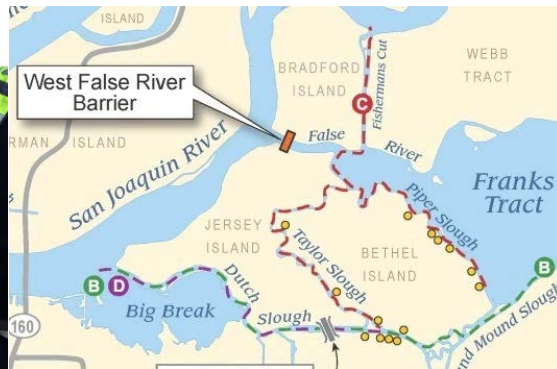


# High speed mapping of water quality with simultaneous water isotopes to determine effects of the emergency drought barrier.

Bryan Downing, Brian Bergamaschi, Katy O'Donnell, Scott Nagel, Elizabeth Stumpner and Travis von Dessonneck

2016 Bay Delta Conference Sacramento, CA. November 15-17.



# Drought Barrier Hypotheses

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\*\*EDB blocked tidal exchange through the False River...

1. Decrease salinity to the Central Delta?
2. Result in changes to water quality, nutrients, and phytoplankton?
3. Changes in residence time east, and SE of Franks Tract?

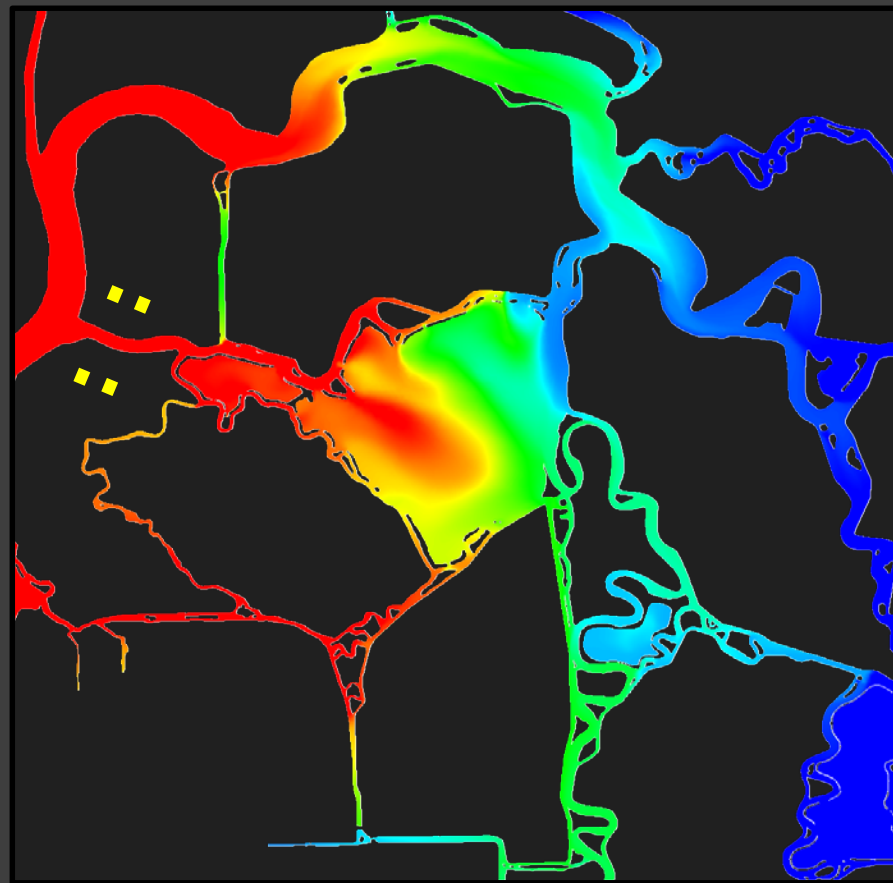
# High Speed Mapping

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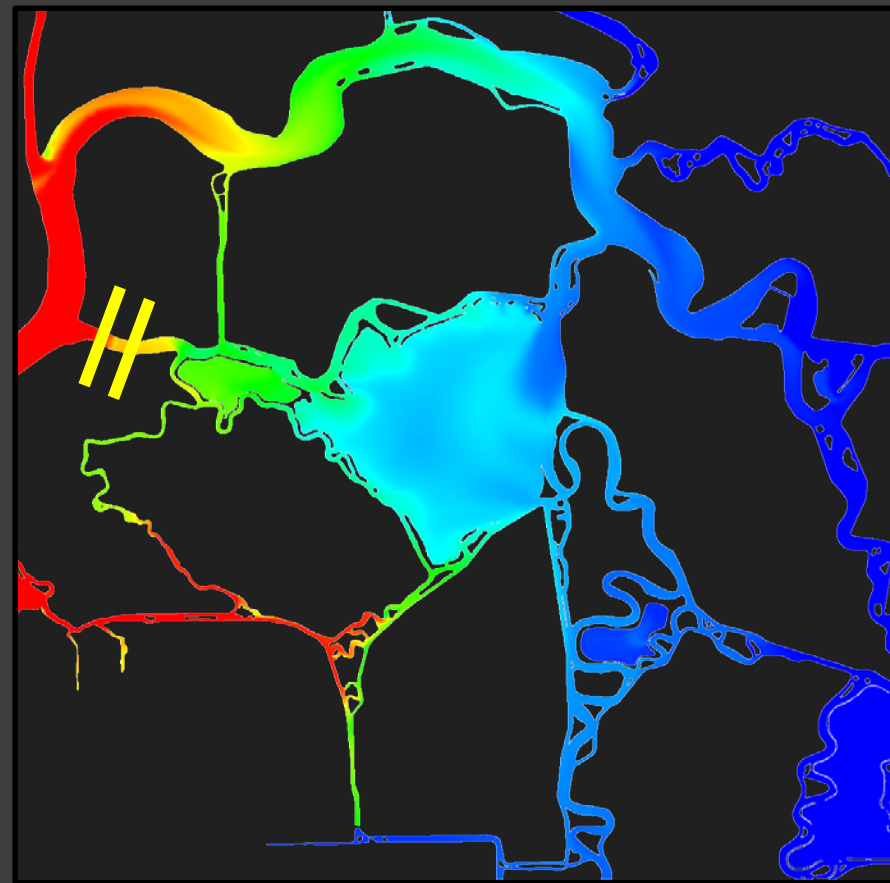
Since water quality conditions vary in the Delta spatiotemporally, confounded by hydrodynamics and interaction with Delta landscape changes...

1. High speed (2- 20 mph) boat measurements made over short time scale (hours).
2. Resolve changes associated with tidal forcings (flood, ebb and slack tides).
3. Collect temporal snap shots of conditions over broad spatial scales (tens of miles)

# Barrier Prevents Salt Intrusion - Flood

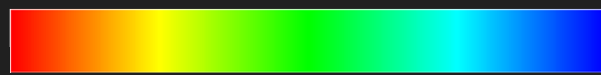


Barrier Out



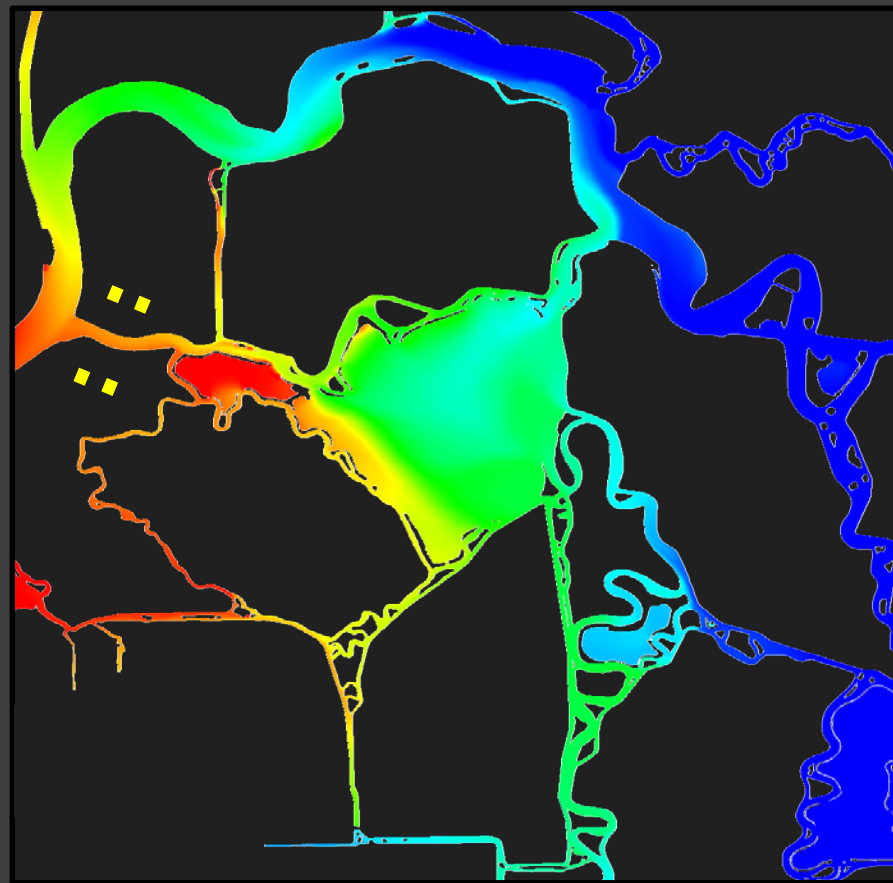
Barrier In

Salty

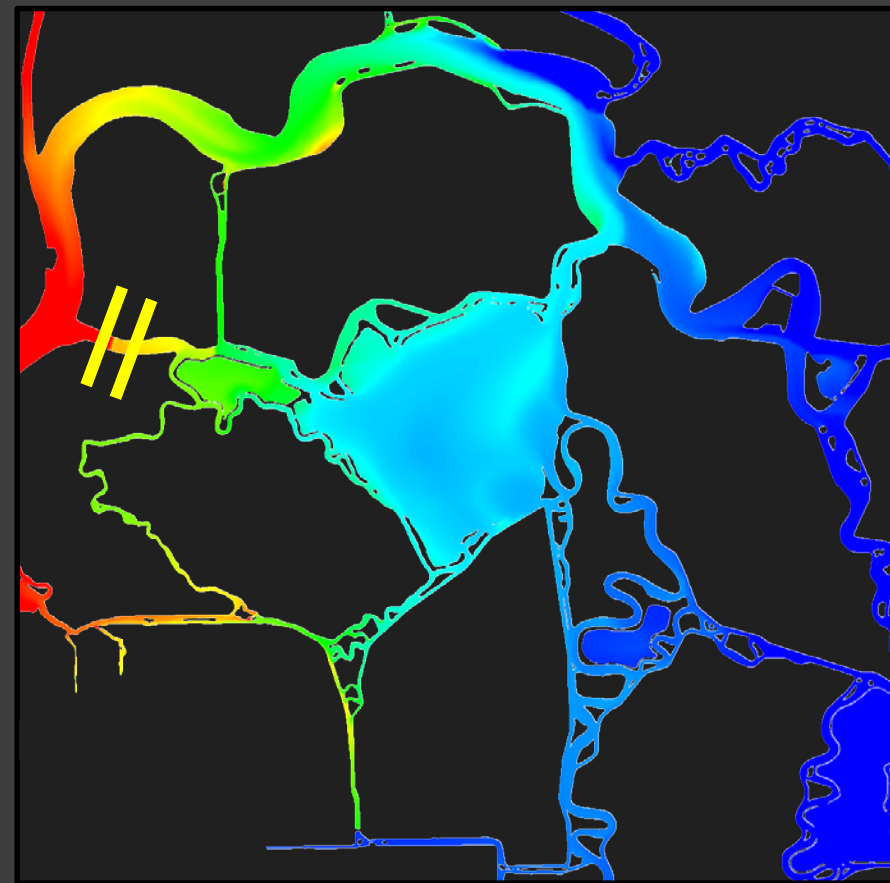


Fresh

# Barrier Prevents Salt Intrusion - Ebb

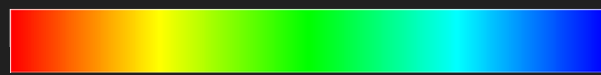


Barrier Out



Barrier In

Salty



Fresh



# High speed mapping April 18, 2016...



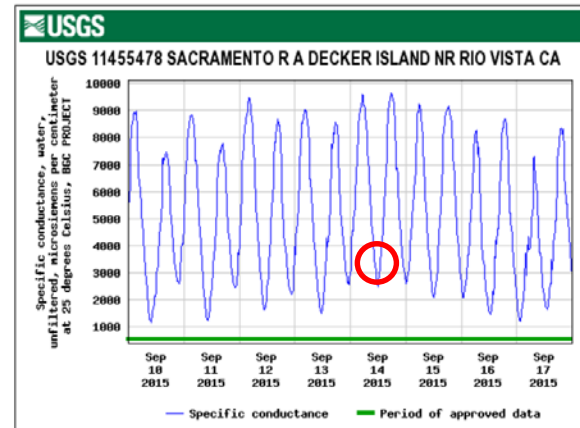
4/18/2016	2:37	4.15H
	9:01	0.44L
	2:38	3.51H

# Conductivity (uS/cm)

Sept 14, 2015

Cond (uS/c...  
200 3000

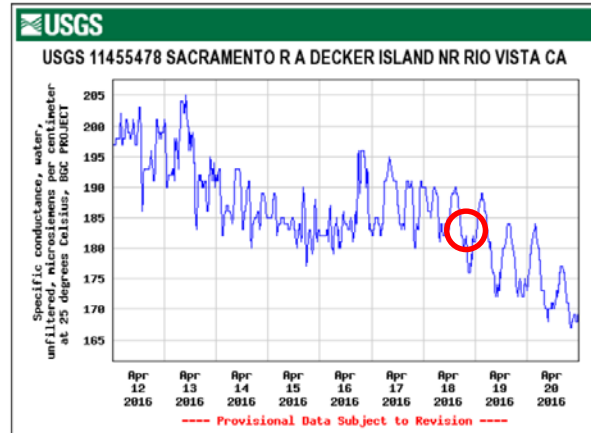
(0% normal snowpack)



April 18, 2016

Cond (uS/c...  
200.0 300.0

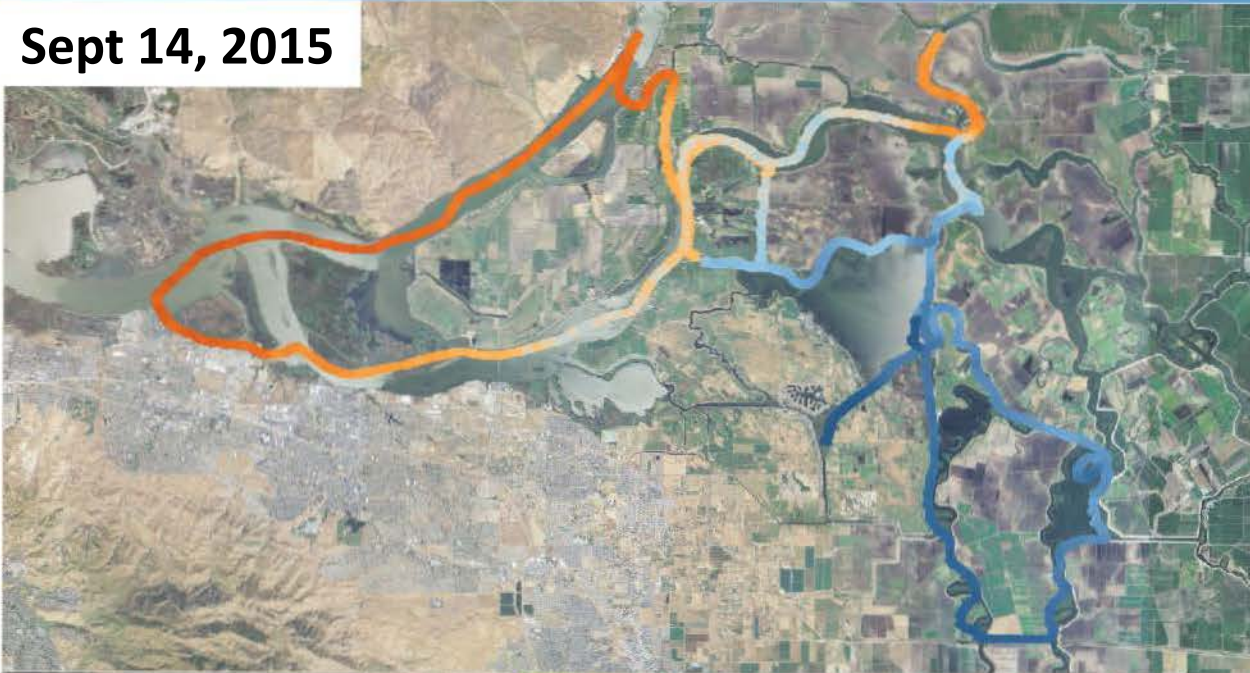
(80% normal snowpack)



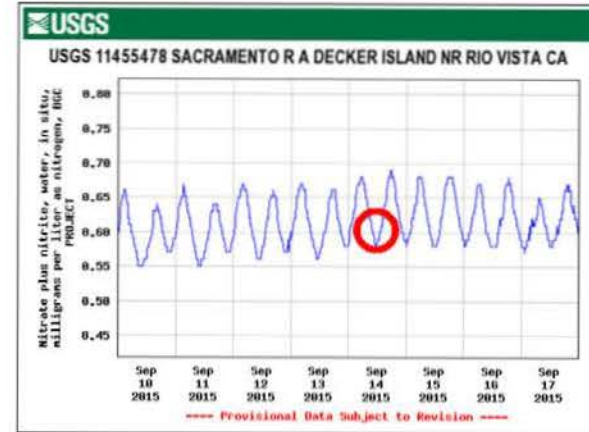


# Nitrate (mg/L)

Sept 14, 2015



NO3 mg/L  
0.1 0.5



April 18, 2016

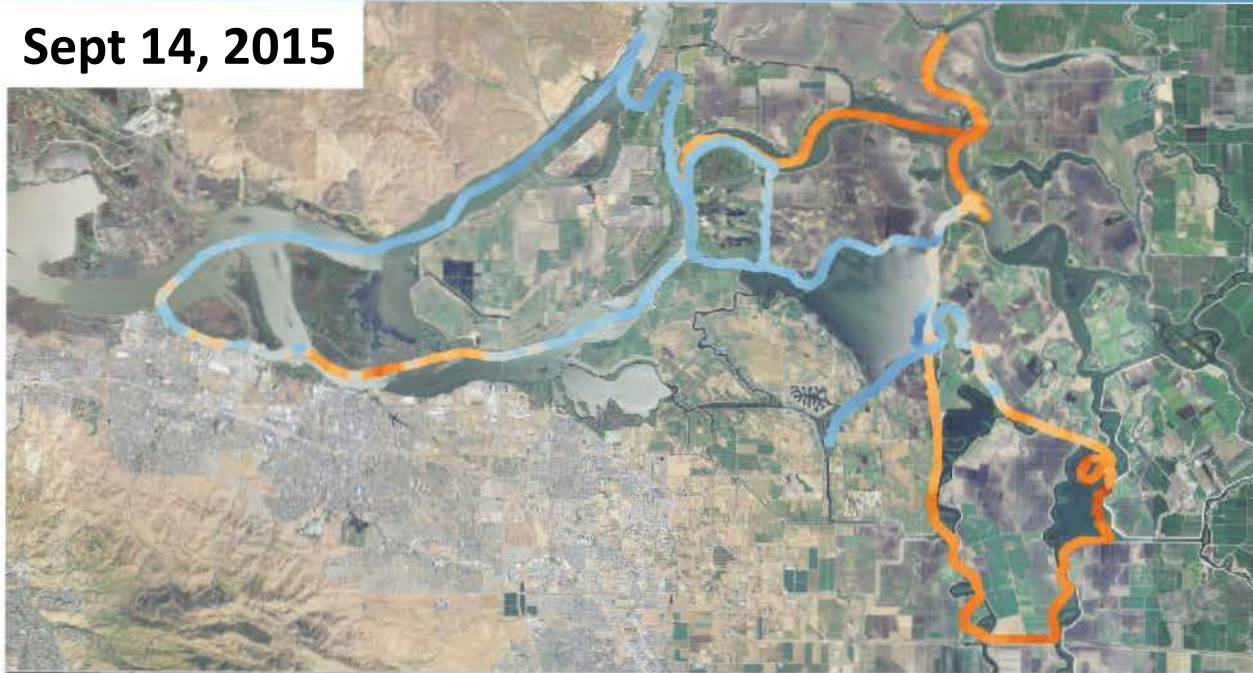


NO3 mg/L  
0.1 0.5

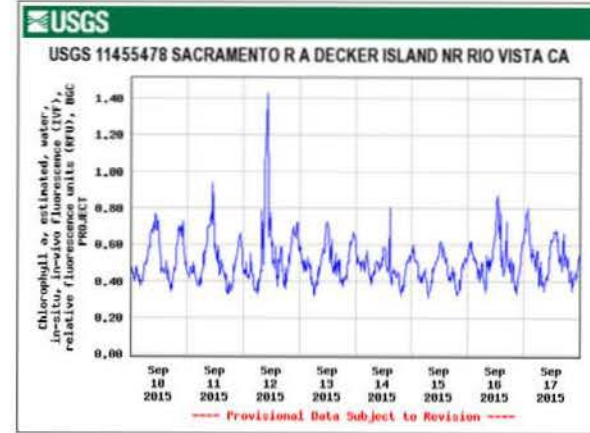


# Chlorophyll-a (ug/L)

Sept 14, 2015



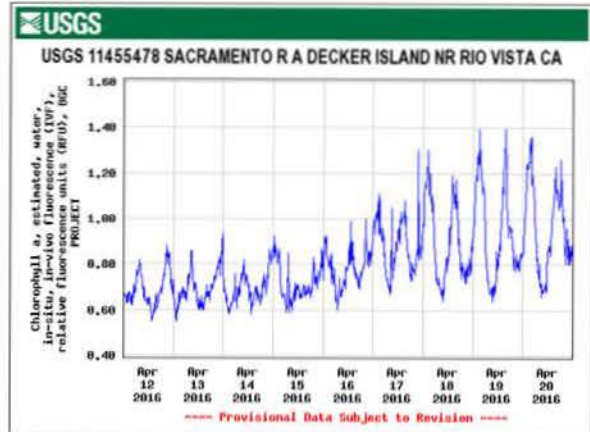
FCHLA ug/L  
1.000 5.000



April 18, 2016

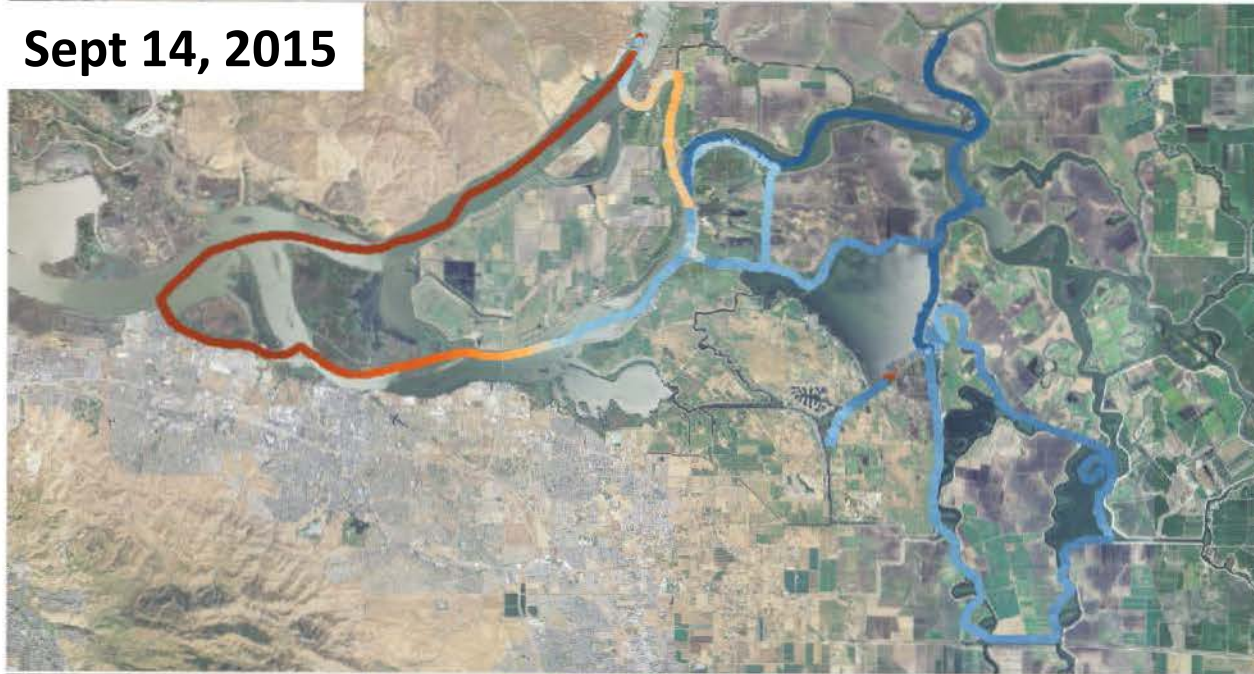


FCHLA ug/L  
1.000 5.000

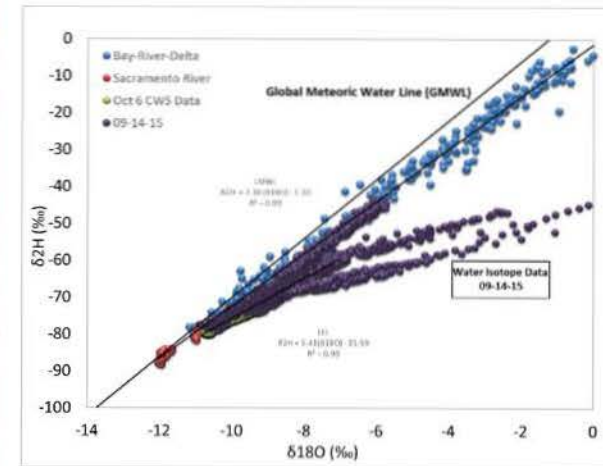


# Stable Isotopes in Water: $\delta^2\text{H}$

Sept 14, 2015



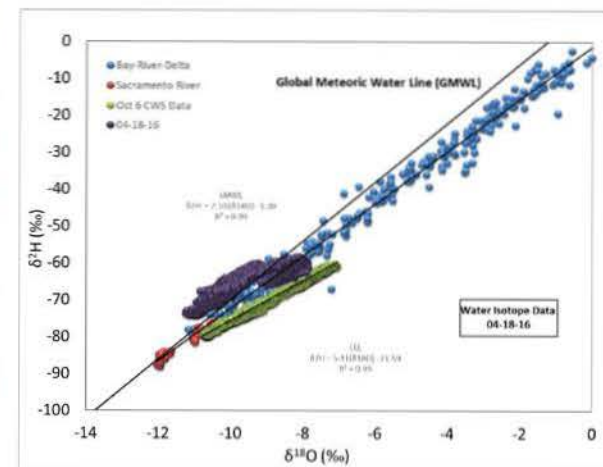
d2H  
-74.00-58.00



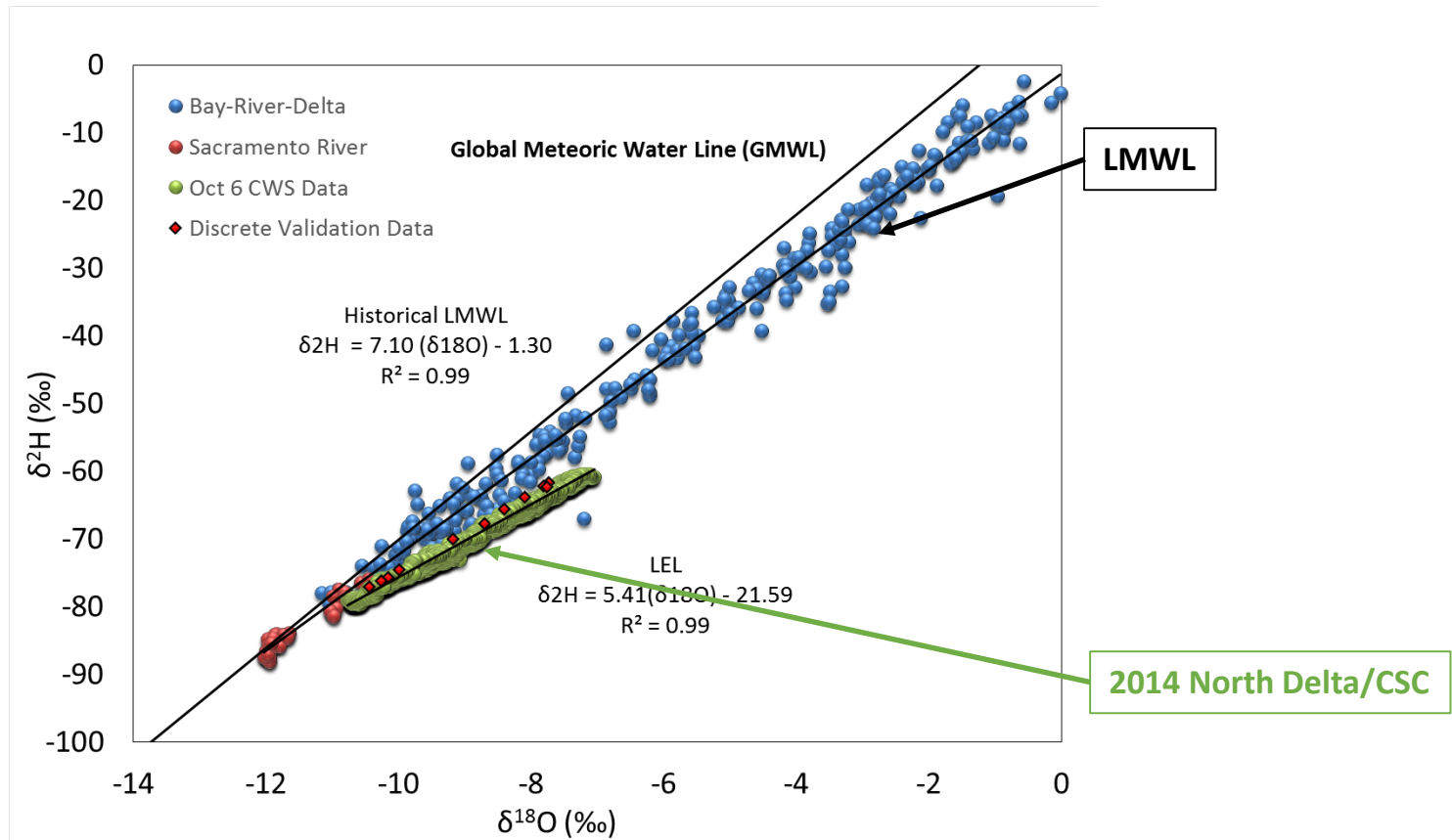
April 18, 2016



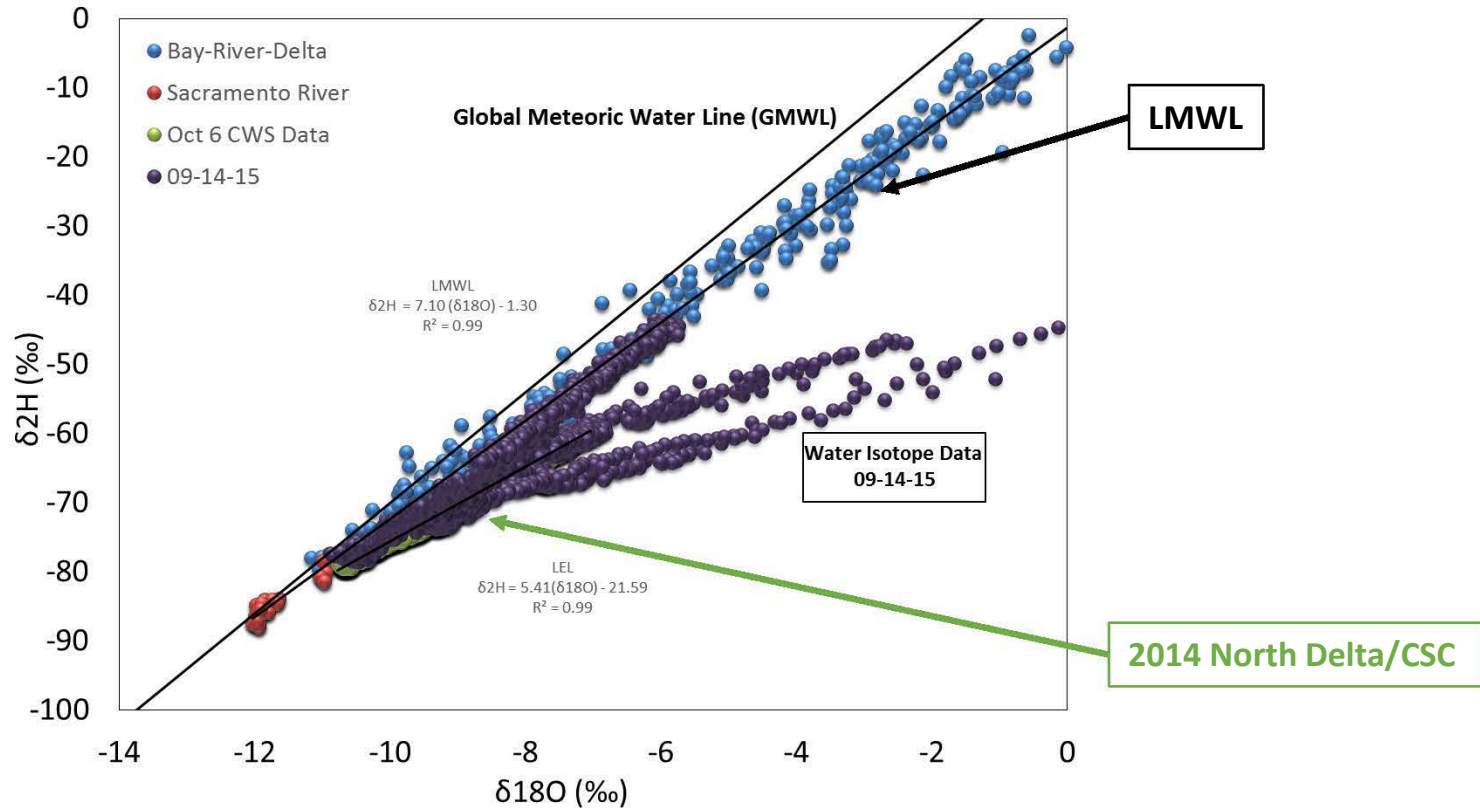
d2H  
-74.00-58.00



# How to interpret $\delta^{18}\text{O}$ , $\delta^2\text{H}$

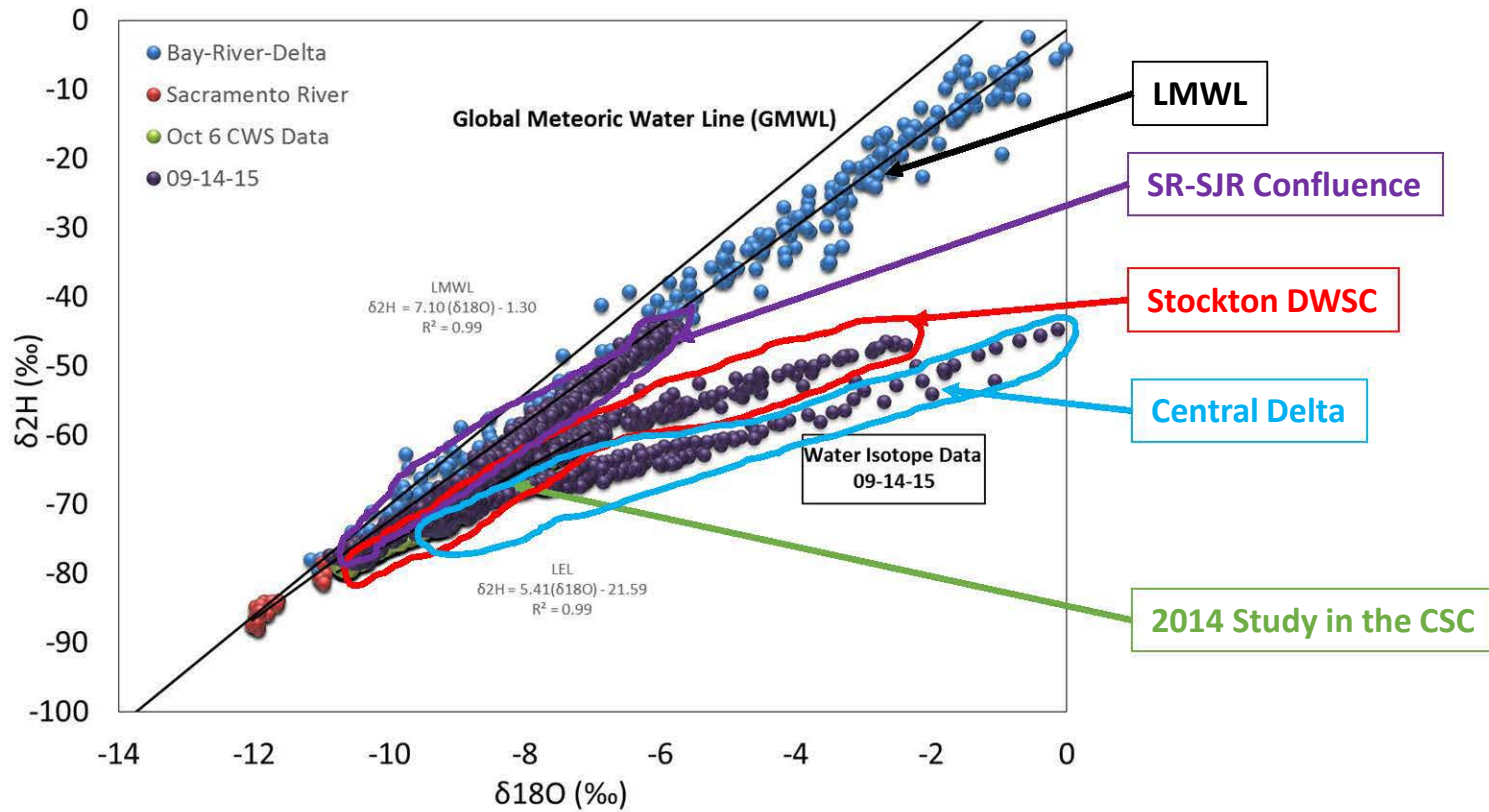


# $\delta^{18}\text{O}$ , $\delta^2\text{H}$ : Sept 14, 2015

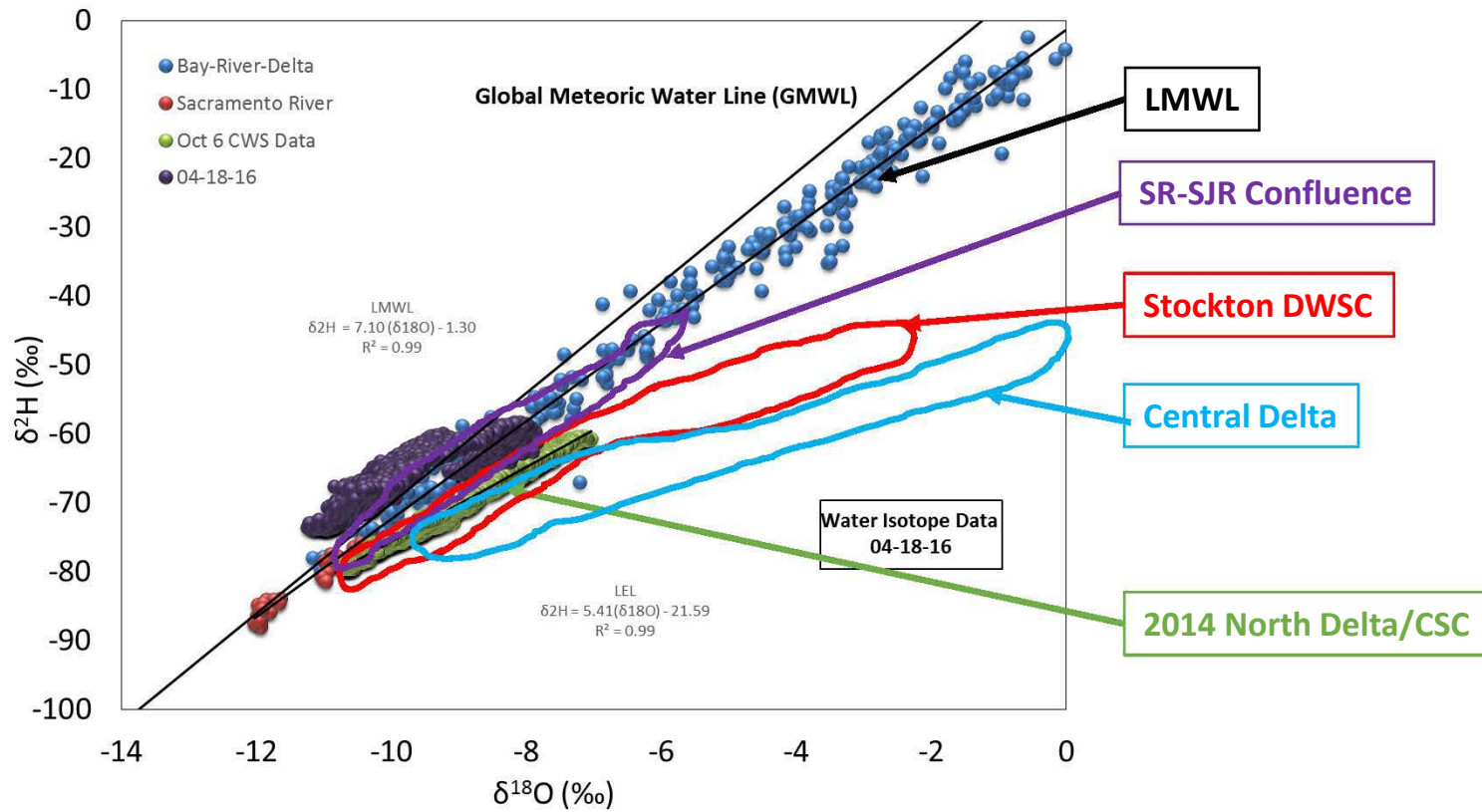


LMWL: Kendall, C., et al. (2015). Tracing nutrient and organic matter sources and biogeochemical processes in the Sacramento River and Northern Delta

# $\delta^{18}\text{O}$ , $\delta^2\text{H}$ : Sept 14, 2015



# $\delta^{18}\text{O}$ , $\delta^2\text{H}$ : April 18, 2016



# Summary

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- Mapping shows EDB impeded flow of high salinity water into central Delta.
- High speed mapping also identified BGC gradients.
- High speed mapping useful to identify water masses
  - Sacramento, San Joaquin, Stockton DWSC...
- \*Slopes in  $\delta^{18}\text{O}$ ,  $\delta^2\text{H}$  show different fractionation and evaporation, useful for residence time models.



## Parting thoughts and bon mots...

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- Among our goals was to identify north-south BGC gradients, and model residence time in Franks Tract using our novel HSM and isotopic approach.
- But, FT was impacted with SAV. Could not map very well with current boats. We need to think on this.
- SAV may present more than just another environmental concern, but an obstacle to research in the Delta as well.

# Thank You - Questions?



Thanks to the Delta Stewardship Council for funding and support. We especially thank Katy O'Donnell, Scott Nagel, Travis Von Dessonneck, Elizabeth Stumpner and Angela Hansen for technical expertise and support.

*Any use of trade, firm, or product names are for descriptive purposes only and does not imply endorsement by the USGS.*

