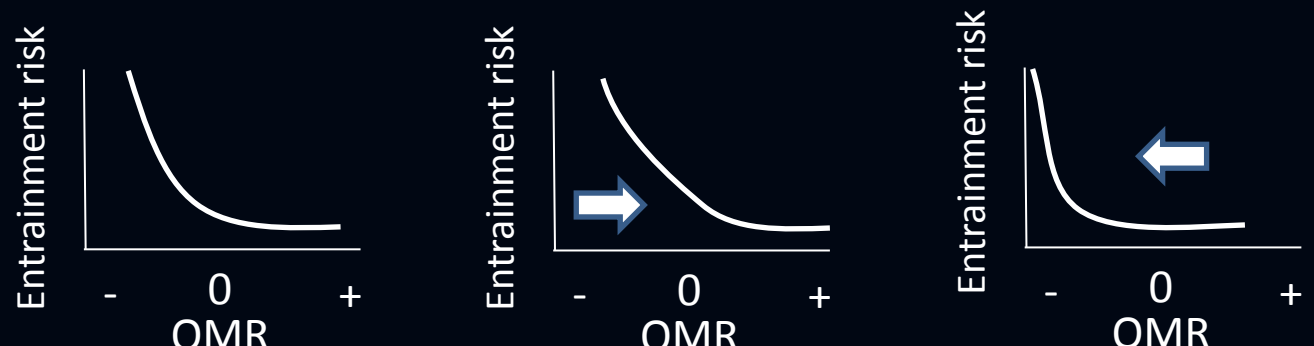
Designed to reduce entrainment and entrainment risk during the winter

Why do smelt make that right turn?
-See Bennett and Burau (2014)

Under what hydrodynamic conditions (years) do we expect them to move up the San Joaquin River?

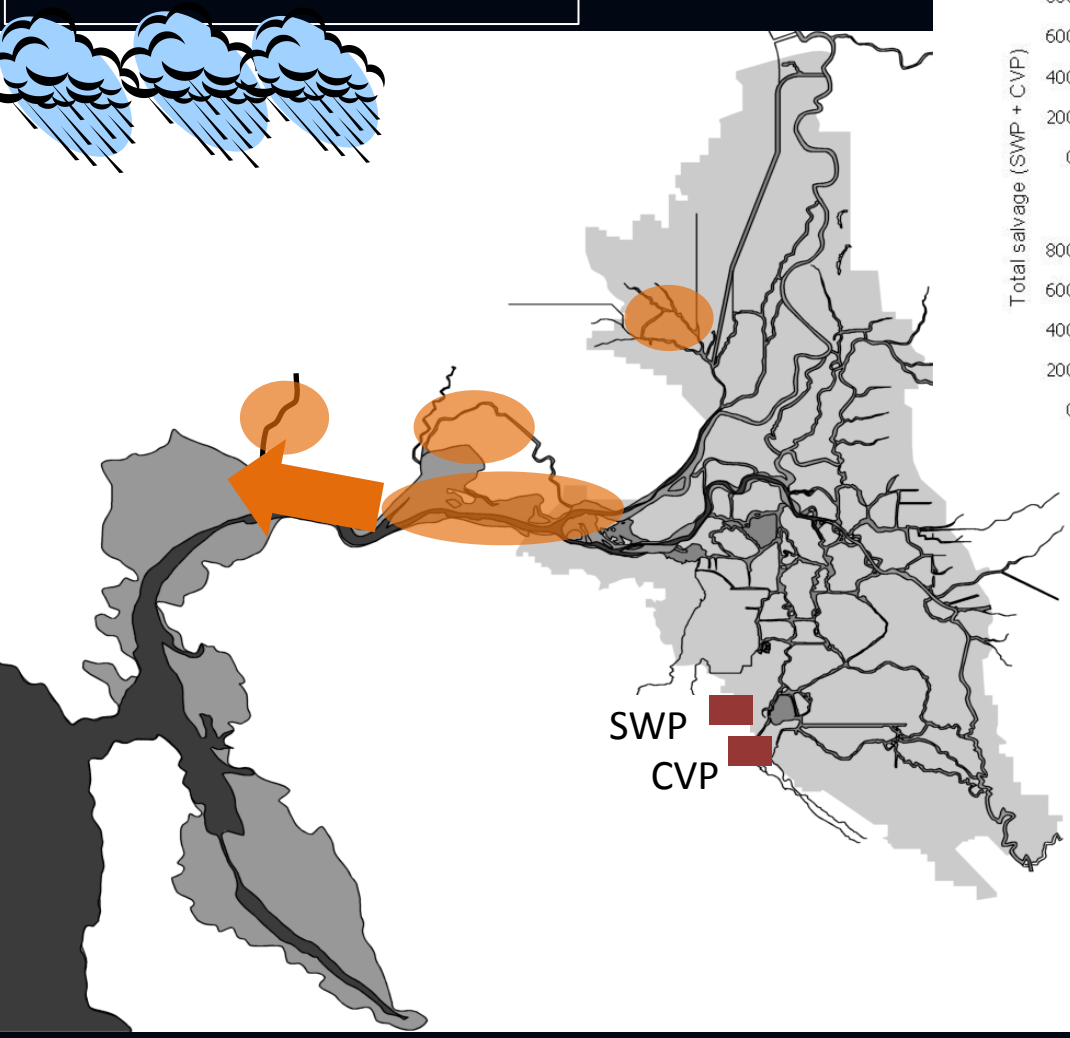
Are these years sufficiently represented in the existing FWS ITL?

Is there a way to fix this?

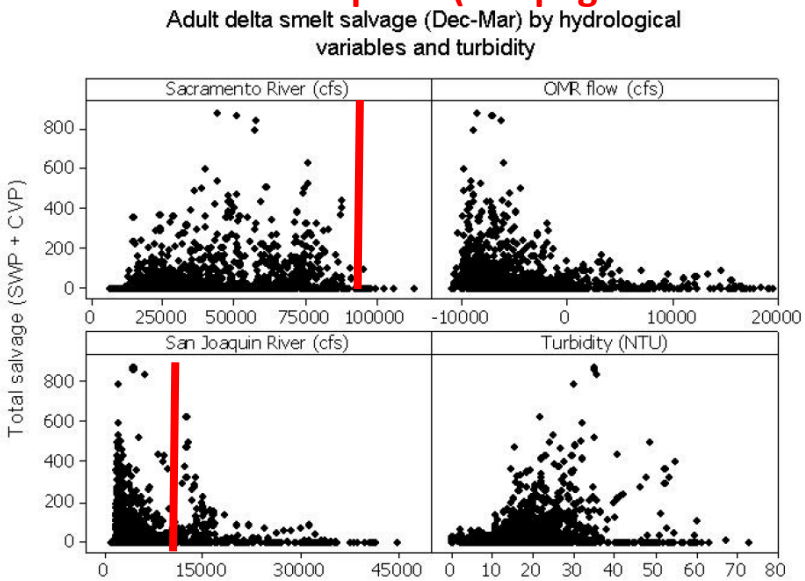


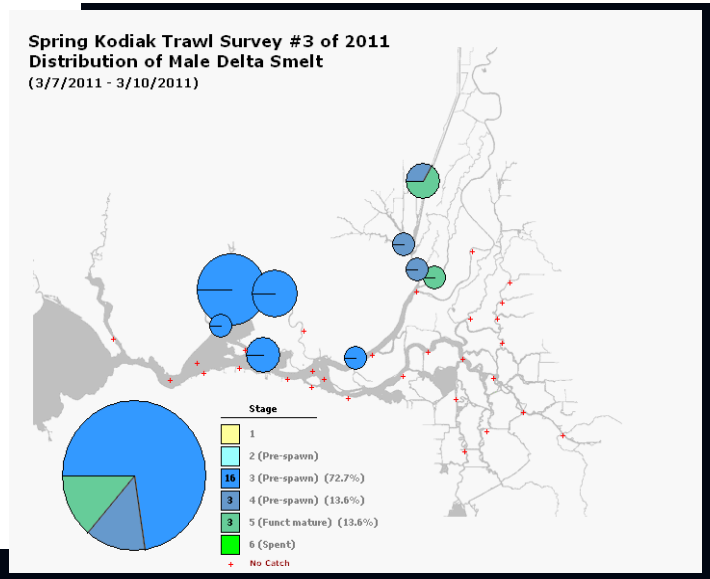
Staging and spawning distributions vary from year to year

In extreme wet years, adult delta smelt distribution is centered westward. Some fish move to north

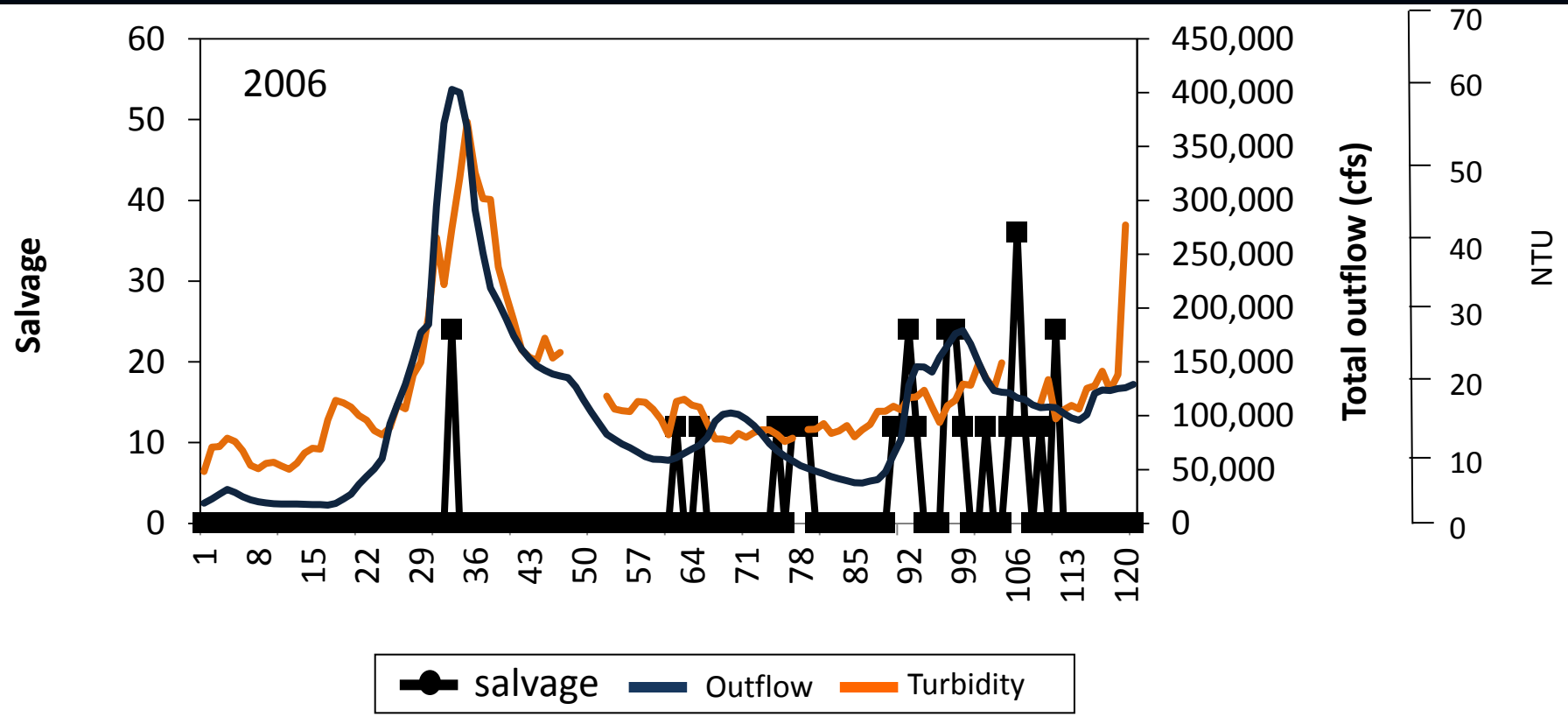


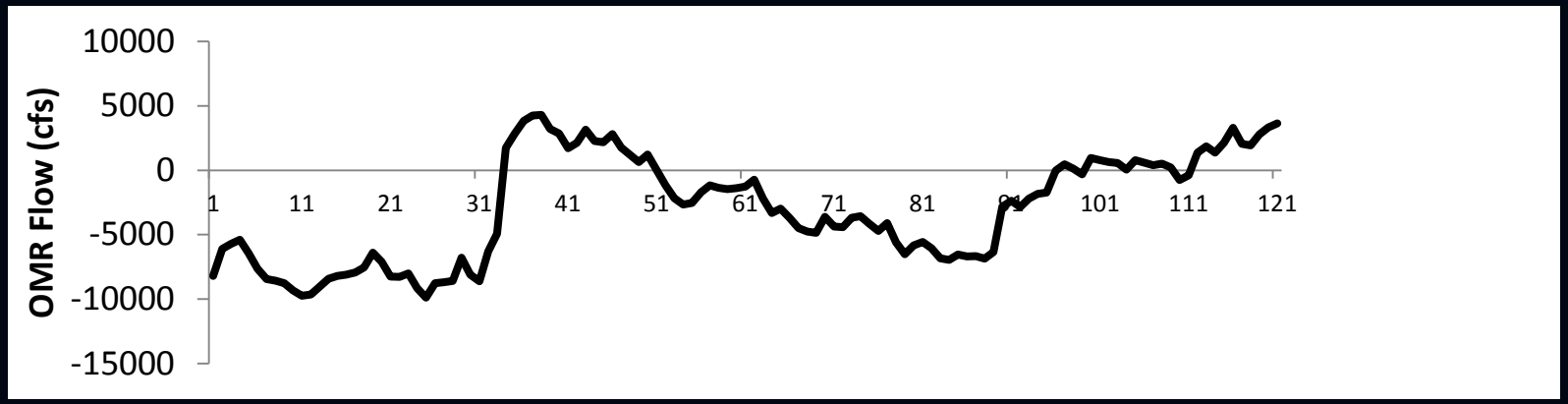
RPA Action 1 and 2 suspend (see page 352 in BiOp)





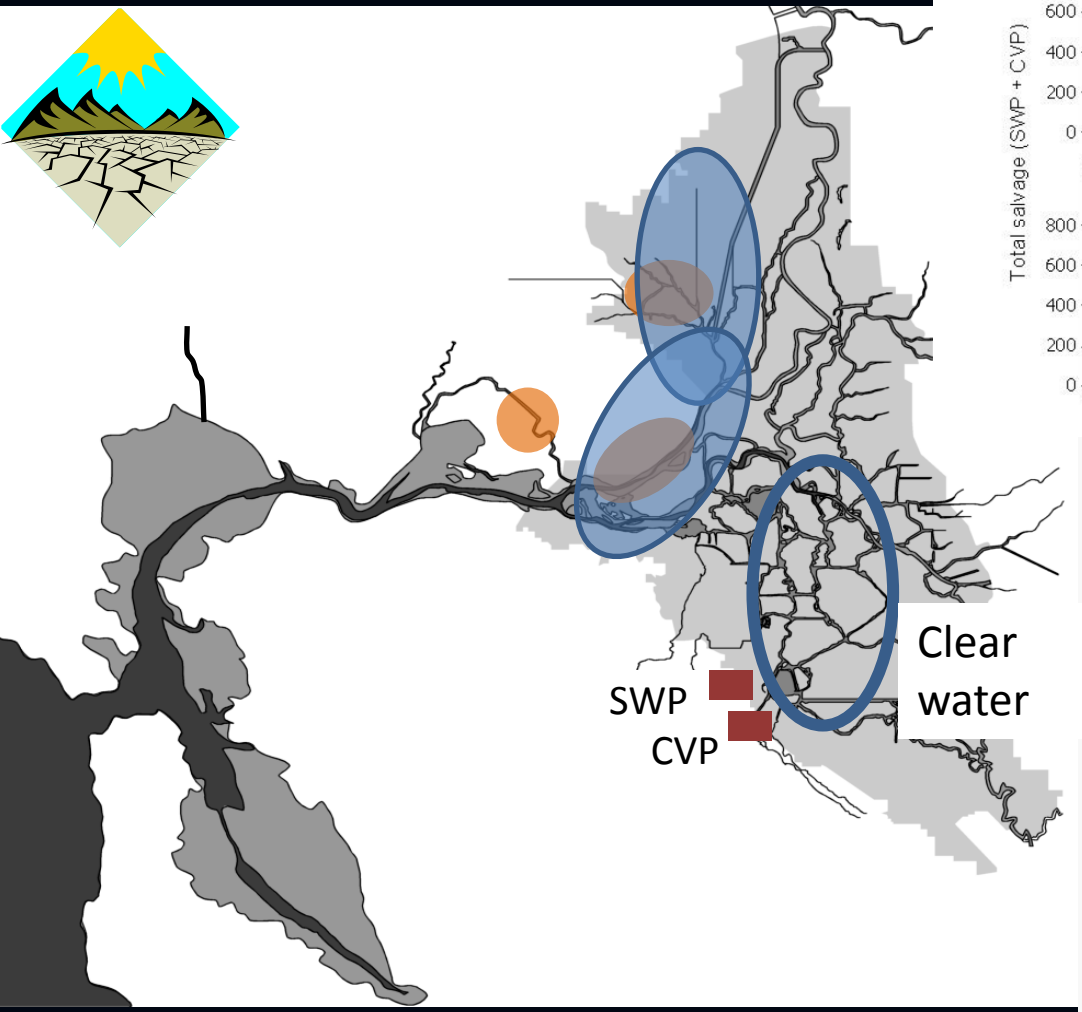
Salvage overall low in wet years, expect to see some on tails of huge outflow events



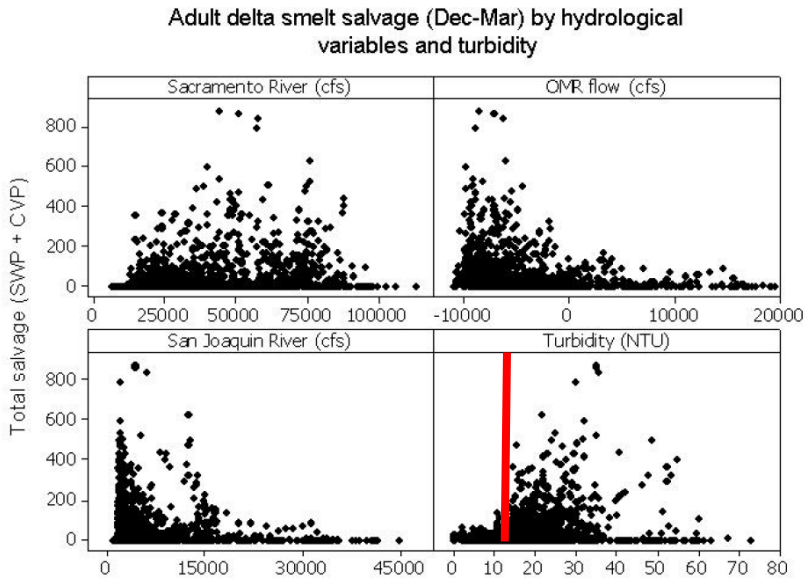


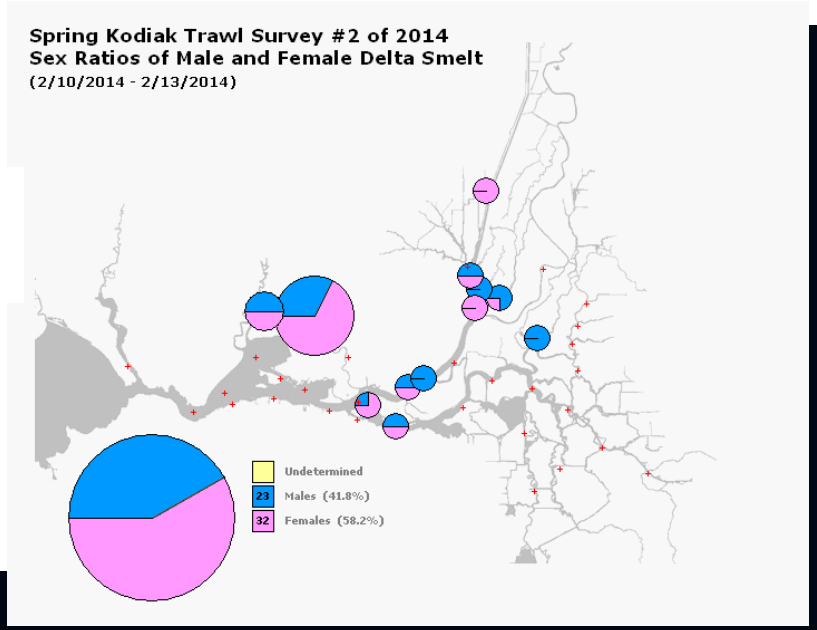
Staging and spawning distributions vary from year to year

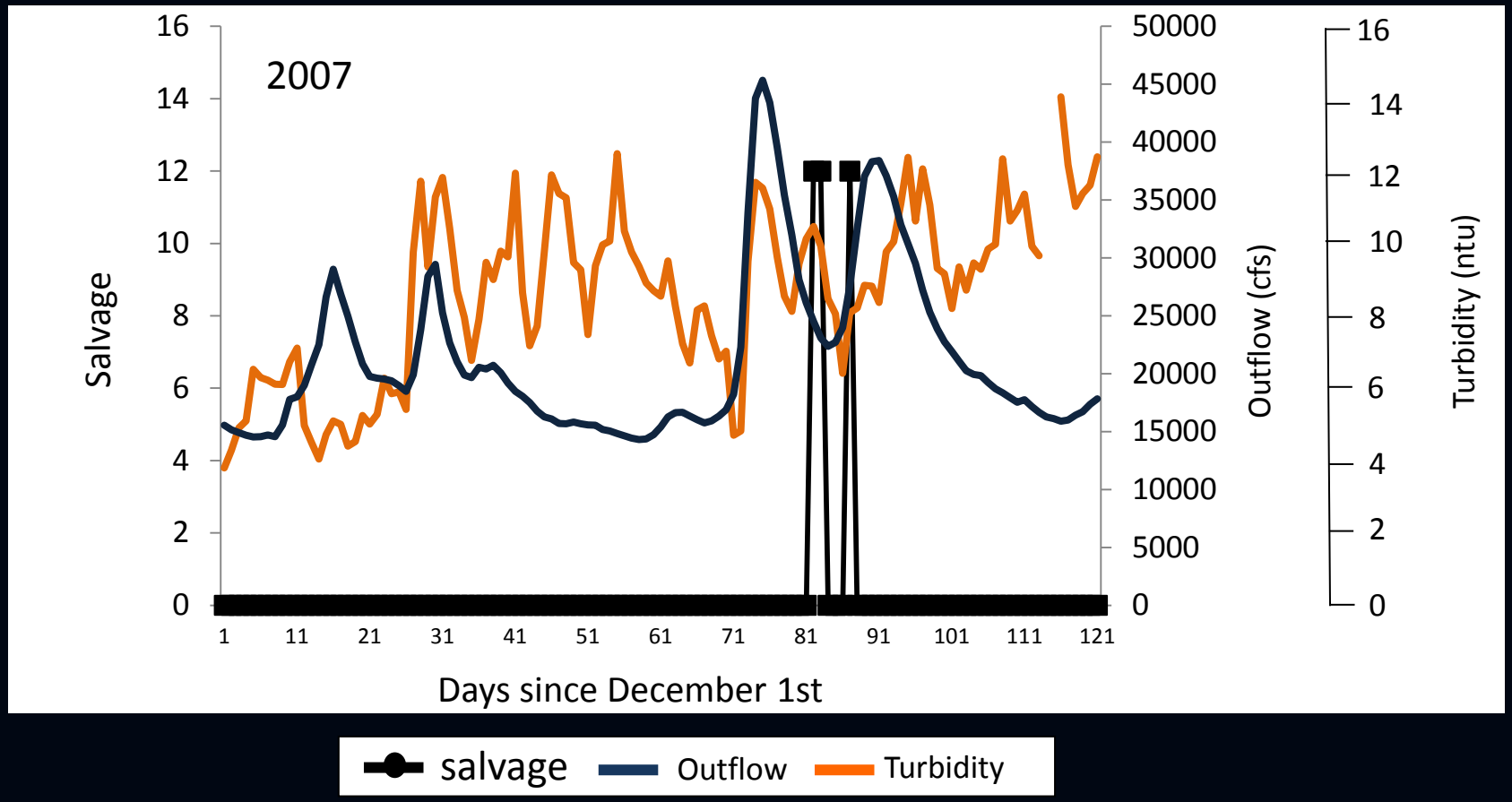
In critical dry years, adult delta smelt distribution is mostly to west and north

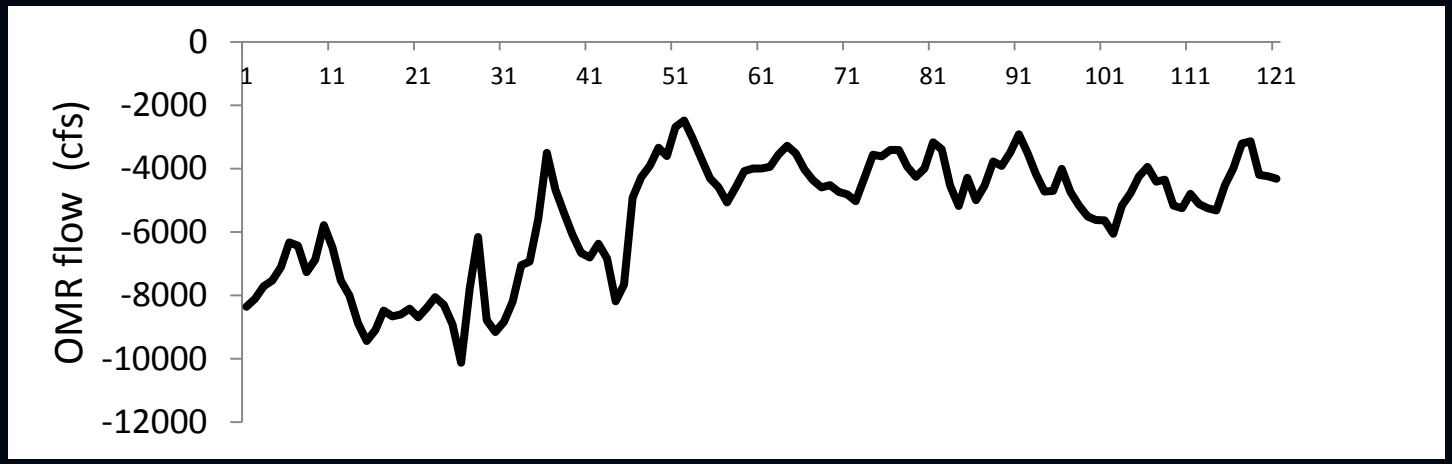


RPA Actions 1 and 2 may not be triggered (see page 329)

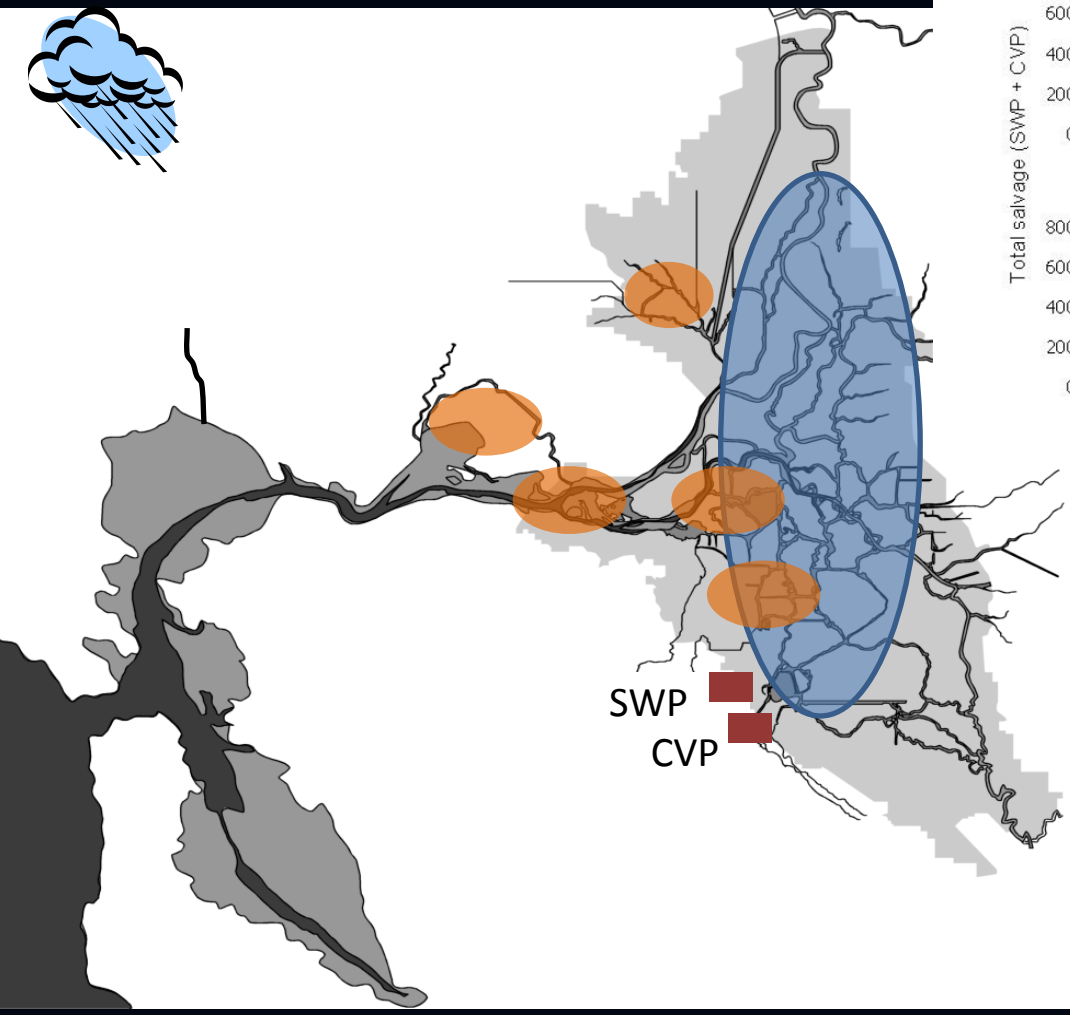


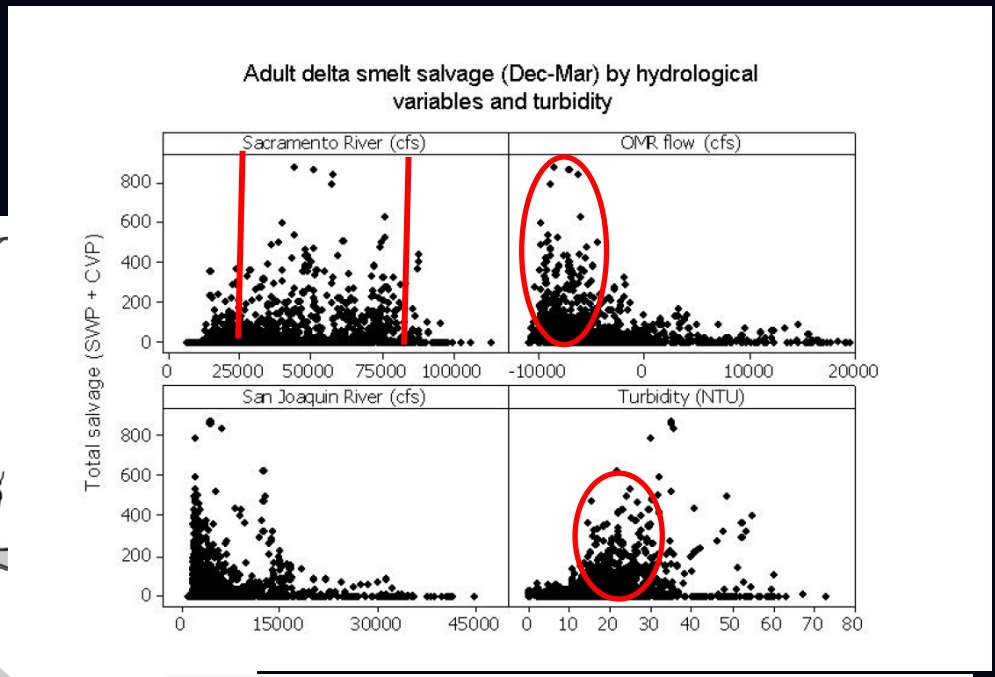


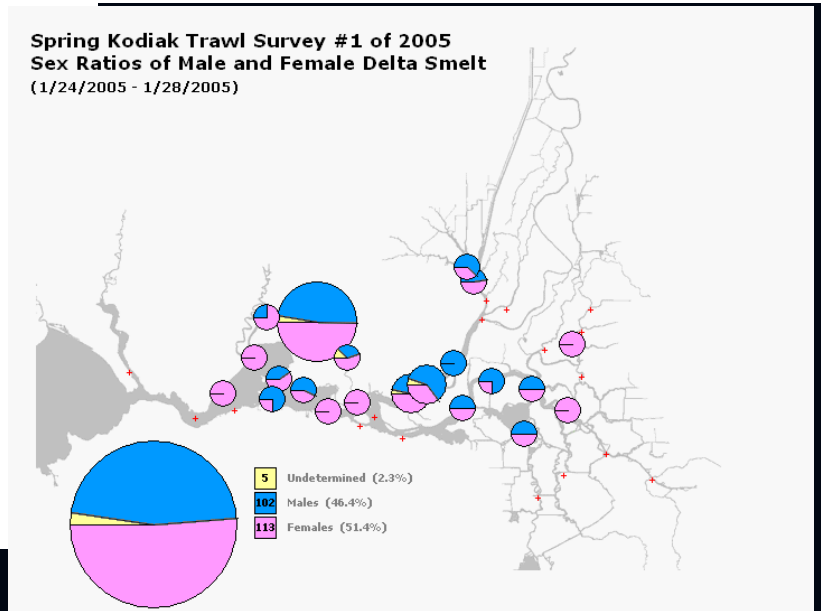

2007
Salvage
Outflow (cfs)
Turbidity (ntu)
Days since December 1st
salvage
Outflow
Turbidity

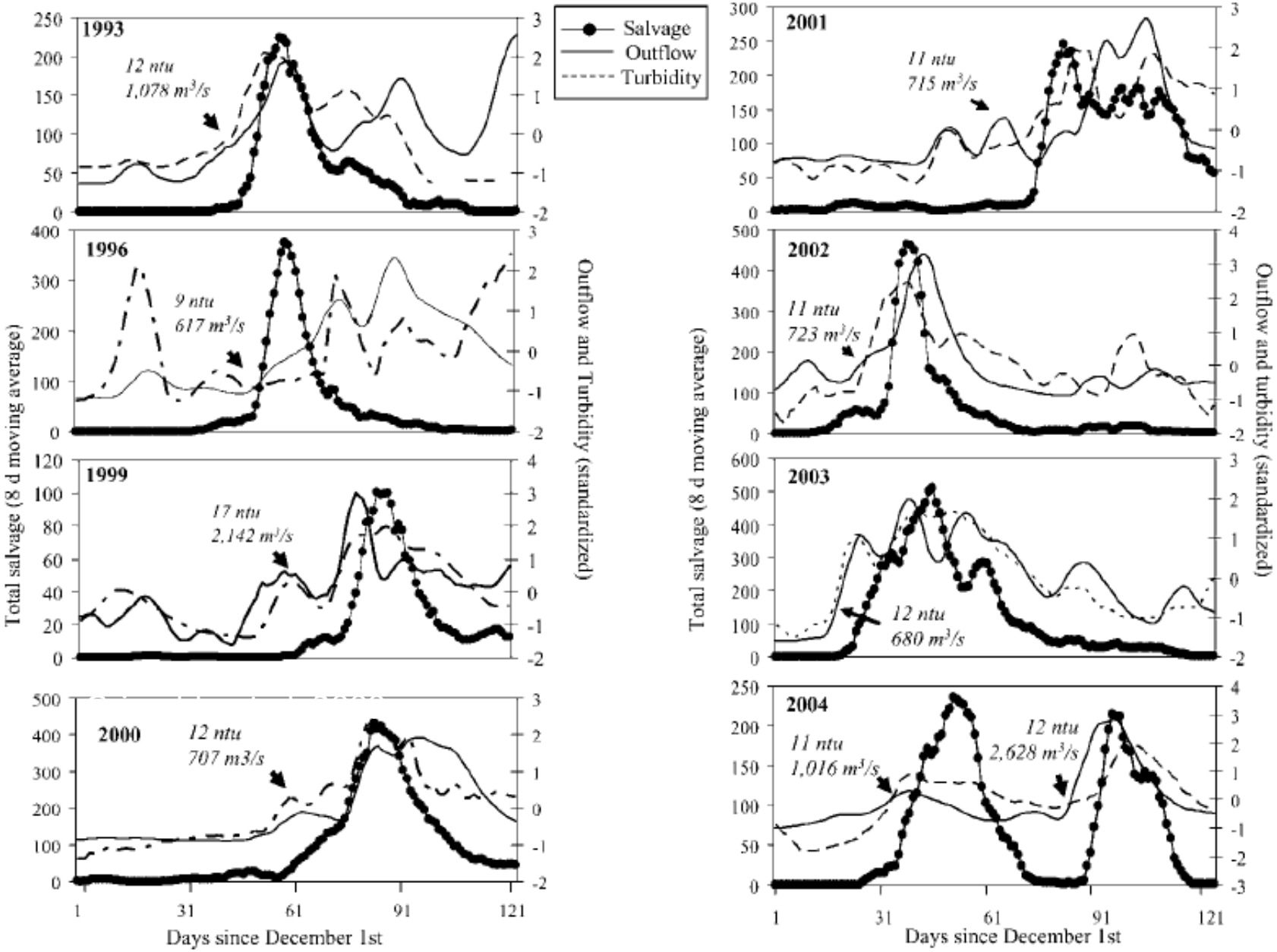

OMR flow (cfs)

Years with moderate first flush years are the most troublesome





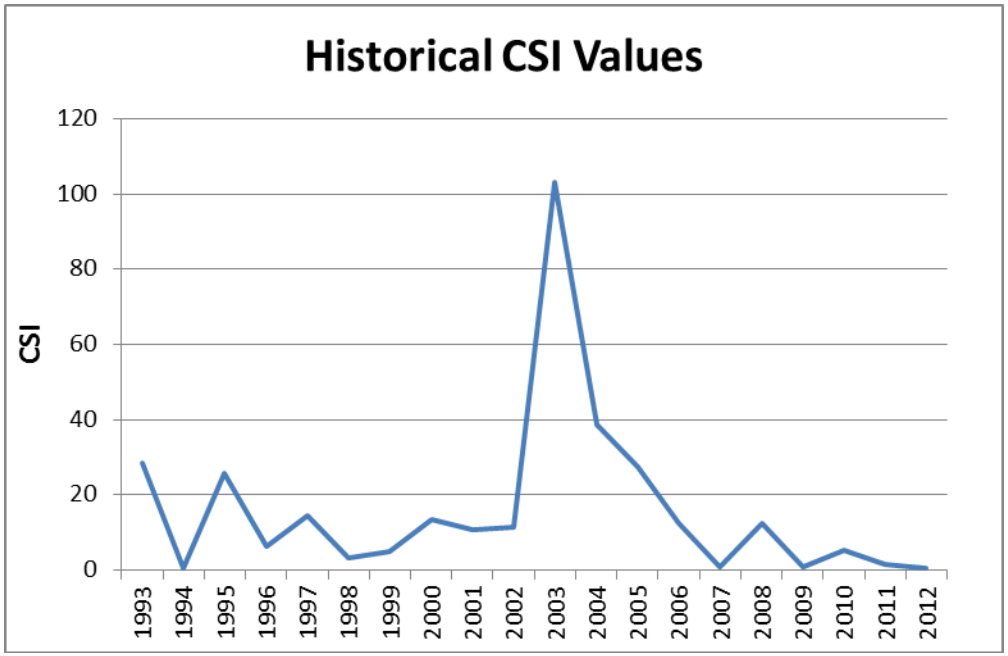



Salvage
Outflow
Turbidity
1993
12 ntu
1,078 m³/s
1996
9 ntu
617 m³/s
1999
17 ntu
2,142 m³/s
2000
12 ntu
707 m3/s
2001
11 ntu
715 m³/s
2002
11 ntu
723 m³/s
2003
12 ntu
680 m³/s
2004
11 ntu
1,016 m³/s
12 ntu
2,628 m³/s
Total salvage (8 d moving average)
Outflow and Turbidity (standardized)
Outflow and turbidity (standardized)
Days since December 1st

END

What is CSI?

- CSI_y= [Total Expanded Adult Delta Smelt Salvage]/Previous FMWT
- A normalized <u>index</u> of salvage. I.e., use to compare level of salvage in different years.



How is CSI used by USFWS?

- CSI Computed for 2006 – 2008: 12.5, .9, 12.5
- ITL Multiplier = Avg(CSI_{2006}, CSI_{2007}, CSI_{2008})= 8.64.
- ITL = 8.64 * PFMWT
- Thus, CSI values = raw materials for ITL

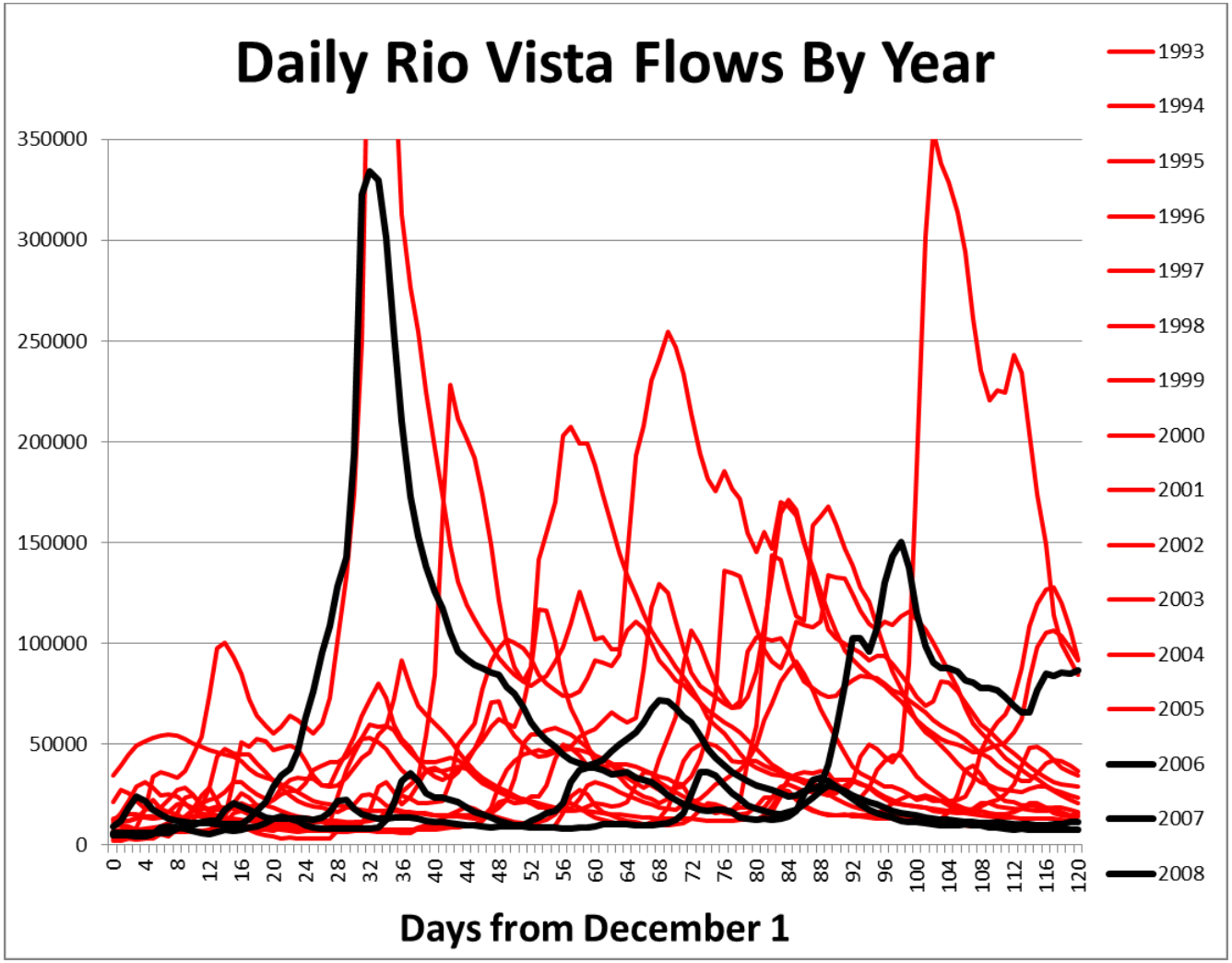
Fundamental Issues with CSI

- CSI provides no information on the <u>percentage</u> of adult smelt <u>entrained or salvaged</u>.
- CSI provides no information on the population level effects of entrainment.
- These limitations are broadly acknowledged.
- <u>This proposal does not solve these problems, but aims to generate a statistically more robust set of CSI values for use by USFWS.</u>

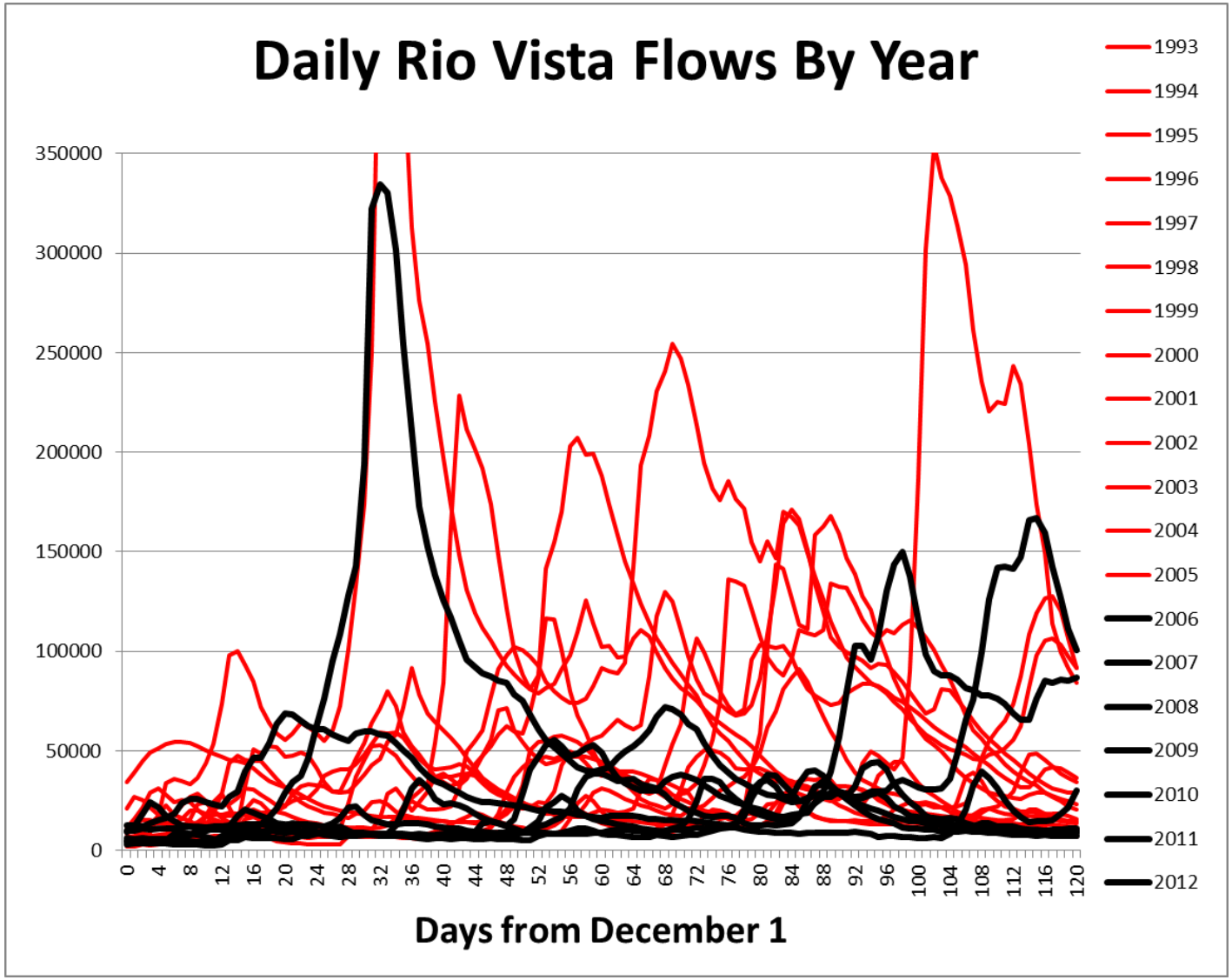
Issues Addressed by Proposal

- Need more than three data points to estimate range of RPA Compliant CSI values.
- 2006 – 2008 do not represent complexity of historical flow/ water quality patterns.

Hydrologic Variability



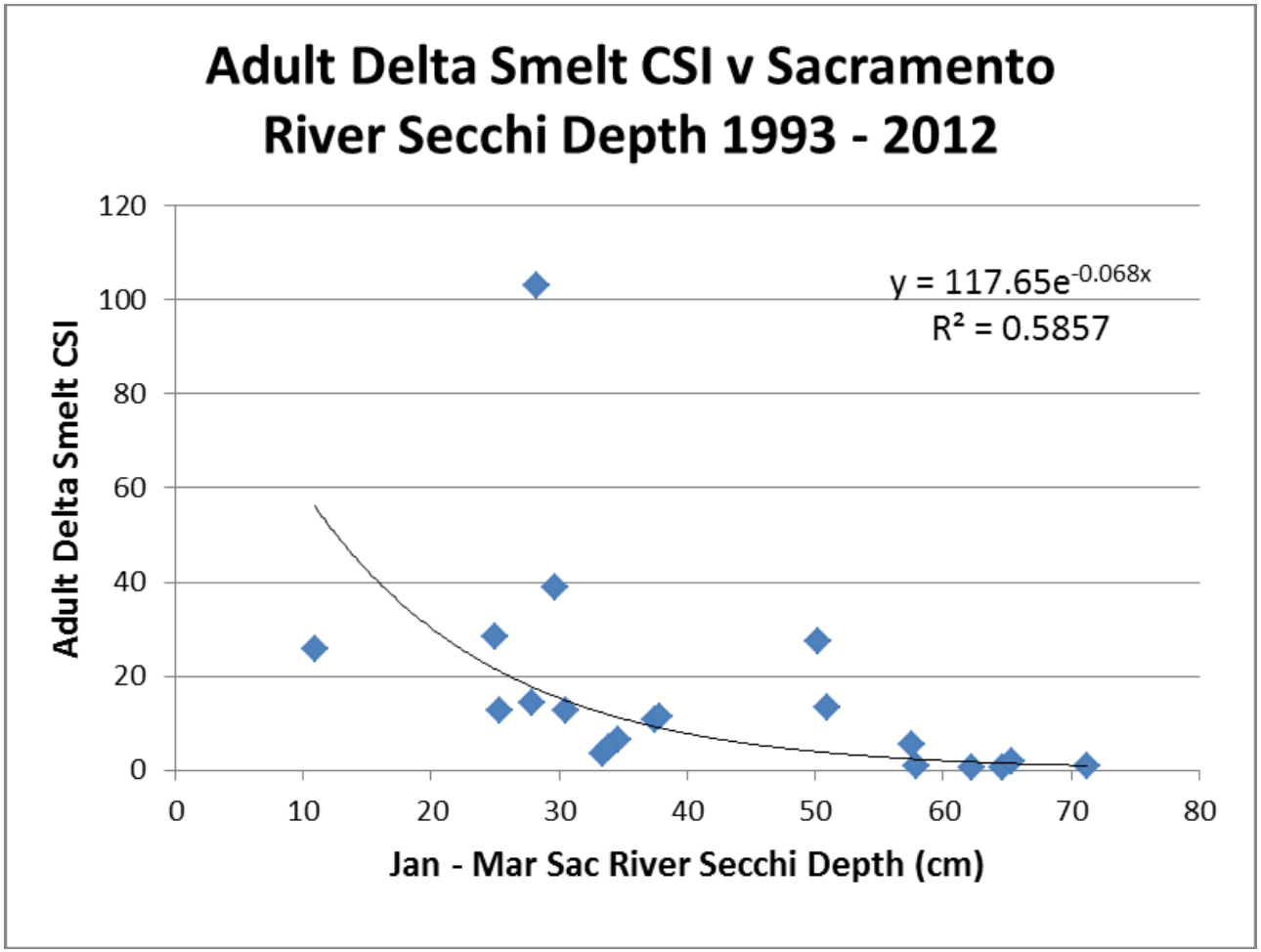
Hydrologic Variability



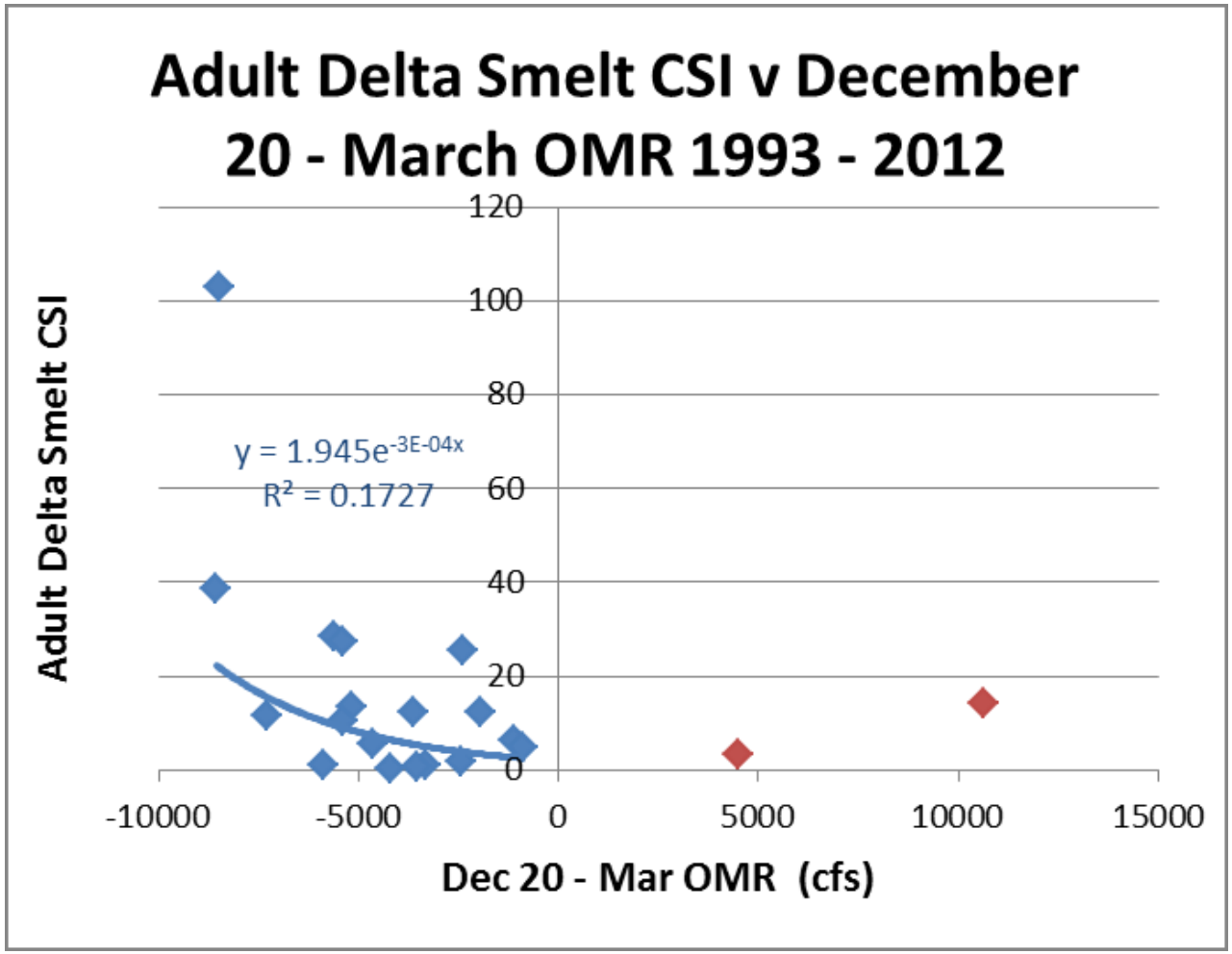
Estimating RPA Compliant CSI Values for Pre-RPA Years

- Model Historical CSI using plausibly causal variables – OMR and Secchi depth.
- Model OMR under RPA constraints
- Using CSI model, estimate historical CSI values if OMR had been limited per RPA.

CSI Relationship with Secchi Depth



CSI Relationship with OMR



Perform Multiple Regression

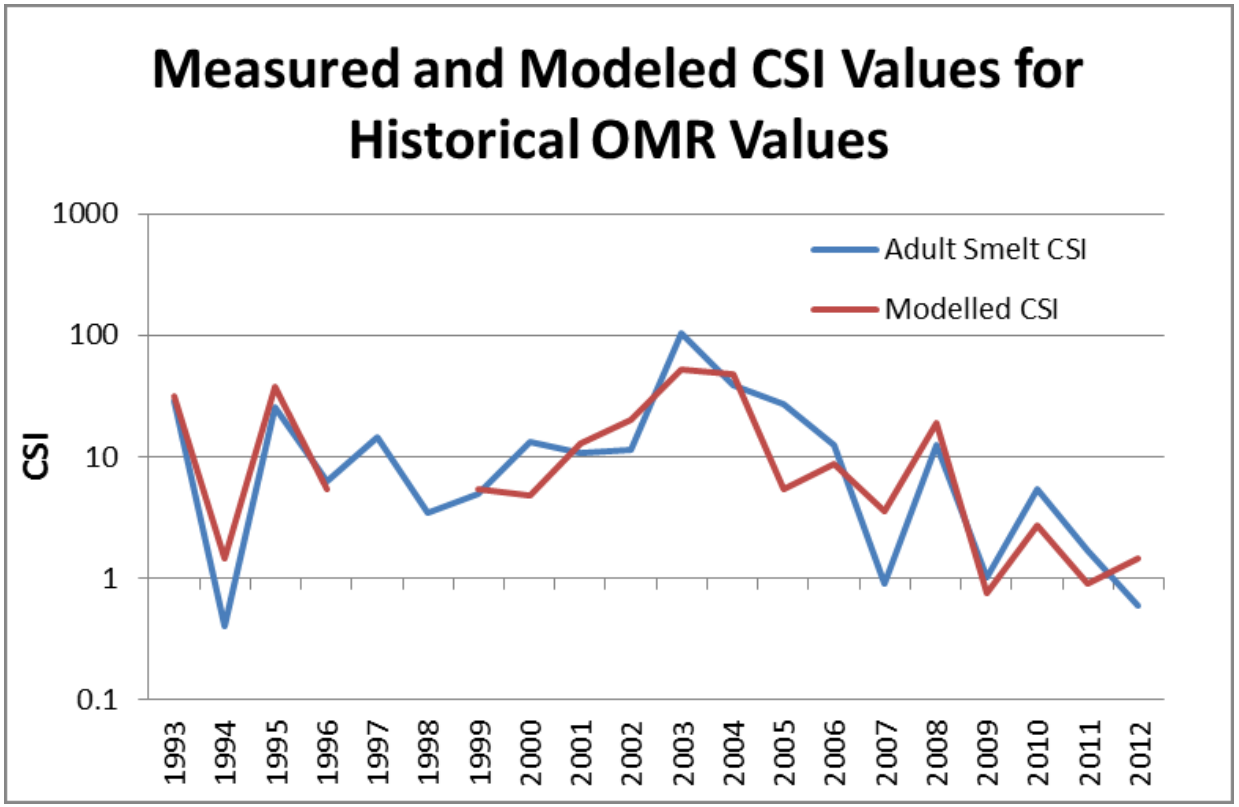
Log (CSI) = 1.641 - .0298 * Secchi depth (cm) - 0.00011 * OMR (cfs) + ε

n = 18

r2 = .75

psecchi < .00001
pOMR = .014

Standard Error = 0.36

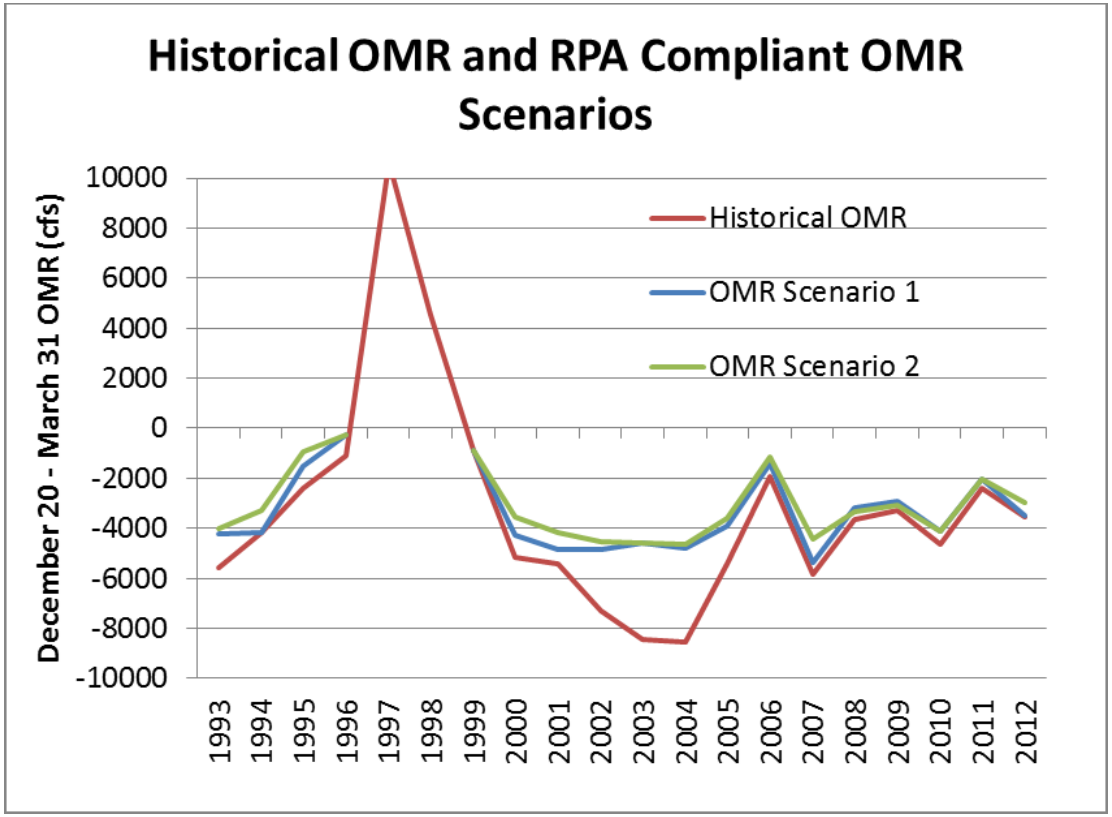


Model RPA Compliant OMR

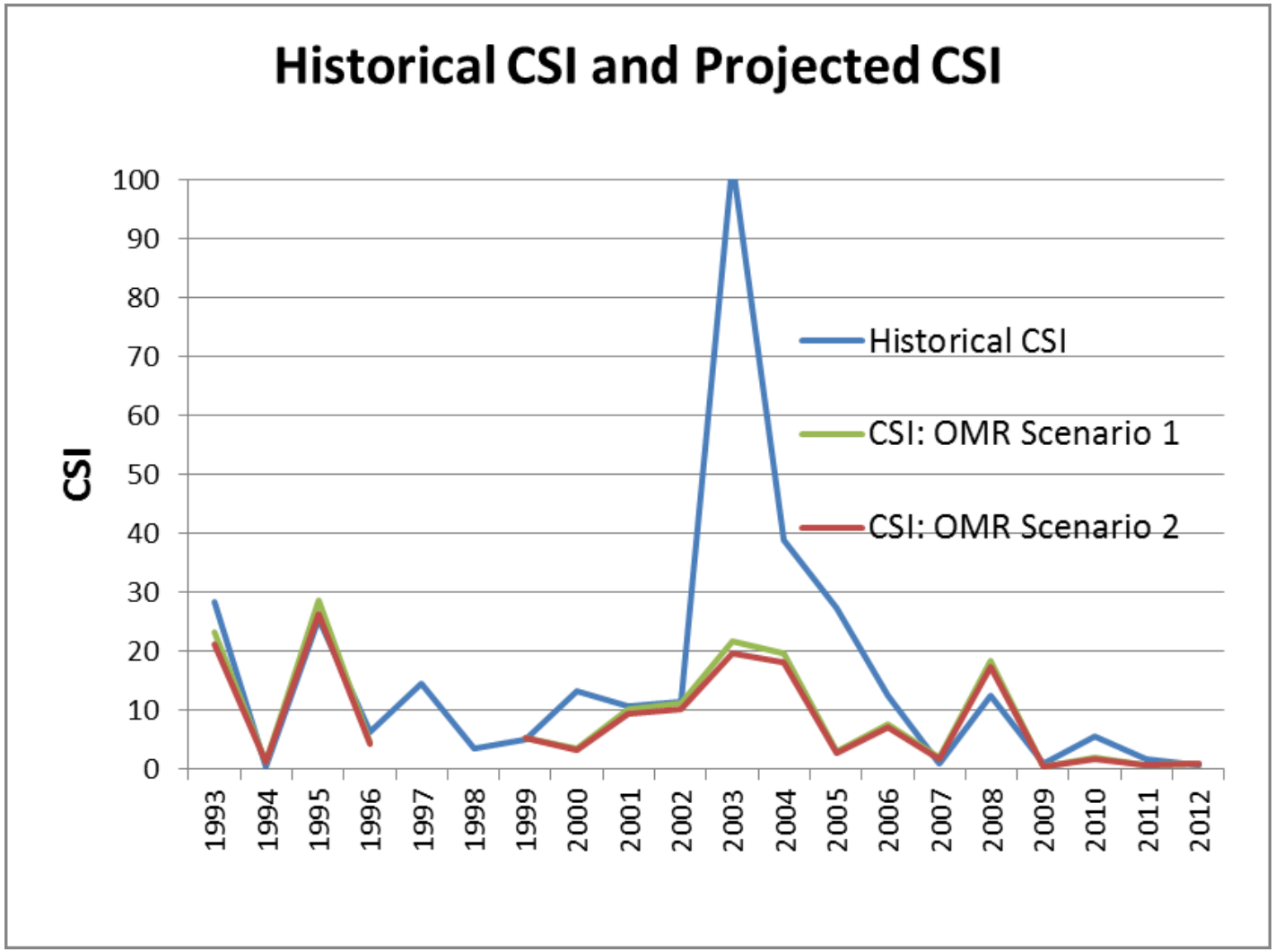
- Scenario 1. -5000 cfs limit starting December 20.
- Scenario 2. -2000 cfs for two weeks, then -5000 cfs.

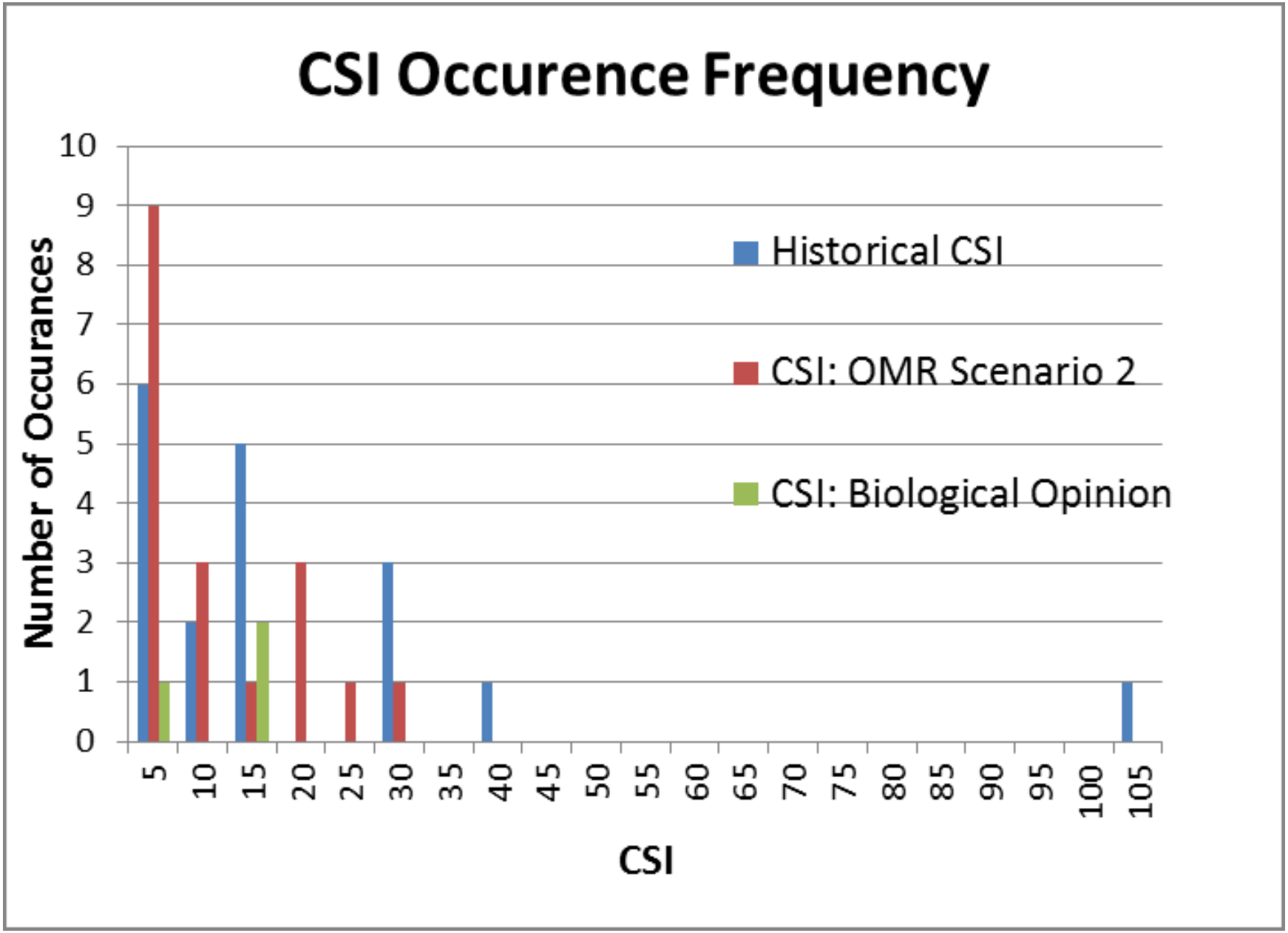
Uncertainty in results:

- Trigger dates frequently after December 20th.
- RPA allows OMR to be restricted below -5000.
- -2000 cfs action frequently not triggered at all.



Historical and Estimated CSI




CSI Occurence Frequency
Number of Occurances
0
1
2
3
4
5
6
7
8
9
10
Historical CSI
CSI: OMR Scenario 2
CSI: Biological Opinion
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
CSI

Take Home Points

- CSI is well correlated with Secchi depth and OMR.
- If ΔOMR → ΔCSI, then apply RPA Compliant OMR estimates to generate RPA Compliant CSI estimates.
- Generates 18 CSI values representing a richer spectrum of possibilities.
- Raw material for updated ITL multiplier.

End