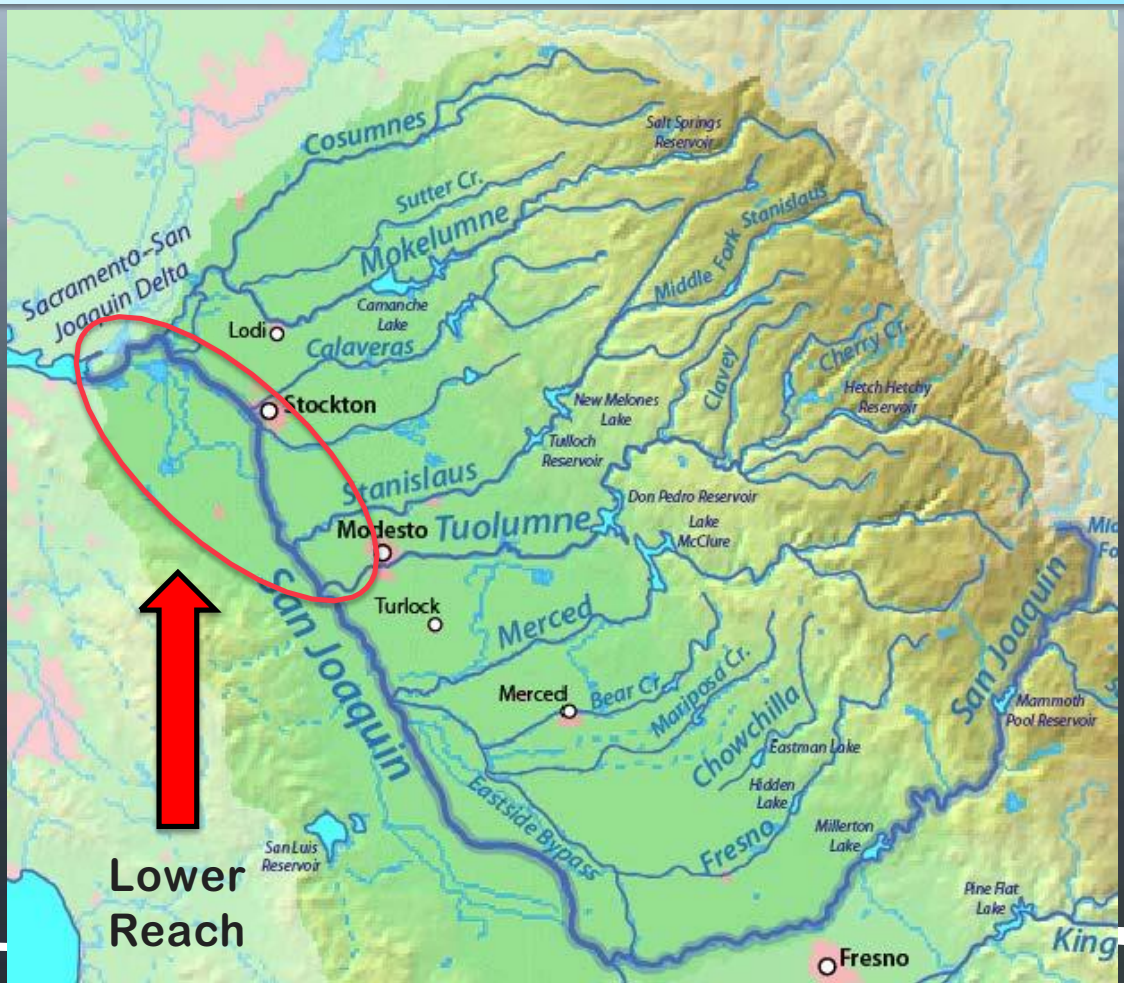
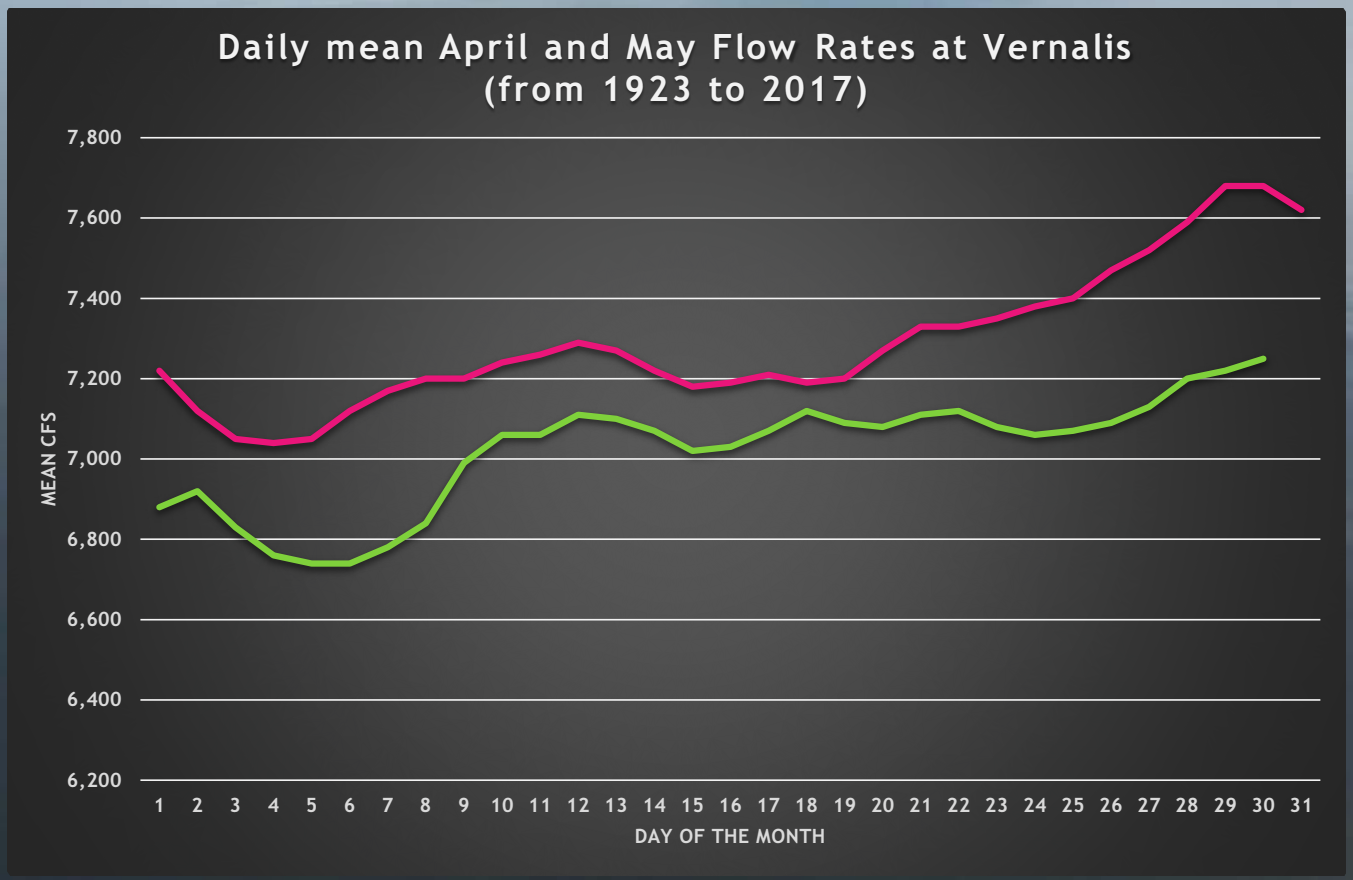
Inflow:Export Ratio

on the San Joaquin River

San Joaquin River



Historical Flows on the River



How is San Joaquin Valley Basin Classified???

- The San Joaquin Valley 60-20-20 Index were developed by the State Water Resources Control Board (SWRCB) for the San Joaquin River hydrologic basin as part of SWRCB's Bay-Delta regulatory activities. Both systems define one "wet" year classification, two "normal" classifications (above and below normal), and two "dry" classifications (dry and critical), for a total of five water year types.

Historical Data

- During the middle of 20th century, exports resulted in loss of hundred of thousands of salmon
- Large loss of salmon spurred researches to study this relationship between river flow and exports of water to southern reservoirs.

San Joaquin River Agreement (SJRA) & Vernalis Adaptive Management Plan (VAMP)

- After years of litigation… an agreement was reached

VAMP Vernalis Flow and Delta Export Targets		
Forecasted Existing - Flow (cfs)	VAMP Target- Flow (cfs)	Delta Export Target - Rates (cfs)
O to 1,999	2,000	
2,000 to 3,199	3,200	1,500
3,200 to 4,449	4,450	1,500
4,450 to 5,699	5,700	2,250
5,700 to 7,000	7,000	1,500 or 3,000
Greater than 7,000	Provide stable flow to extent possible	1,500, 2,250, or 3,000* *Suggested rates

Water Right Decision 1641

- Only required the Vernalis Adaptive Management Program study, which has ended.
- D-1641 decision approved the San Joaquin River Agreement for the purpose of conducting the Vernalis Adaptive Management Program experimental flows

OCAP Biological Assessment

- Reclamation and DWR intend to continue a VAMP-like action for the foreseeable future or until the SWRCB adopts new permanent objectives that replace the current program.

- The combined export targets for the 31 days of VAMP were: 1500 cfs (when target flows are 2000, 3200, 4450, or 7000 cfs), and 2250 cfs (when target flow is 5700 cfs, or 3000 cfs [alternate export target when flow target is 7000 cfs]).

Background

- **NMFS RPA Action IV.2.1**

Objective-To reduce the vulnerability of emigrating CV steelhead within the lower San Joaquin River to entrainment into the channels of the South Delta and at the pumps due to the diversion of water by the export facilities in the South Delta, by increasing the inflow to export ratio. To enhance the likelihood of salmonids successfully exiting the Delta at Chipps Island by creating more suitable hydraulic conditions in the main stem of the San Joaquin River for emigrating fish, including greater net downstream flows.

What is an "I:E Ratio"

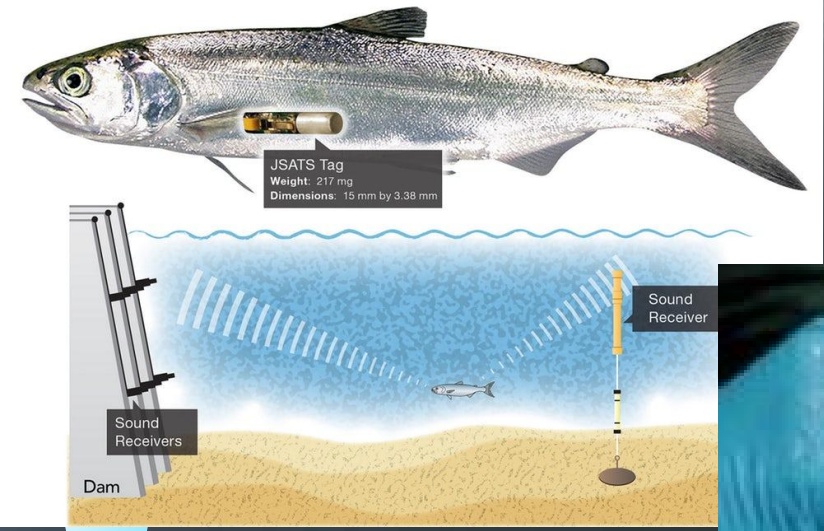
- Water Flow at the Vernalis USGS Water Gage on the San Joaquin River-to-combined exports of the CVP/SWP

San Joaquin Valley Classification	Vernalis flow: CVP/SWP combined export ratio	Targeted Minimum flow at Vernalis: Minimum export (cfs)
Critically dry	1:1	1,500 : 1,500
Dry	2:1	3,000 : 1,500
Below normal	3:1	4,500 : 1,500
Above normal	4:1	6,000 : 1,500
Wet	4:1	6,000 : 1,500
Vernalis flow equal to or greater than 21,750 cfs	N/A	Unrestricted exports until flood recedes below 21,750 cfs

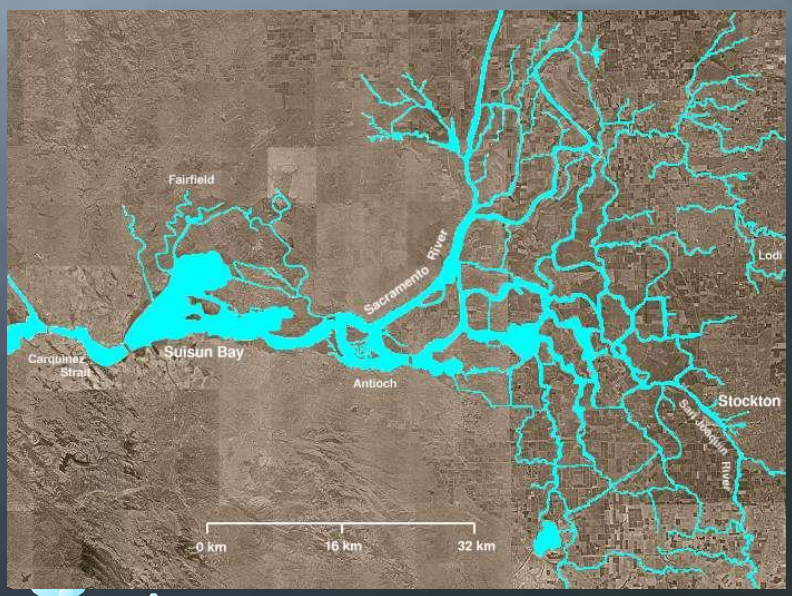
How the RPA was developed

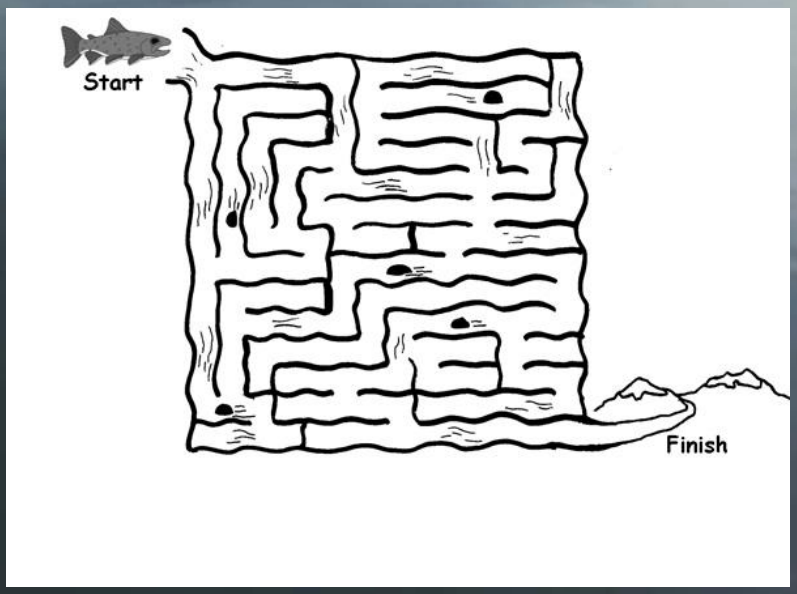
- Water that was reasonably available based on the historic flow patterns since 1922 and flows that appeared feasible for project operations
- Estimated the minimum flow needed for fish; flows over 5,000 to 6,000 cfs were required to move into the linear phase of increasing fish escapement.
- NMFS chose 6,000 cfs as the minimum. NMFS looked at San Joaquin River flow to export ratios as a method for providing flexibility in the operations of the CVP and SWP rather than capping the exports at fixed levels.

RPA Implementation



Delta Fish Maze





Head of Old River Barrier (HORB)

Peter F. Baker and J. Emil Morhardt 2001"Survival of Chinook Salmon Smolts in the Sacramento-San Joaquin Delta and Pacific Ocean"

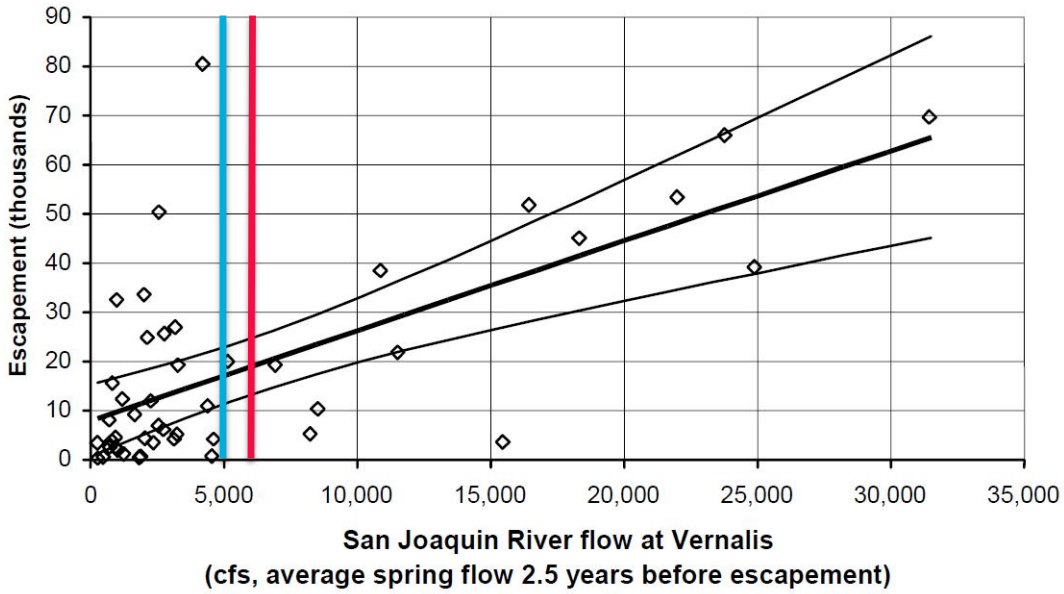


Figure 11 Total escapement to San Joaquin tributaries, 1951 through 1996, and spring flow in the San Joaquin River at Vernalis 2.5 years earlier. Fitted regression line and envelope of 95% confidence region for fitted line are shown.

Blue Line- Proposed Minimum In-flow

Red Line- Current Minimum In-Flow

Science Since 2009

- Stipulation Study: Steelhead Movement and Survival in the South Delta with Adaptive Management of Old and Middle River Flows
- Results of Reclamation's 6 Year Acoustic Tag Study
- 2013 South Delta Chinook Salmon Survival Study

RPA

OPTIONS

A New Ratio (3.3 to 1) or other flow requirements?

- 5,000 cfs :1,500 cfs during above normal and wet years

or

- 5,000 cfs or 7,000 cfs at Vernalis Requirement during above normal and wet years

Modeling Results

3.3 to 1	W	AN	Overall
Total Pumping	60	31	22
CVP SOD Ag and M&I Delivery	21	16	9
SWP SOD Delivery	25	12	10
Total Delta Outflow	-59	-32	-22

"Five"	W	AN	Overall
Total Pumping	395	379	231
CVP SOD Delivery	135	200	86
SWP SOD Delivery	189	214	103
Total Delta Outflow	-416	-359	-232
"Seven"	W	AN	Overall
Total Pumping	338	254	170
CVP SOD Delivery	104	142	55
SWP SOD Delivery	172	179	90
Total Delta Outflow	-354	-245	-172

Additional Conservation Measures

Supplemental ideas

Examples...

- Minimize exports at specific times to reduce the proportion of the San Joaquin River discharge flowing into Old River when most juvenile salmon are arriving at the Old River –San Joaquin River Junction (E.g. during the day and possibly during flood tides)

- Reduce high predation near Stockton Waste Water Treatment Facility