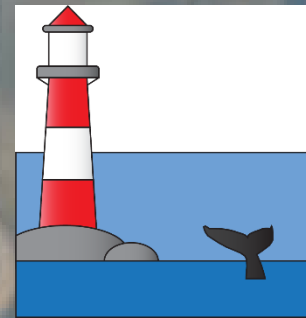


# Tracking Central Valley Freshwater Flows

**Greg Reis, The Bay Institute**  
**Virgil Zetterlind, ProtectedSeas**  
**Jon Rosenfield, The Bay Institute**



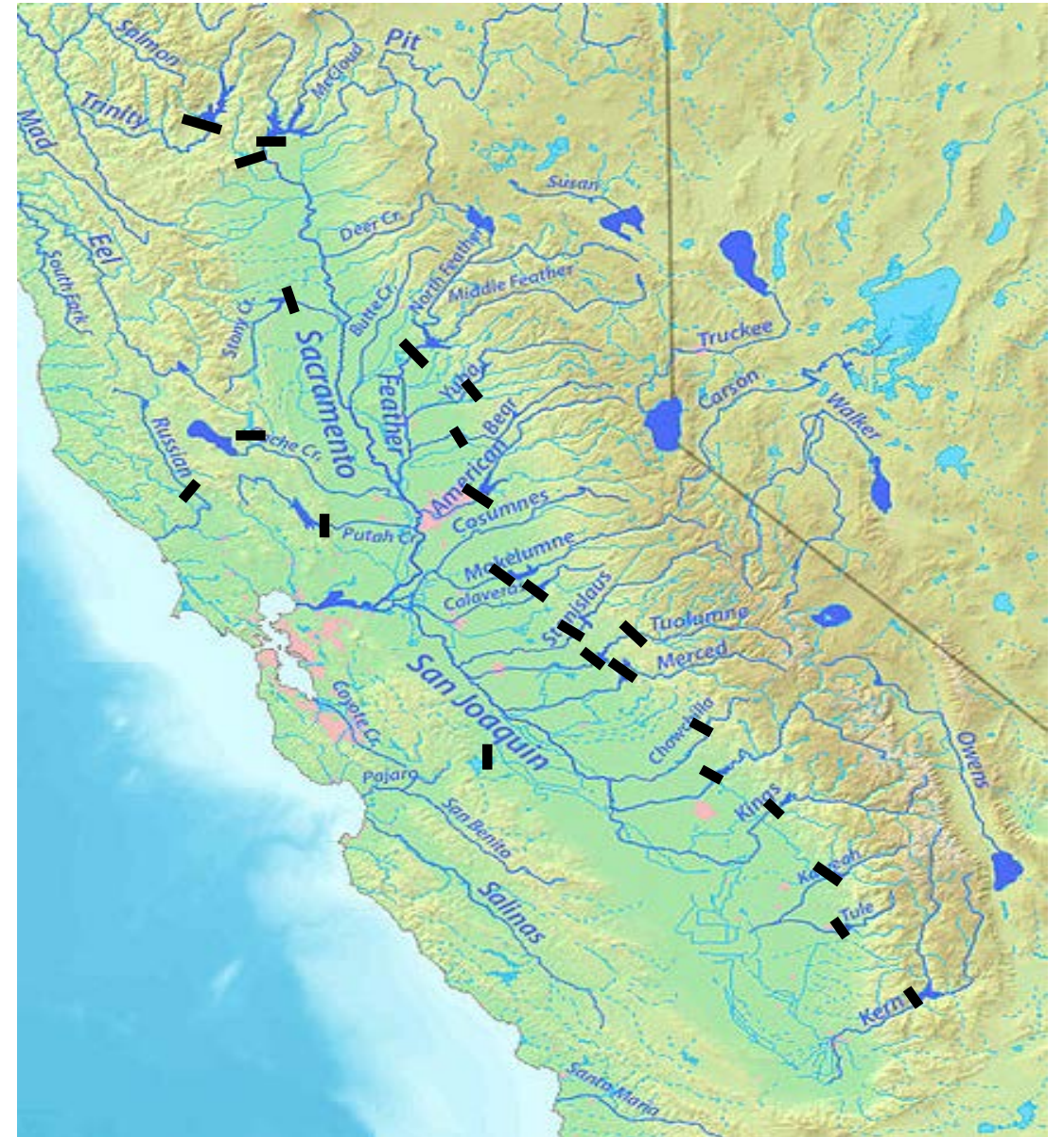
**protectedseas**

- estuary—productive ecosystem where fresh water and salt water mix

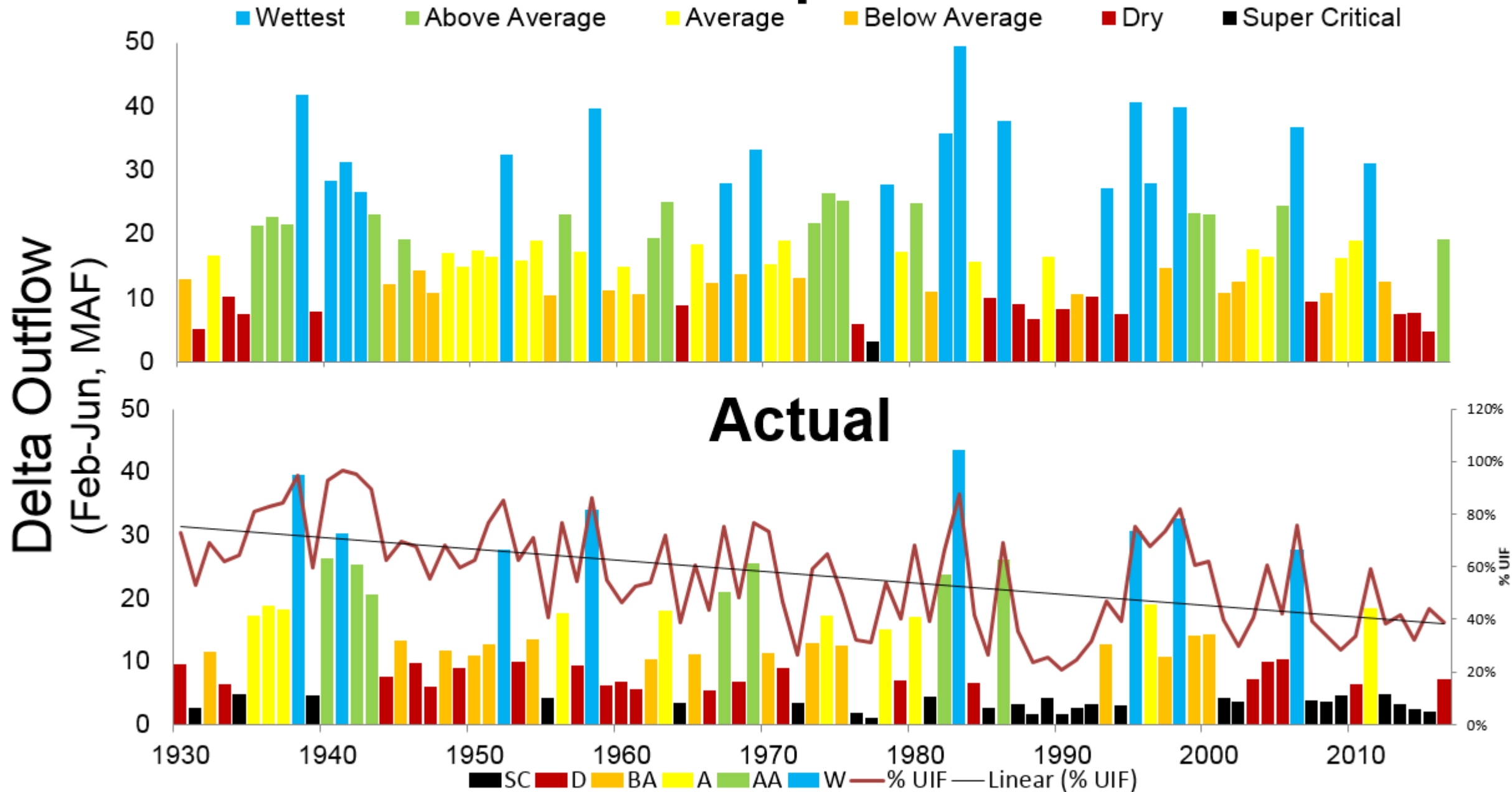
- San Francisco Bay is the largest estuary on the west coast of the Americas, with endemic species



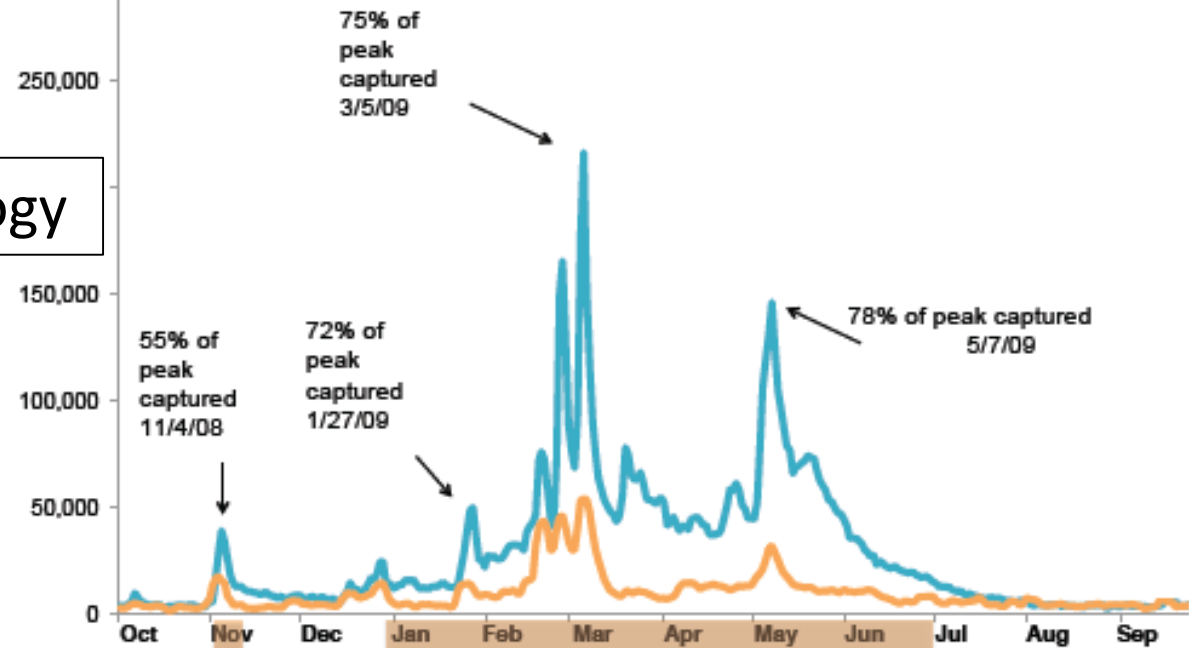
- Our water management has created a state of permanent drought
- Species dependent on the estuary and rivers in its watershed are in severe decline, with many endangered



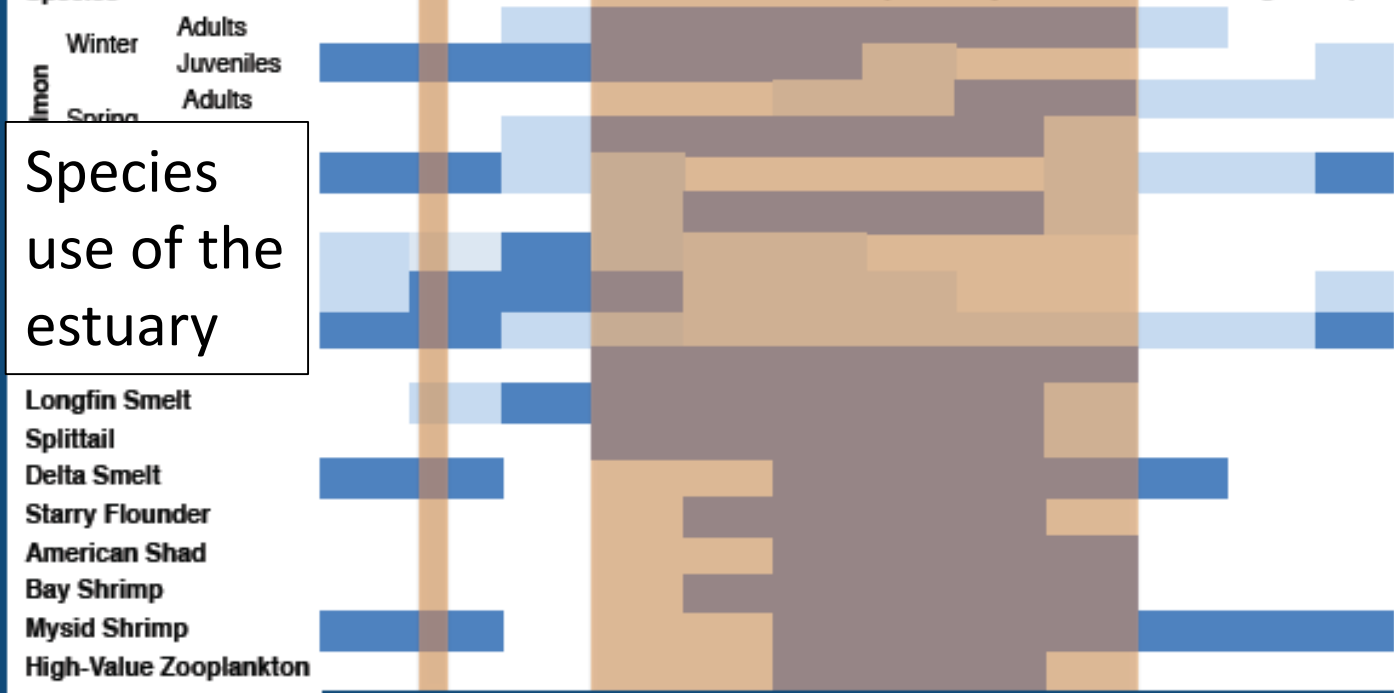
# Unimpaired



# Hydrology



# Species use of the estuary



Brown shading indicates periods of greatest hydrologic impairment

Only 28% of the Central Valley watershed's runoff made it to the Bay between February and June 2009, the lowest percentage of available

# SAN FRANCISCO BAY:

## THE FRESHWATER-STARVED ESTUARY

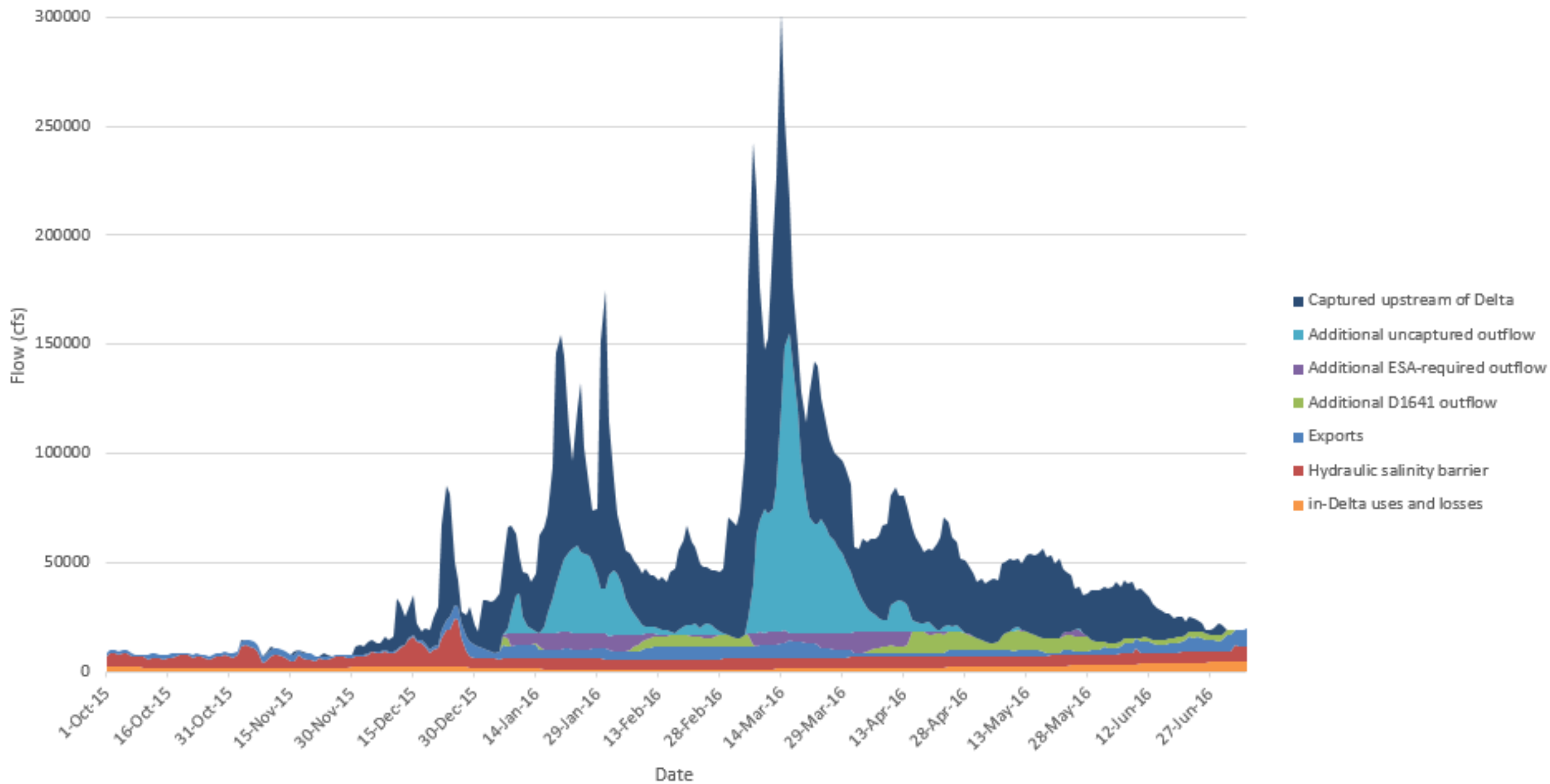
HOW WATER FLOWING TO THE OCEAN SUSTAINS  
CALIFORNIA'S GREATEST AQUATIC ECOSYSTEM



<http://tinyurl.com/BayInstitute-FSE>  
<http://tinyurl.com/Flow-starved-estuary>

Water Year	2016												% Days						
Month	O	N	D	J	F	M	A	M	J	J	A	S	2011-16	2011	2012	2013	2014	2015	2016
<b>Export Limitation</b>													92%	70%	88%	94%	100%	100%	100%
<b>HSB</b>													35%	4%	21%	16%	62%	56%	48%
<b>Fish &amp; Wildlife</b>													29%	15%	26%	55%	30%	28%	20%
<b>Outflow</b>													18%	11%	20%	40%	18%	5%	16%
<b>E/I Ratio</b>													2%	2%	1%	7%	1%	0%	0%
<b>Vernalis 1:1</b>													4%	0%	5%	8%	3%	1%	4%
<b>AF RPA</b>													17%	32%	31%	4%	8%	7%	20%
<b>OMR</b>													11%	13%	23%	1%	8%	5%	13%
<b>Salvage</b>													4%	9%	9%	2%	0%	1%	1%
<b>SJR I/E</b>													3%	10%	0%	0%	0%	0%	7%
<b>DS RPA</b>													6%	0%	8%	19%	0%	0%	7%
<b>Fall X2</b>													1%	0%	8%	0%	0%	0%	0%
<b>OMR</b>													4%	0%	0%	19%	0%	0%	7%
<b>Voluntary</b>													2%	0%	0%	0%	0%	9%	4%
<b>Maintenance</b>													1%	6%	1%	0%	0%	0%	0%
<b>Full Storage</b>													2%	13%	0%	0%	0%	0%	0%
<b>Full Capacity</b>													8%	29%	12%	6%	0%	0%	0%

# Central Valley Water Balance Water Year 2016





# Inputs - Water Balance

## Inputs

### Water Balance

*How much waters comes in, goes out, gets diverted, ...*

- Net inflows for reservoirs and rivers
- Flow sensors at various locations
- Net outflow from the Delta
- Exports into the Canal System

## Sources

- US Geological Survey
- CA Dept of Water Resources (CDEC)
- US Bureau of Reclamation
- CA State Water Project Operations

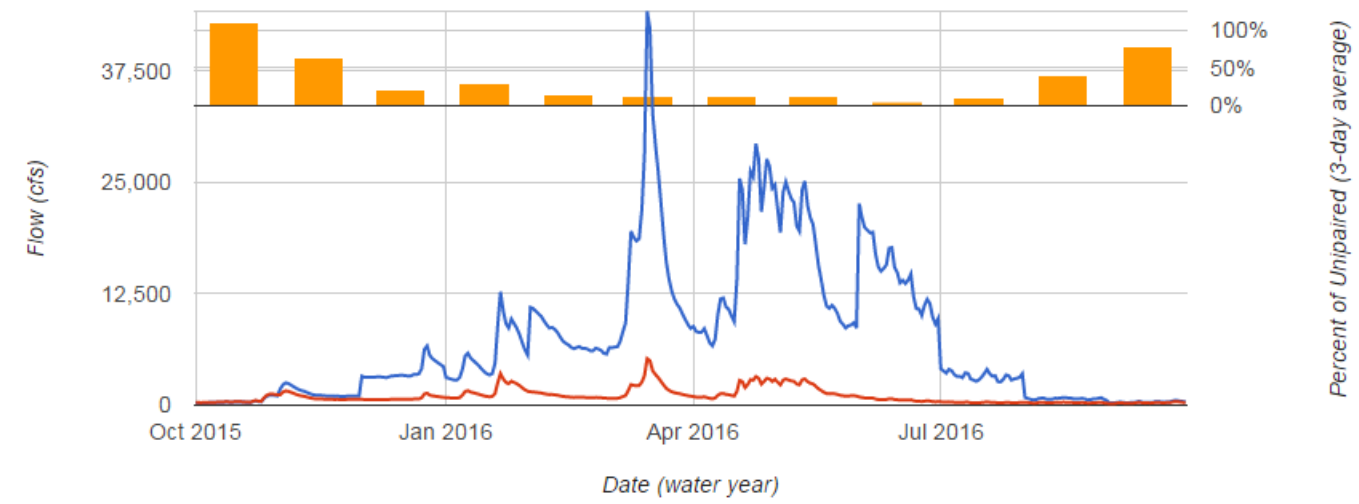
## Formats

- PDF Tables
- Web service that renders HTML Tables
- Web service that generates CSV

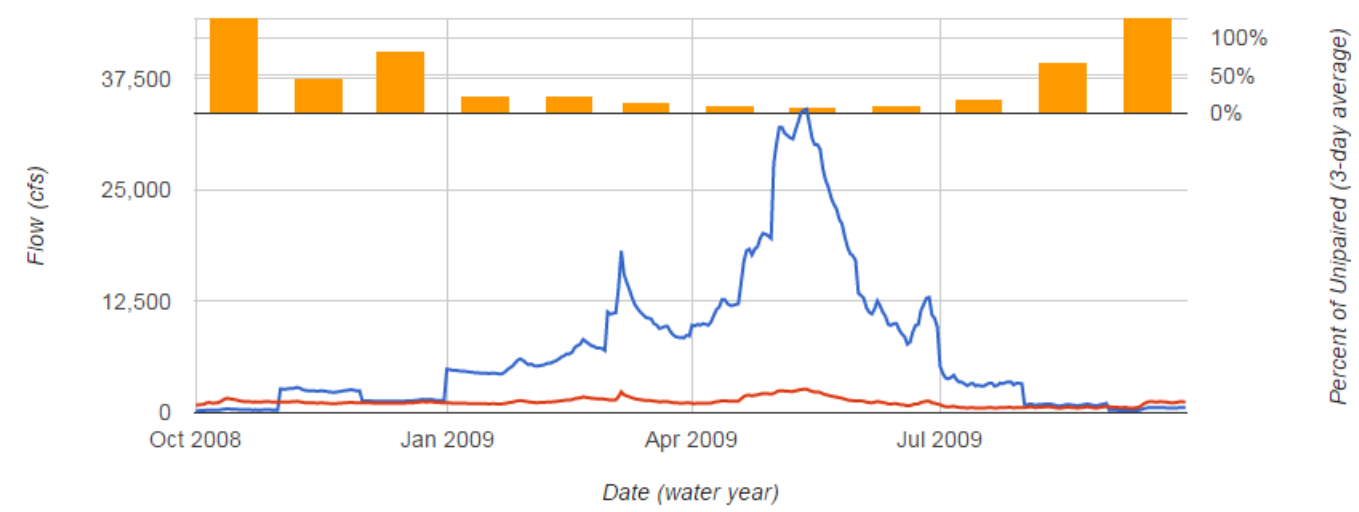
Estuary: **San Joaquin River** Water Year: **2016** Compare to Year: **2009** Log Scale:

- San Joaquin River
- San Francisco Bay Inflow
- Sacramento-San Joaquin Delta Inflow
- San Joaquin River**
- Sacramento River

- YTD: 0/4 14% WY: 0/5 14% (MAF)  
Actual Percent of SJR runoff reaching the Delta



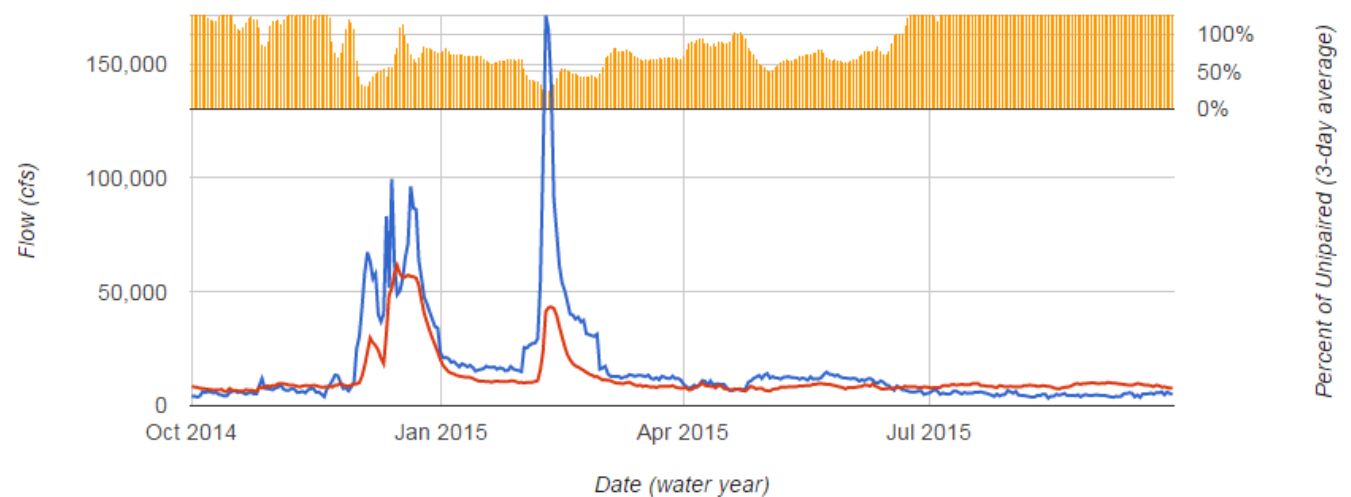
**2009 San Joaquin River - YTD: 0/4 16% WY: 0/5 17% (MAF)**  
Unimpaired Actual Percent of SJR runoff reaching the Delta



Estuary: Sacramento-San Joaquin Delta Inflow Water Year: 2015 Compare to Year: 2014 Log Scale:

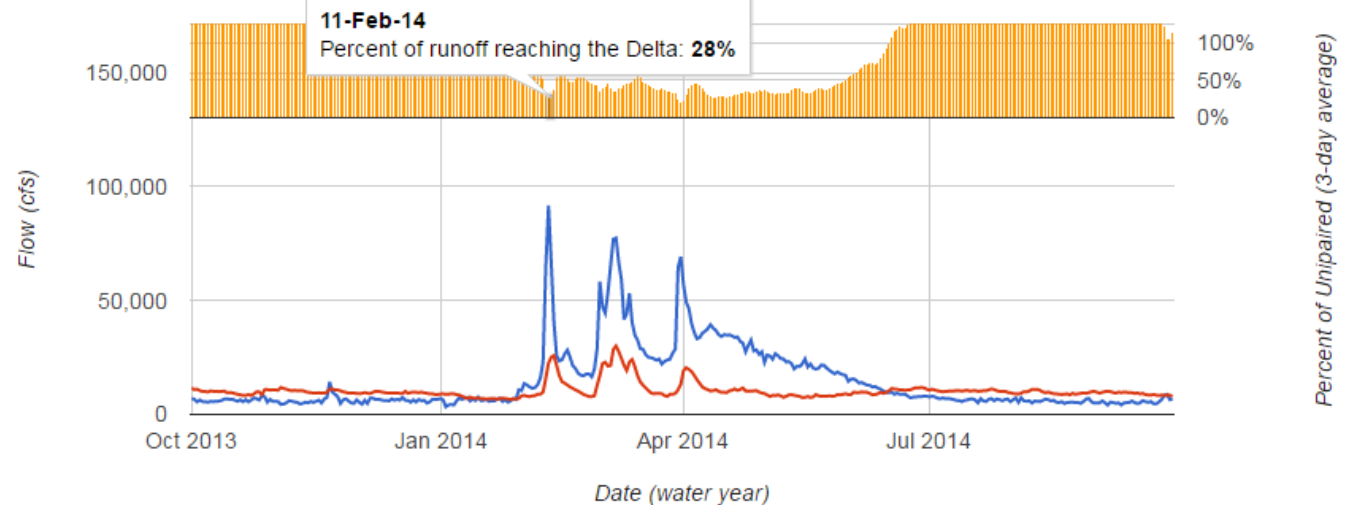
2015 Sacramento-San Joaquin Delta Inflow - YTD: 7/11 65% WY: 8/12 74% (MAF)

Unimpaired Actual Percent of runoff reaching the Delta



2014 Sacramento-San Joaquin Delta Inflow - YTD: 5/9 60% WY: 7/10 71% (MAF)

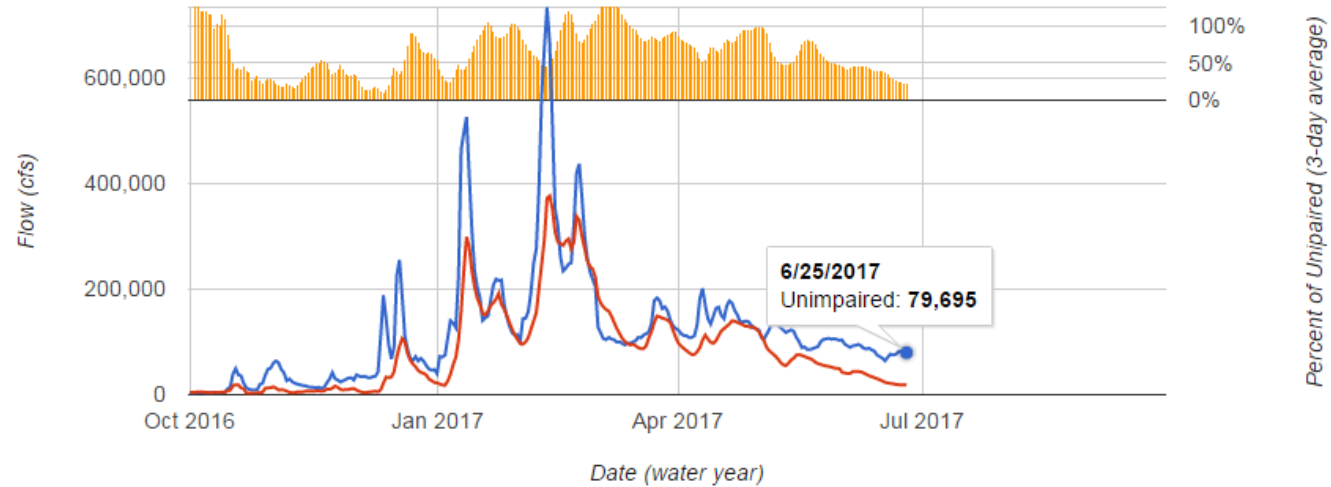
Unimpaired Actual Percent of runoff reaching the Delta



Estuary: San Francisco Bay Inflow Water Year: 2017 Compare to Year: 2011 Log Scale:

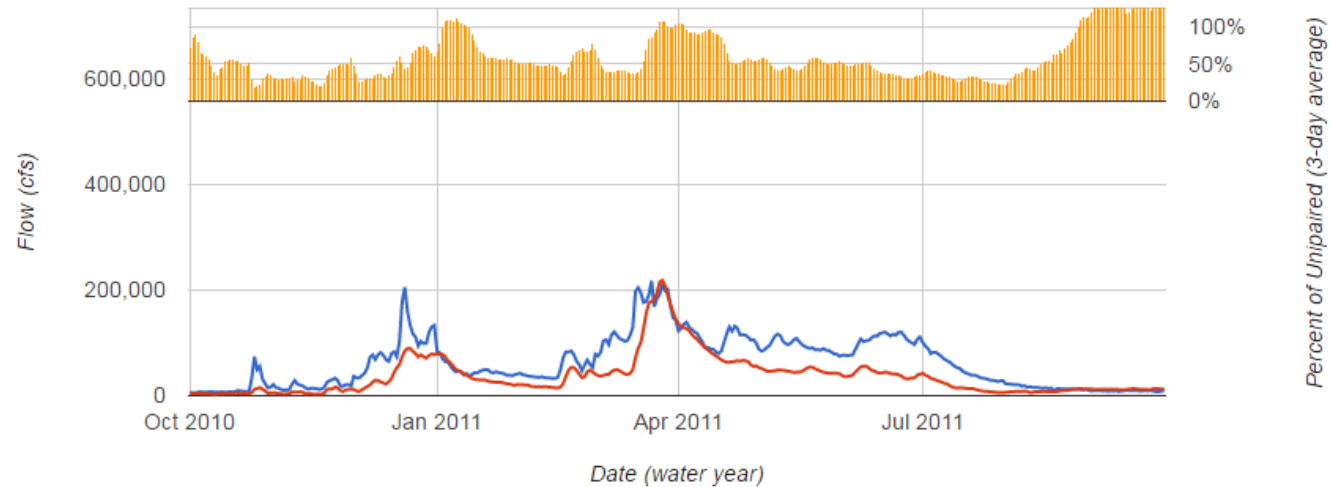
**2017 San Francisco Bay Inflow - YTD: 45/65 70% WY: 45/65 70% (MAF)**

— Unimpaired — Actual — Percent of runoff reaching the Estuary



**2011 San Francisco Bay Inflow - YTD: 24/40 60% WY: 26/45 59% (MAF)**

— Unimpaired — Actual — Percent of runoff reaching the Estuary



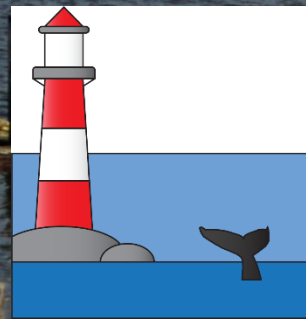


# The Bay Institute

<https://mpa.protectedseas.net/water>

<http://thebayinstitute.org/interactive-graph-test-page>

<http://maplify.com/water/>



**protectedseas**