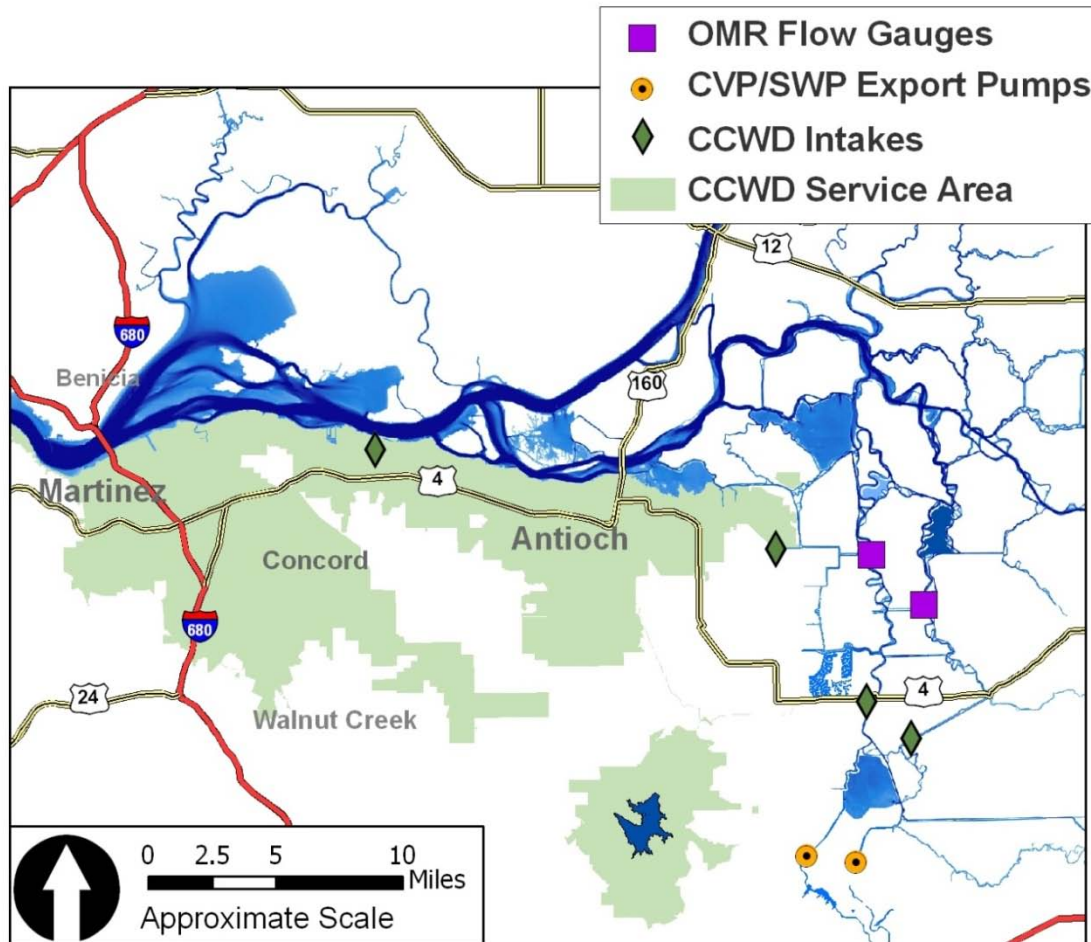


# Use of an Index for South Delta Flow Regulations

Remand Stakeholder Engagement (RSE) Process Meeting

# Contra Costa Water District



- **Location:** In-Delta diverter, serving 500,000 customers in Bay area
- **Water supply:** CCWD water rights and CVP contract
- **Permits:** CCWD operations are fully mitigated (outside OCAP):
  - operational requirements
  - state of the art fish screens

# Why use an index for OMR?

- Resolve current implementation issues
- Provide fish protection equivalent to the current method that uses USGS OMR

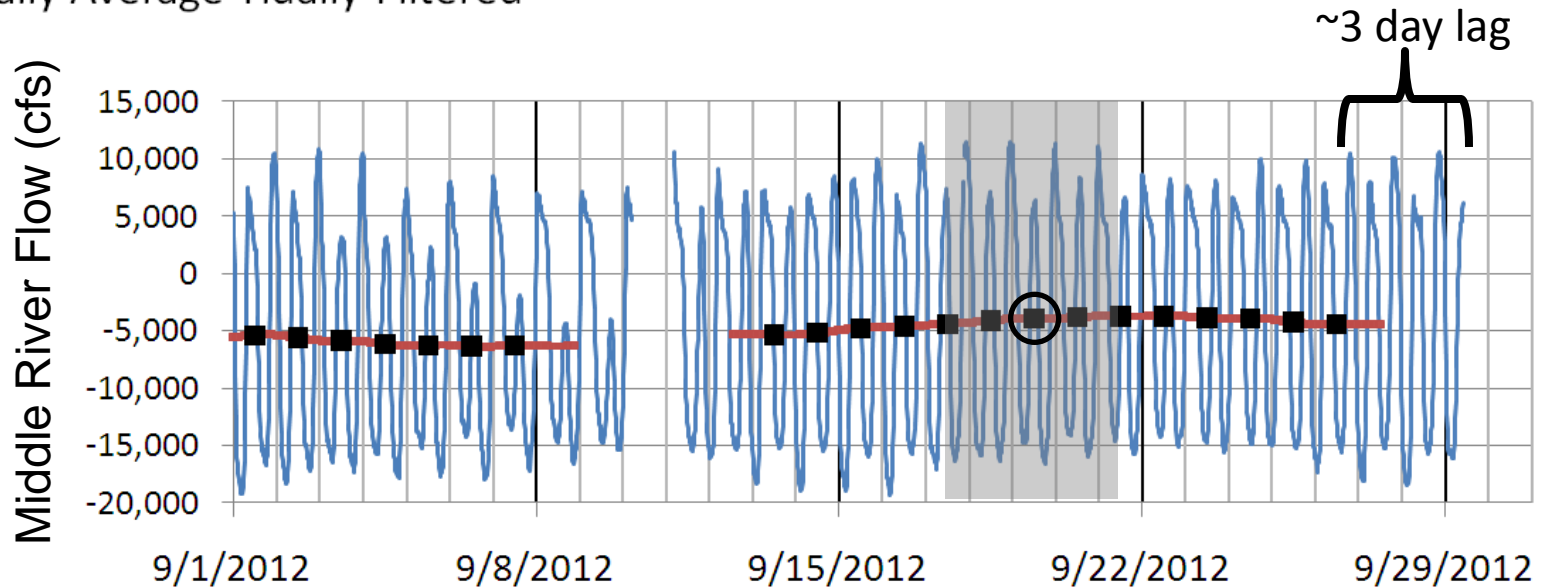


# Current Implementation Issues

- Daily values are not available in real-time
  - Artifact of the calculation

- Measurements
- Tidally Filtered
- Daily Average Tidally Filtered

Daily average tidally filtered USGS values for today depends on flows that occur in the future.



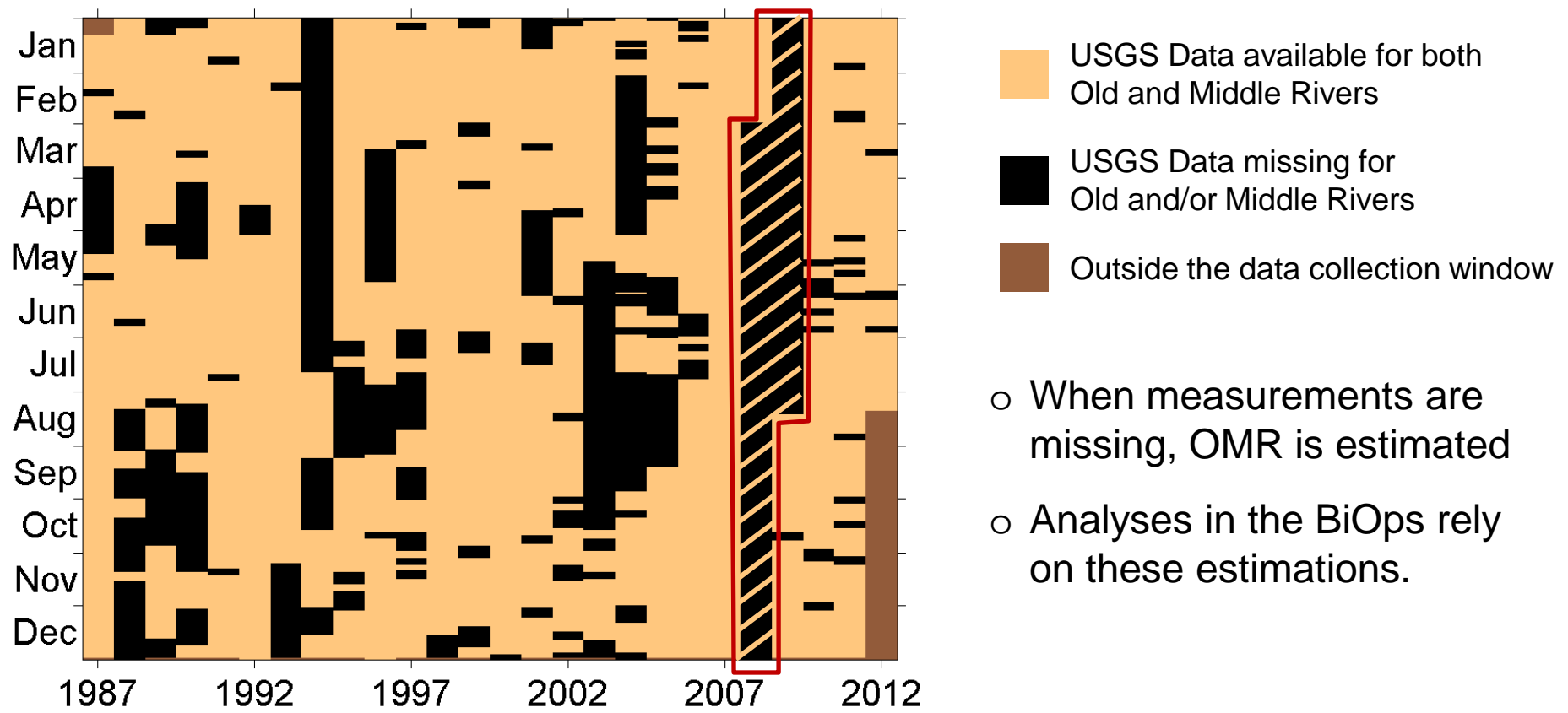
Data source: USGS station 11312676 downloaded from USGS NWIS September 29, 2012.

# Current Implementation Issues

- Daily values are not available in real-time
  - Artifact of the calculation:
    - Daily average tidally filtered USGS values for today depends on flows that occur in the future.
  - Complicates operational decisions
  - Impossible to determine compliance in real-time

# Current Implementation Issues

- Daily values are not available in real-time
- Measurements are missing over ~~26%~~ of the time



# Current Implementation Issues

- Daily values are not available in real-time
- Measurements are missing over 26% of the time
- Forecasting project operations is complicated by other factors that affect OMR
  - Noise in the measurements
  - Changes in flow due to wind, atmospheric pressure, precipitation, channel barriers and local in-Delta diversions and return flows.

# Proposed Solution

- Regulations should be based on a flow index, rather than the tidal measurements
- Benefits of a flow index
  - Based on readily available information
    - Improves operations forecasting
    - Allows determination of compliance
  - Remains representative of regional hydrodynamics
  - Remains protective of fish



# Flow Index based on readily available information

- If HORB is not installed:

$$\textit{Flow Index} = 0.42 * \overline{Q_{SJR}} - 0.87 * Q_{Exports}$$

- If HORB is installed:

$$\textit{Flow Index} = -0.79 * Q_{Exports}$$

# Flow Index remains representative of regional hydrodynamics

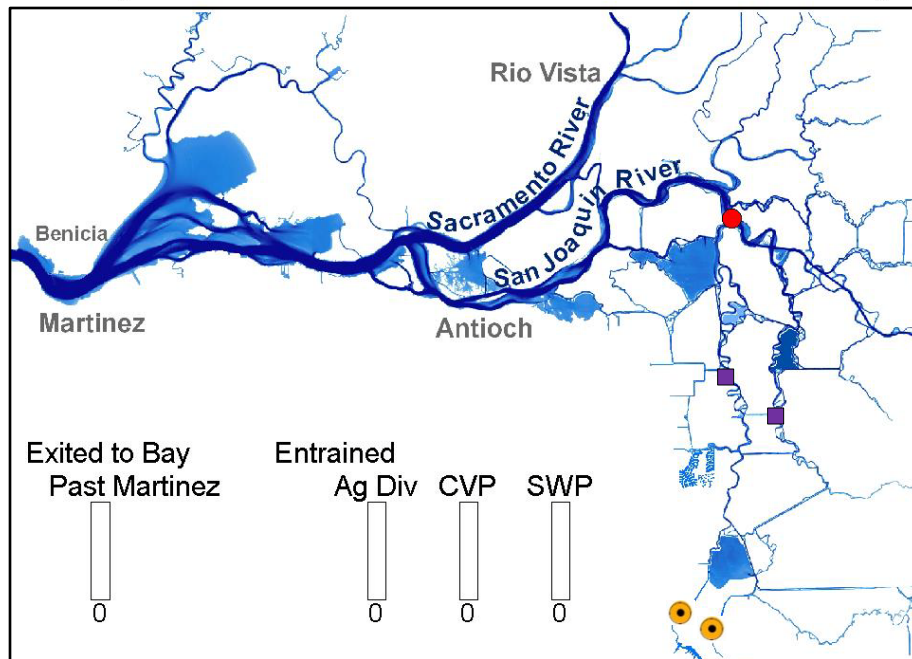
- USGS OMR is index of regional conditions
  - Derived from tidal flow measurements at two locations
  - Filtering incorporates future conditions
- Particle Tracking Model (PTM) provides a more comprehensive representation of regional hydrodynamics, so we examine PTM results under different OMR values.

# Particle Tracking Simulations

USGS OMR = -4,600 cfs

Mar.01, 2007

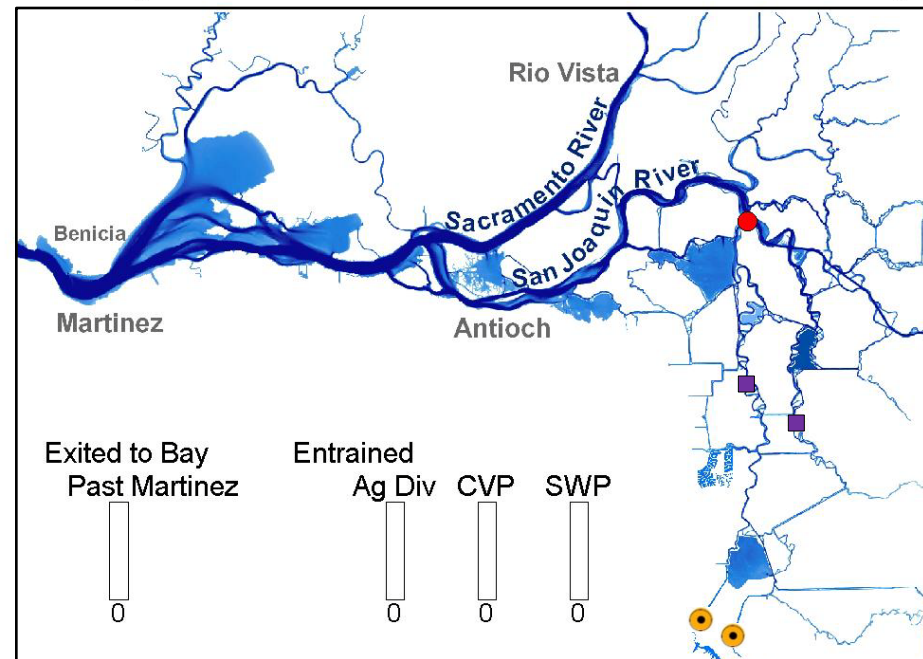
0 Days



USGS OMR = -4,850 cfs

Jan.01, 2011

0 Days



Model assumptions:

- historical inflows and tides
- release 1000 particles over 25 hour period (2 tidal cycles)

# Particle Tracking Simulations

USGS OMR = -4,600 cfs

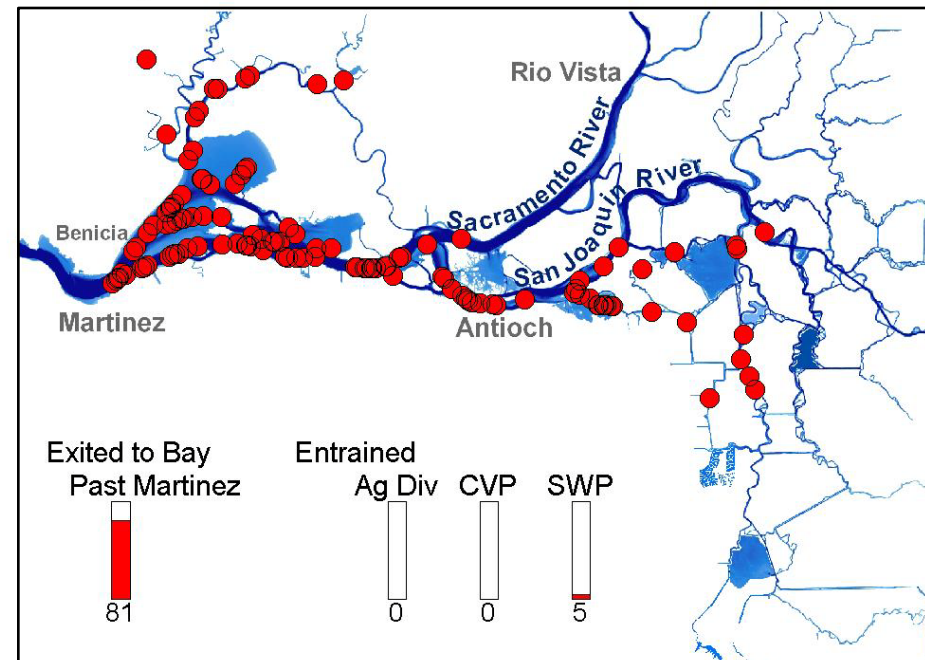
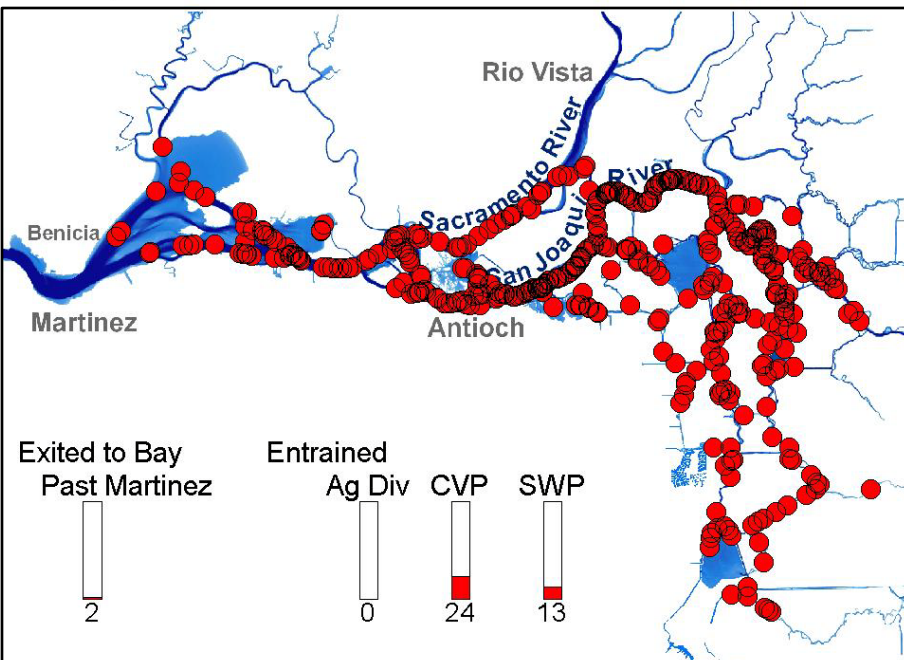
USGS OMR = -4,850 cfs

Mar.01, 2007

21 Days, 0 Hours

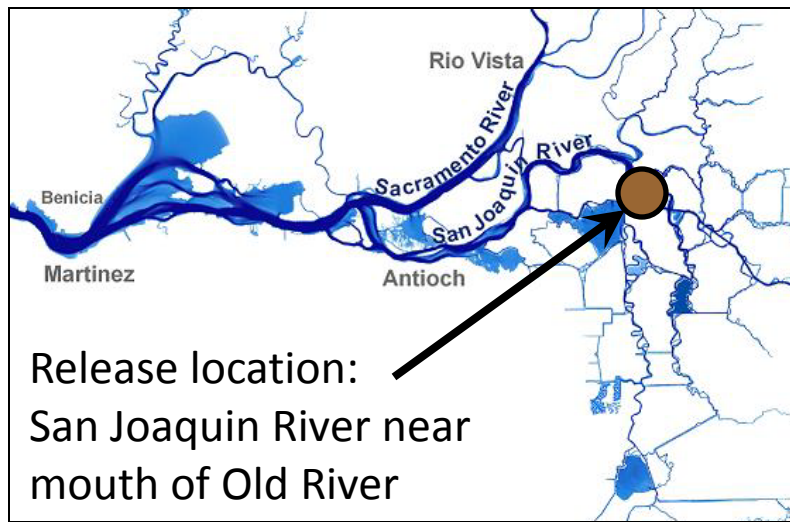
Jan.01, 2011

21 Days, 0 Hours

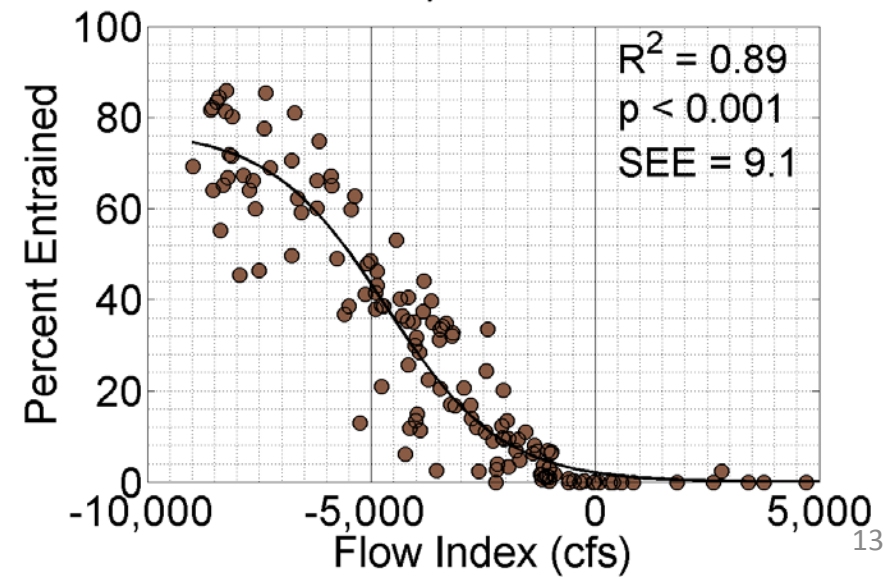
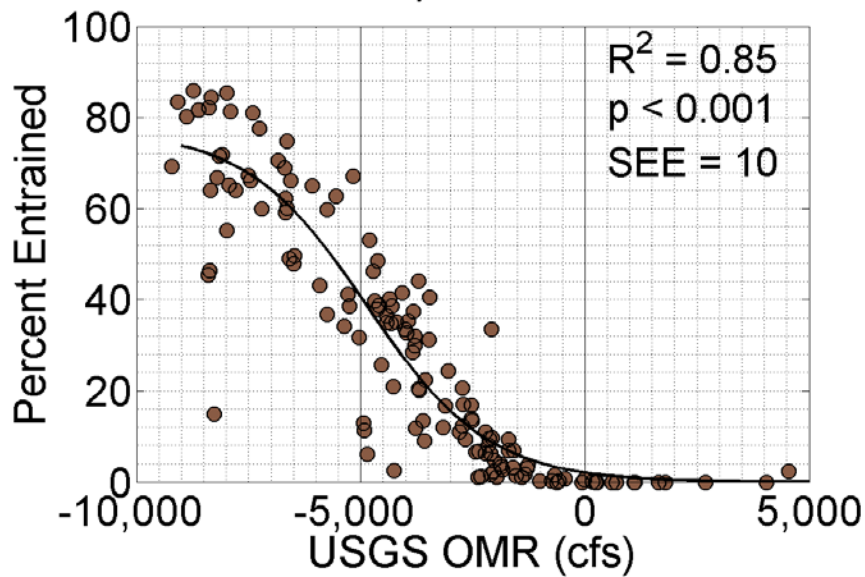


Two time periods with very similar OMR values show very different particle transport.

# Flow Index reflects regional hydrodynamics

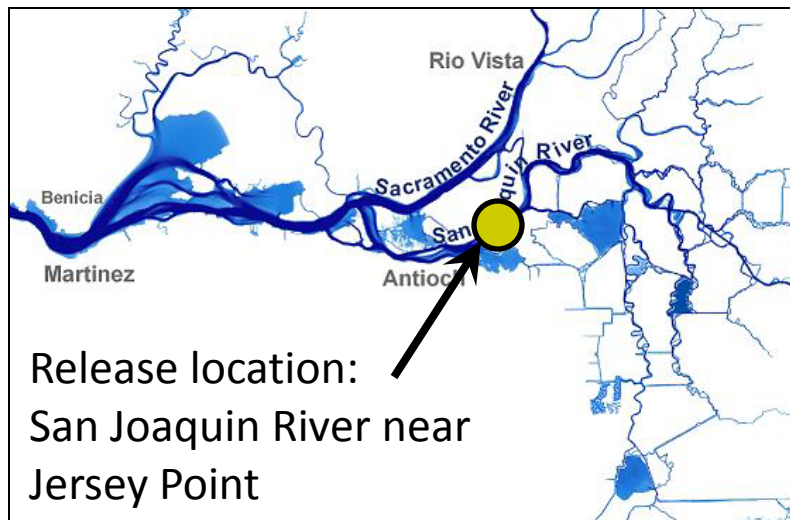


- Entrainment increases as USGS OMR become more negative
- Considerable scatter such that a given OMR does not precisely predict entrainment
- Flow index is just as good a predictor as USGS OMR

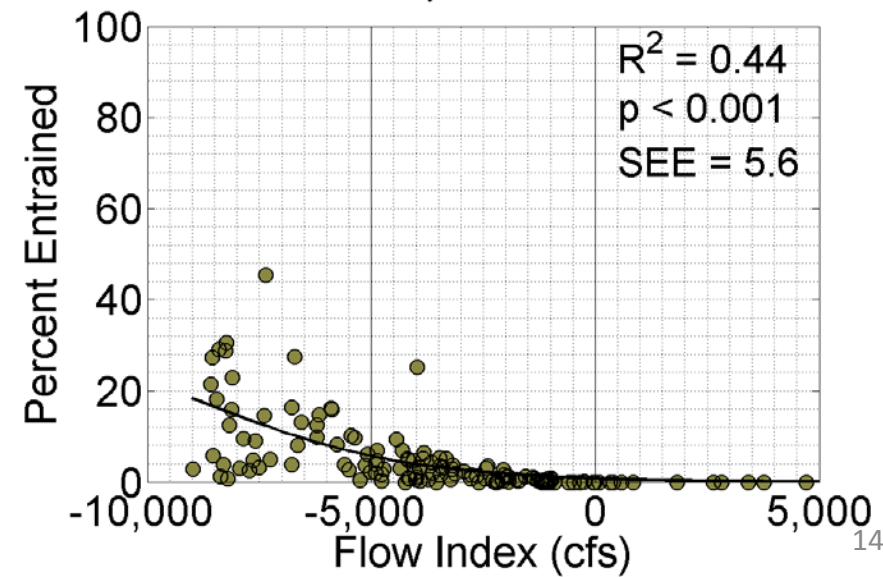
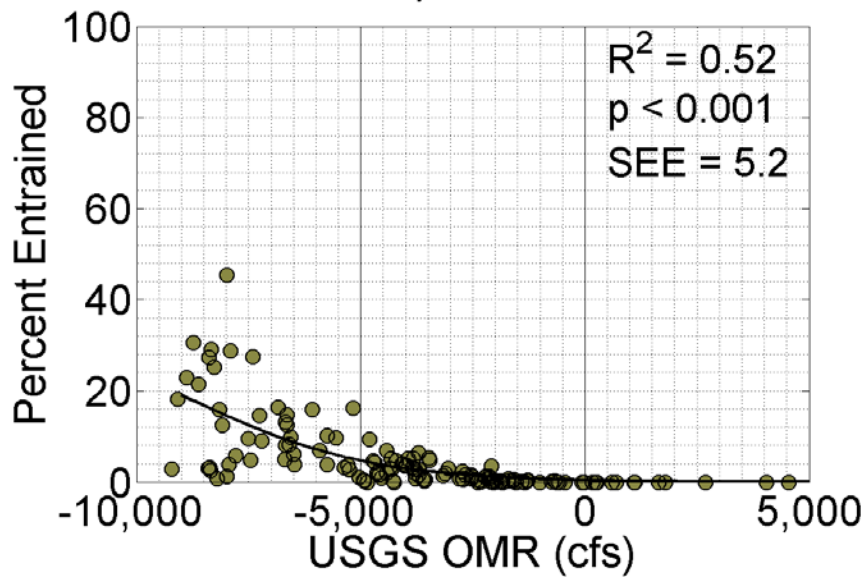




# Flow Index reflects regional hydrodynamics



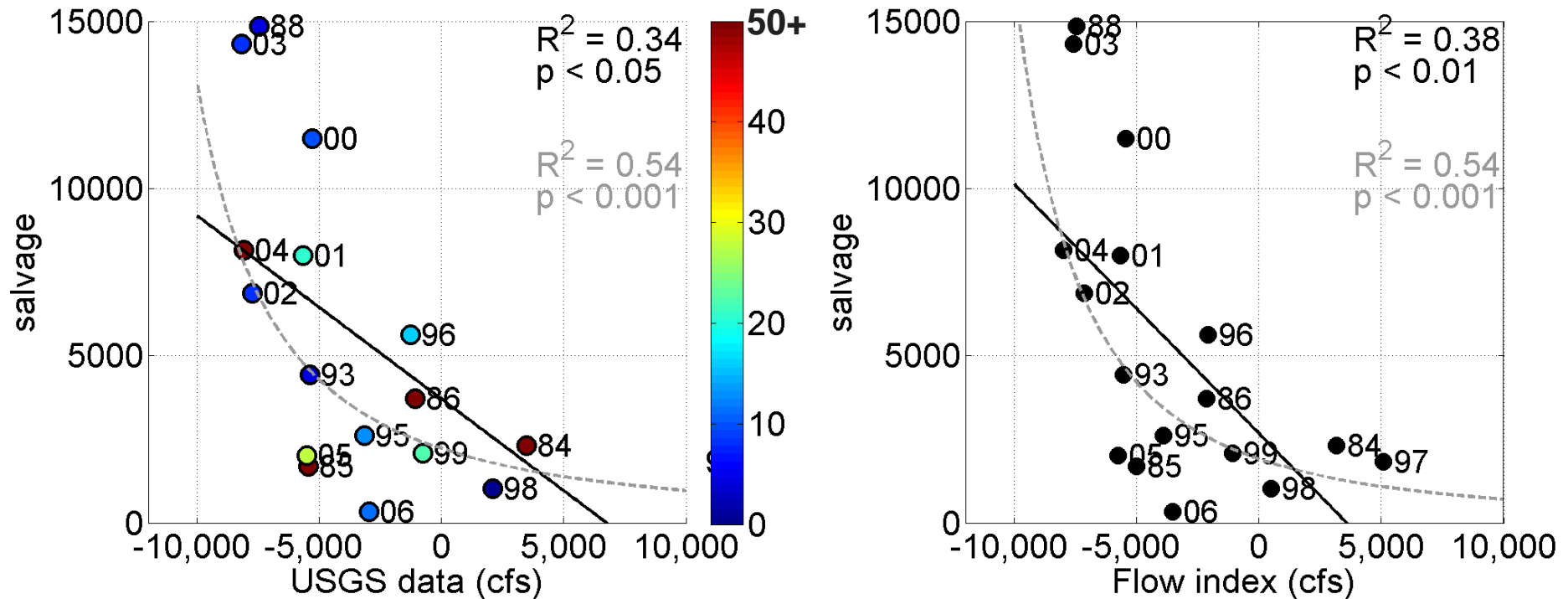
- As the particle release point gets further away, entrainment is less likely and OMR accounts for less variability.





# Flow Index remains protective of adult delta smelt

Salvage as a function of flow

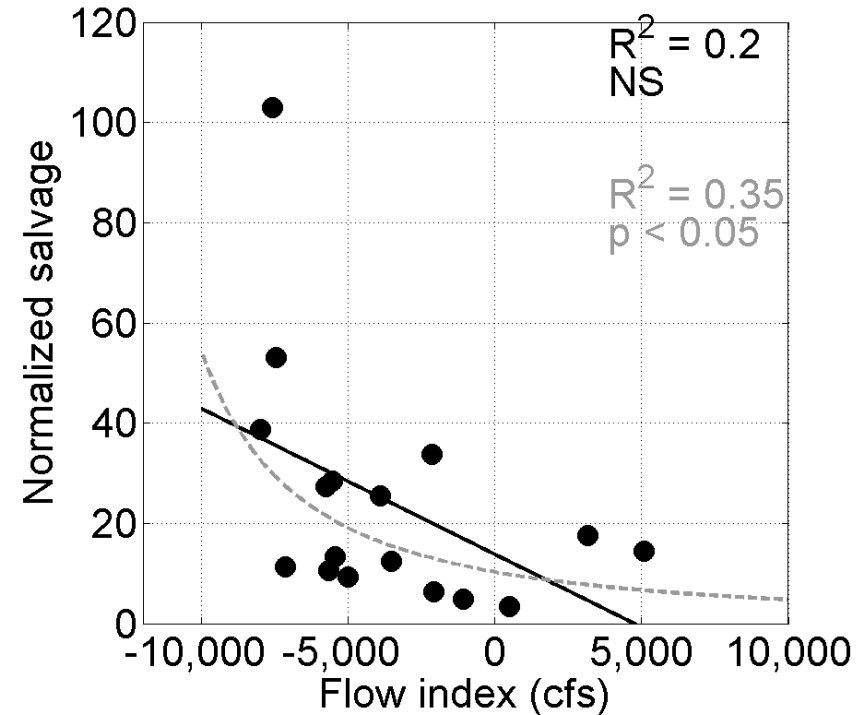
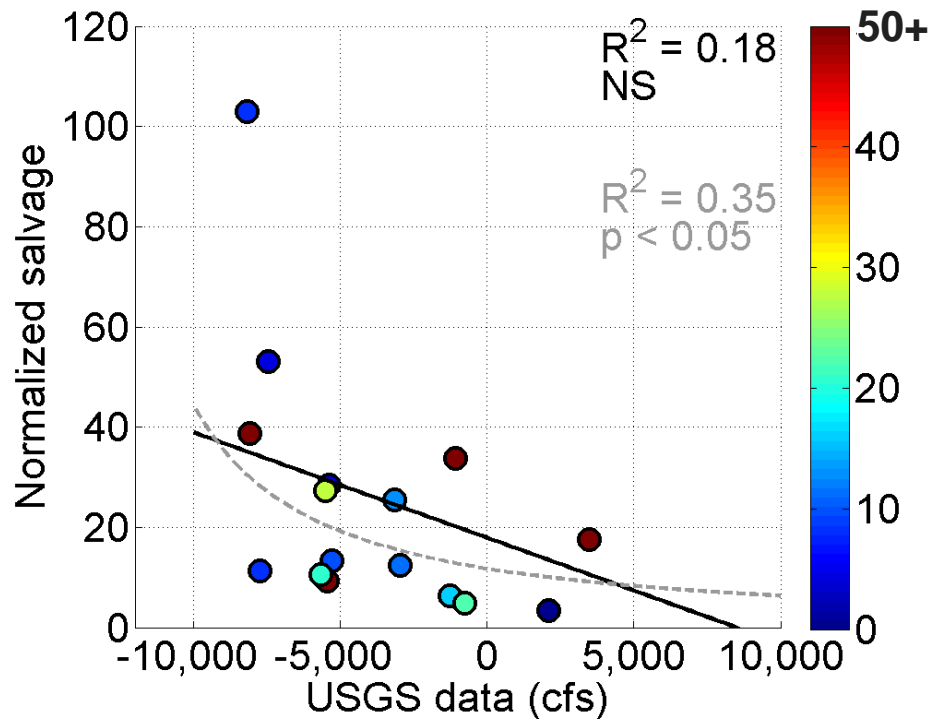


Based on Figure S-8 from 2008 USFWS BiOp  
Years colored by percent estimated (Dec-Mar)

Statistical relationship with the Index is as good as or better than USGS OMR.

# Flow Index remains protective of adult delta smelt

Normalized salvage as a function of flow



Based on Figure S-8 from 2008 USFWS BiOp  
Years colored by percent estimated (Dec-Mar)

Statistical relationship with the Index is as good as USGS OMR.

# Conclusions and Next Steps

- **Conclusion**

- Index solves operational and transparency issues
- Index provides a level of protection for listed fish species equal to that of the USGS OMR.

- **Next Steps**

- Conduct additional analyses and refine the flow index, as appropriate
- Conduct an experiment for WY 2013

# Questions

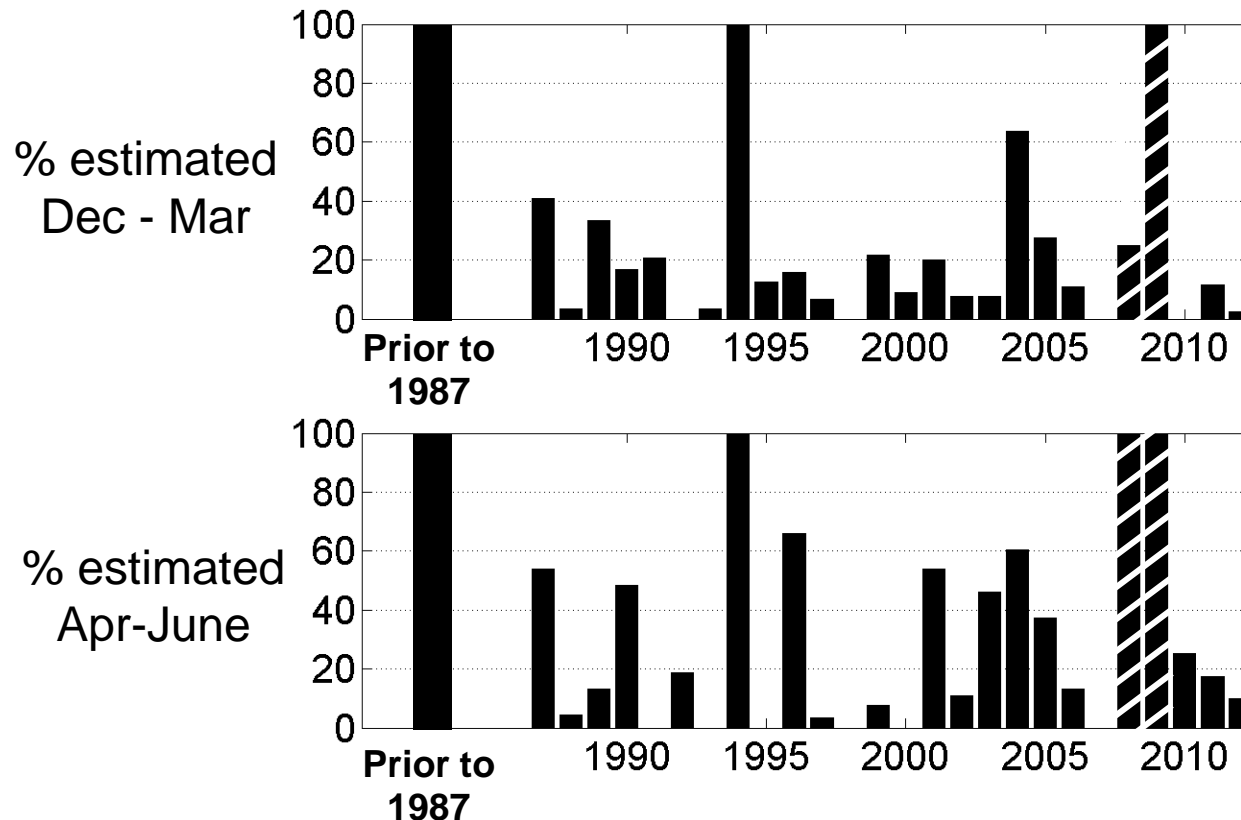
- Frequency and duration of gaps in gage data?
- Is the index a better predictive tool?
- Differences in species protective actions?
- How can the index be modified as the landscape changes?
- How will CCWD be affected?

# Extra Slides

# Questions

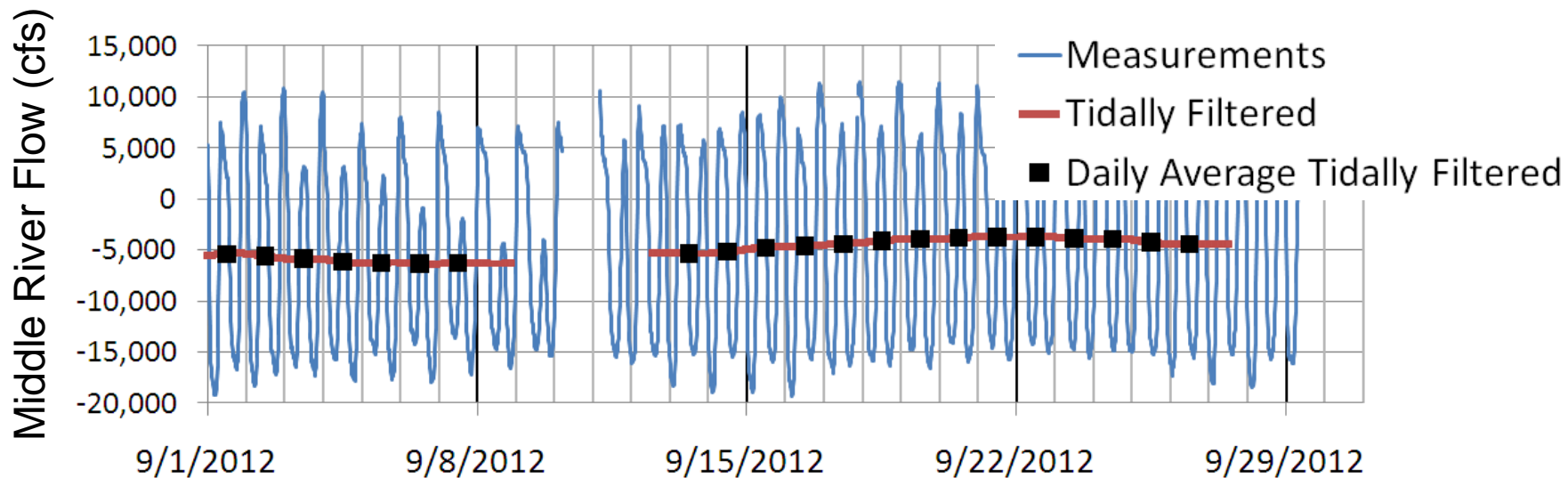
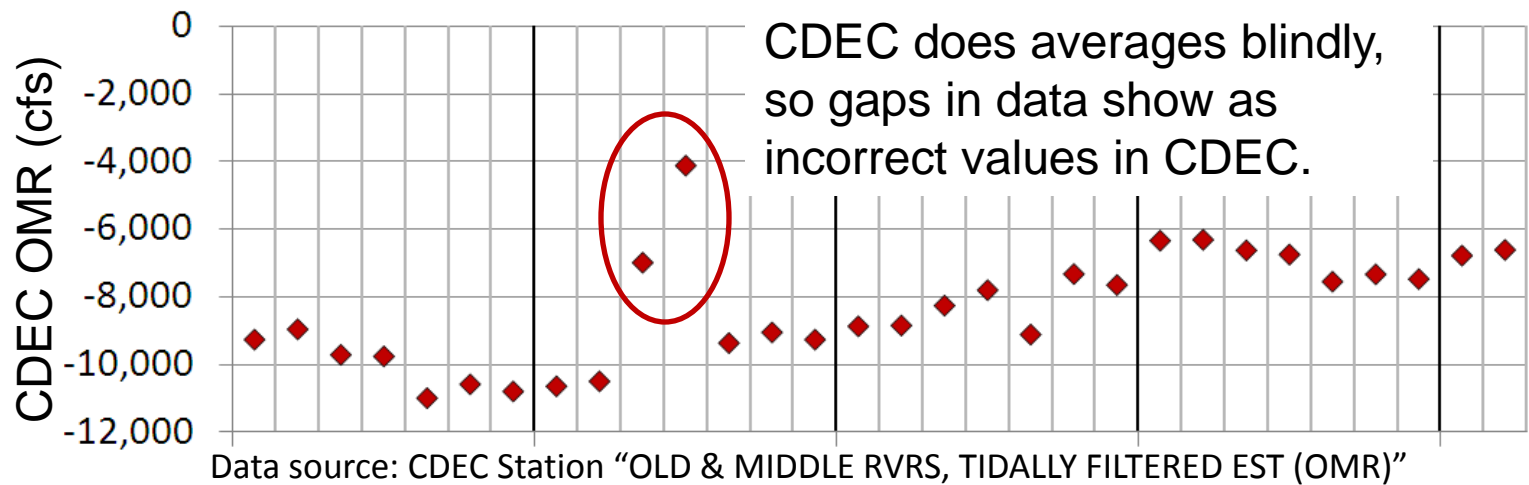
- Frequency and duration of gaps in gage data?

Percent of time when OMR is estimated in BiOp datasets.





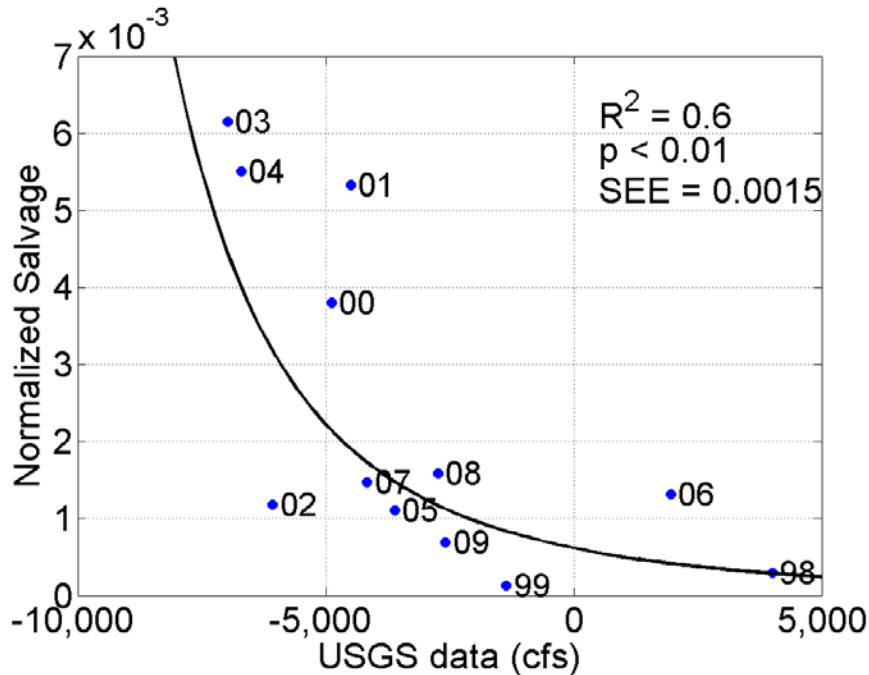
# Current Implementation Issues



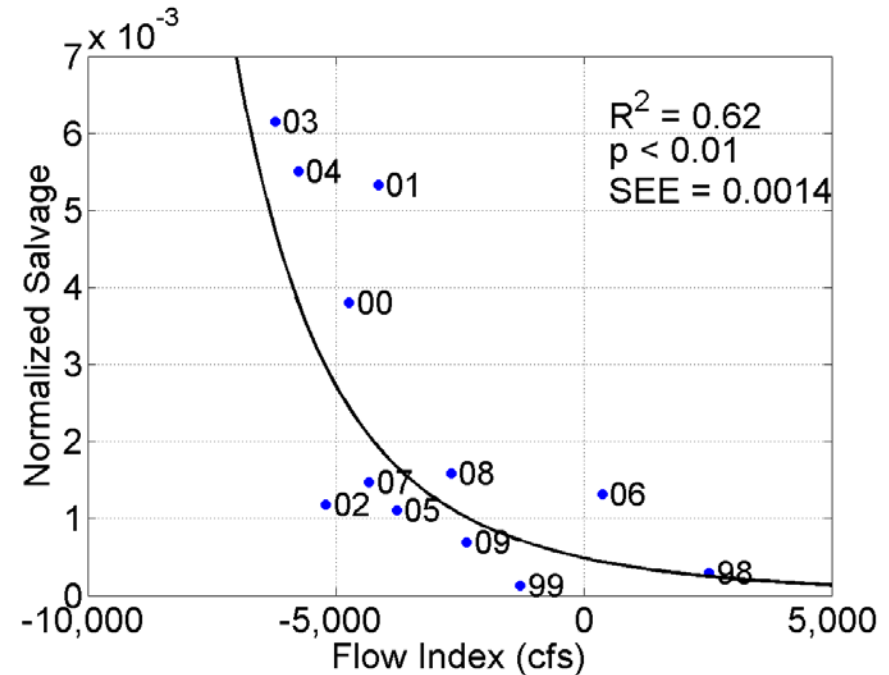
Data source: USGS station 11312676 downloaded from USGS NWIS September 29, 2012.

# Flow Index remains protective of steelhead

Seasonal aggregate of normalized hatchery steelhead salvage as a function of flows



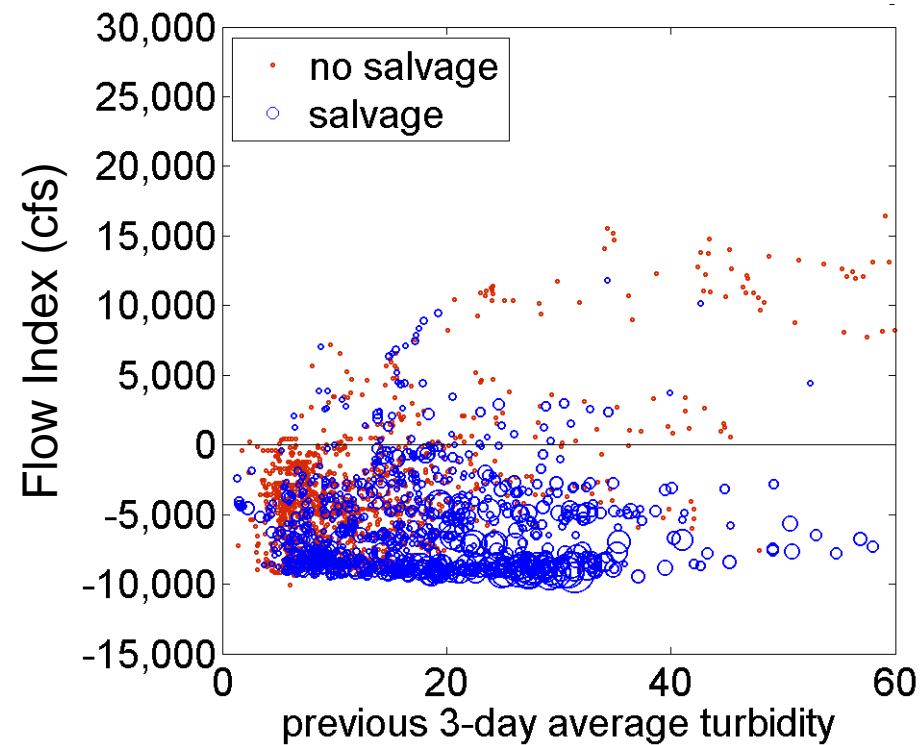
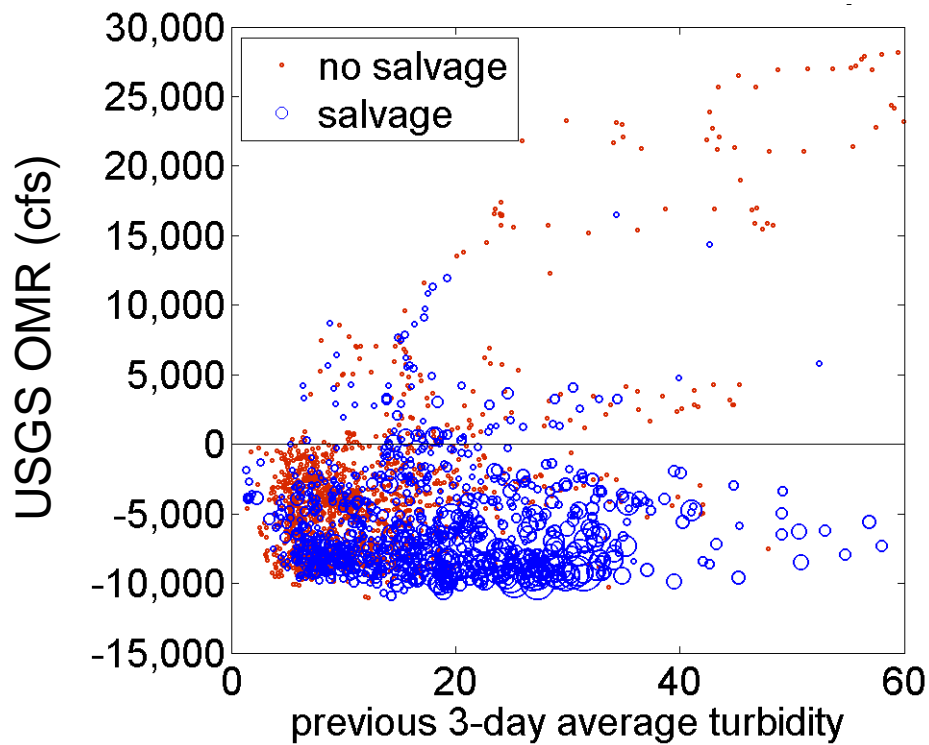
Analysis based on Grimaldo (2012)



Flow Index is just as predictive as USGS OMR

# Flow Index remains protective of adult delta smelt

Normalized salvage (shown as size of bubble) as a function of flow and turbidity

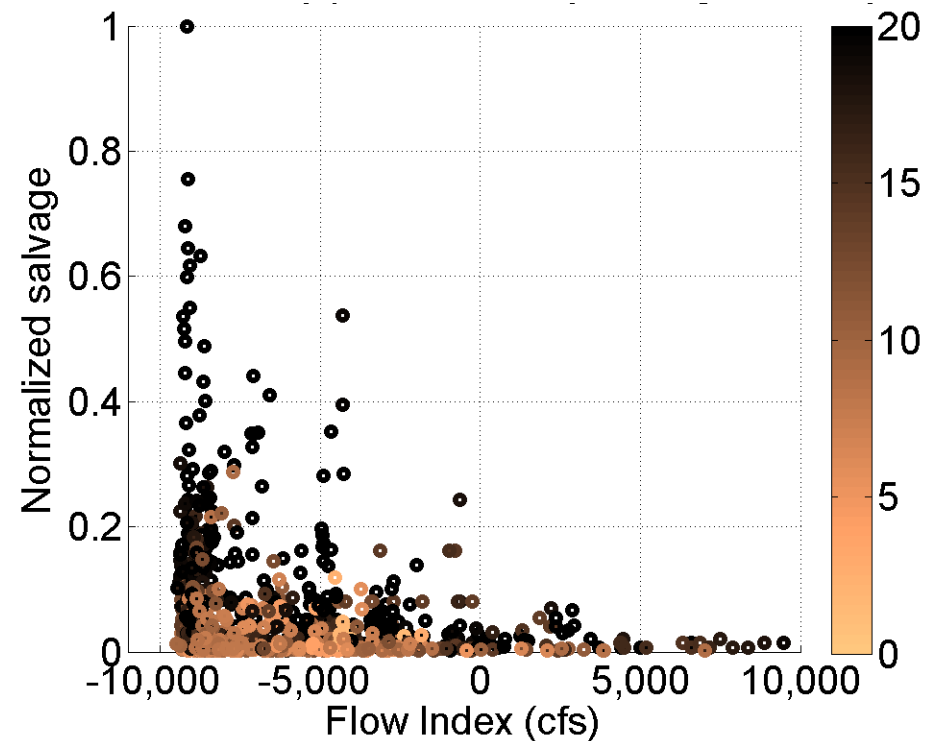
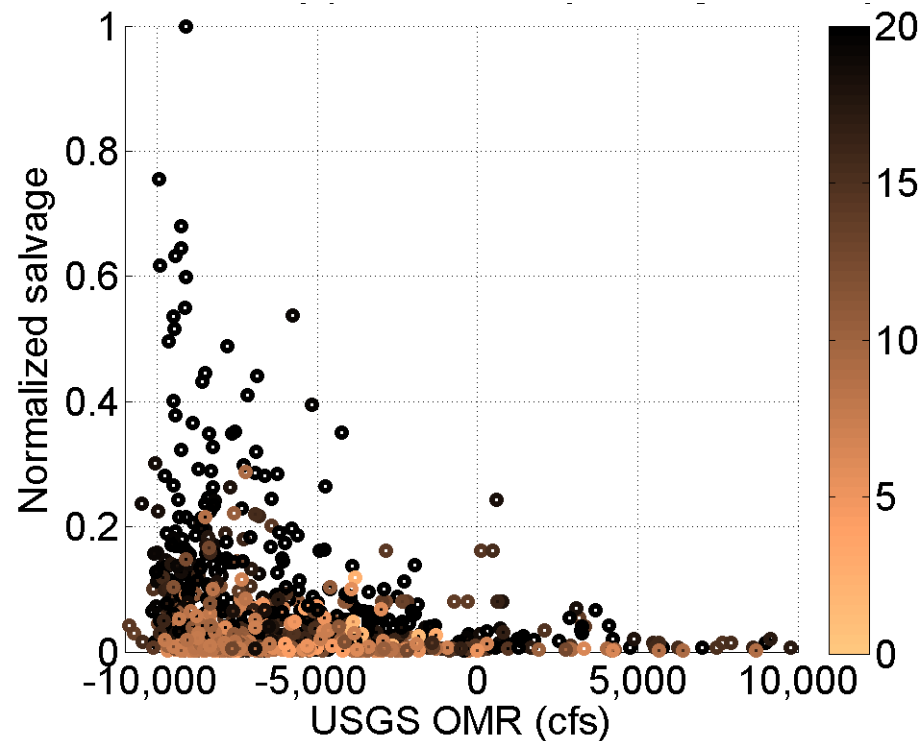


Recreation of Figure 45 from 2011 USFWS BiOp

Flow Index appears to reduce scatter.

# Flow Index remains protective of adult delta smelt

Normalized salvage as a function of flow and turbidity  
Data colored by prior 3-day average turbidity (NTU)



Flow Index appears to reduce scatter.