

# Juvenile Salmonids Drought Operations and Monitoring Assessment



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Google earth

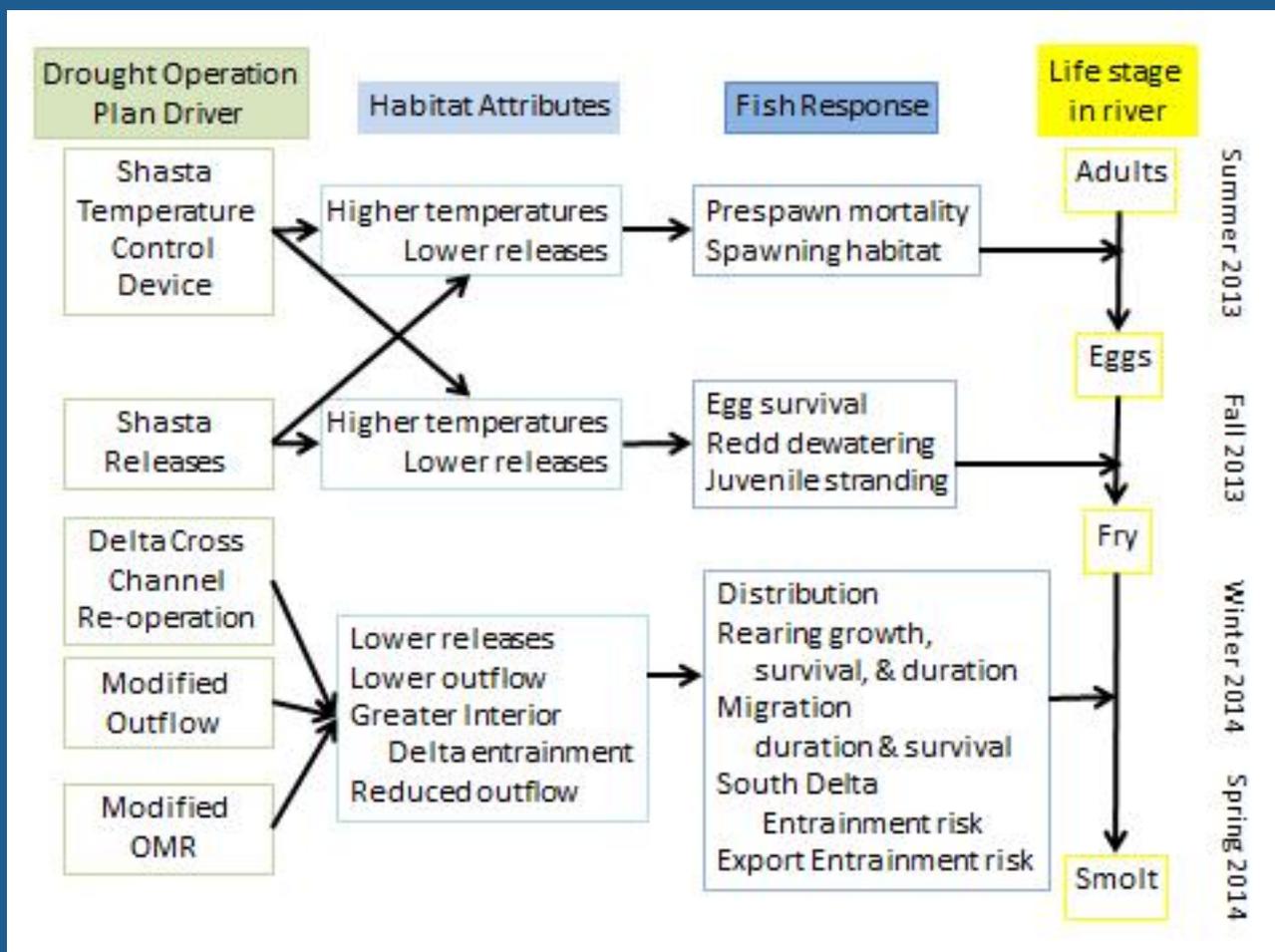
# Agencies Participating in the Drought Operations and Monitoring Assessment

- ❖ National Marine Fisheries Service (NMFS)
- ❖ United States Fish and Wildlife Service (USFWS)
- ❖ Bureau of Reclamation (Reclamation)
- ❖ California Department of Water Resources (DWR)
- ❖ California Department of Fish and Wildlife (CDFW)

# Timeline for DOP Assessment

- ❖ Met 7 times between late June and late October 2014.
- ❖ Developed and refined conceptual models – identified management and environmental drivers, processes, and outcomes related to salmonid ecology and management in the Delta.
- ❖ Developed a set of questions and hypotheses related to the DOP actions and expected outcomes.
- ❖ Examined available monitoring data to answer proposed questions and hypotheses.
- ❖ A draft report will be sent to the Drought Management Team for review in the near future.

# Drought Assessment Team's Conceptual Model BY2013 Winter Run Chinook Salmon (WRCS)



# Holistic View of Drought Conditions and Operational Effects on BY2013 WRCS

## ❖ Effects of drought on:

- Adult WRCS holding and spawning
- WRCS egg survival in upper river
- WRCS fry survival in upper river
- Juvenile WRCS migration and survival through Delta

# Did the drought conditions affect BY 2013 WRCS adults in the upper river?

- ❖ River temperatures – Adult upstream migration – **NO**
- ❖ River Flows – Adults – **NO**
- ❖ Early/ pre-spawn adult mortality – very low levels – **NO**
- ❖ ACID dam installed 1 month early – no apparent effect – **NO**
- ❖ LSNFH – WRCS brood stock 3/13 – 7/13 – normal timing - **NO**
- ❖ LSNFH – WRCS brood stock – no evident signs of disease – **NO**
- ❖ **No obvious impacts to adults and their pre-spawn eggs**

# Was BY 2013 egg to fry survival lower due to water temperatures and flow conditions in the Summer/ fall of 2013?

## ❖ POTENTIALLY

- ❖ Used Dynamic Simulation Model (Cramer Fish Sciences)
  - BY2007-2012 modeled egg survival: Avg = 23%
  - 2013 modeled egg survival 21%
  - **No apparent difference**
- ❖ Red Bluff Diversion Dam (RBDD) Passage Data
  - Used fry to smolt equivalents (1.7 fry to every smolt) to get # fry passing RBDD
  - USFWS uses fry passage equivalents to calculate apparent egg survival.
  - Baseline years of BY2007-2012 egg survival = 30.8%
  - BY2013 estimate is 15.1%
  - **Nearly 50% lower survival in BY2013 compared to baseline**

# Was Fry survival lower in 2013?

## ❖ YES

- ❖ 2013 estimated RBDD Juvenile Production Index (JPI) = 2,485,787 fry,
- ❖ NMFS' Juvenile Production Estimate (JPE) at RBDD = 4,431,064 fry based on # females in carcass survey
- ❖ Some redd dewatering and stranding occurred, but not sure if this was enough to account for lower RBDD passage of fry. Need better monitoring over more comprehensive time and spatial scales.
- ❖ Could not account for lower than expected JPI due to the 17 day gap in monitoring due to partial Federal Government furlough.

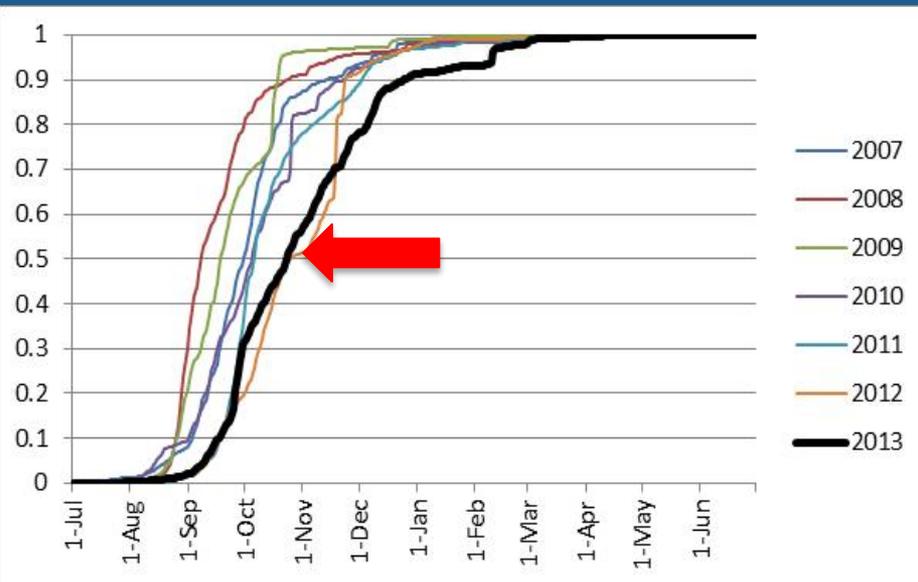
	Monthly Mean	Annual Mean	Daily Max Percentage	150% Daily Max Percentage
17-day Proportion	14%	23%	40%	50%
Winter Fry Eq. JPI	2,488,356	2,786,992	3,595,220	4,319,838
JPE Comparison (a)	-44%	-37%	-19%	-2.50%
Spring Juveniles estimated at RBDD	426,325	426,325	426,325	426,325
Winter + Spring	2,914,681	3,213,317	4,021,545	4,746,163
JPE Comparison(b); Winter+Spring	-34%	-27%	-9%	7%



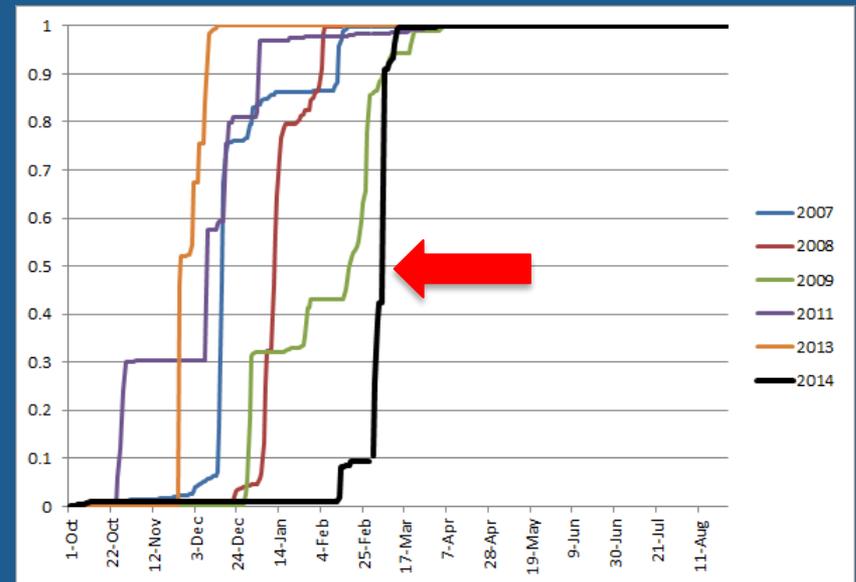
# Did WRCS spend a prolonged rearing and emigration period in the Upper Sacramento River reaches compared to previous years?

- ❖ **YES**, based on passage data for the RBDD and Knights Landing Rotary Screw Traps (RSTs), WRCS spent a prolonged period in the upper river.

RBDD RSTs



Knights Landing RSTs



# Did the drought conditions create a shorter rearing period and faster emigration of WRCS juveniles through the Delta in WY2014?

- ❖ **YES**, based on Data from the Sacramento Trawl at Sherwood Harbor and the Chipps Island Trawl in the western Delta, fish entered the Delta later and exited sooner than in the previous 6 years.

	WY 2008 - 2013				WY 2014
	LCL 95%	Mean	UCL 95%		
<b>Sherwood Harbor</b>					
Date first WR @ Sac	27-Oct	7-Dec	16-Jan		9-Feb
5% @ Sac	27-Oct	7-Dec	17-Jan		12-Feb
25% @ Sac	11-Nov	3-Jan	25-Feb		13-Feb
50% @ Sac	23-Dec	1-Feb	13-Mar		15-Feb
75% @ Sac	31-Dec	14-Feb	30-Mar		4-Mar
95% @ Sac	10-Jan	28-Feb	17-Apr		14-Mar
100% @ Sac	11-Jan	2-Mar	20-Apr		4-Apr
<b>Chipps Island</b>					
Date first WR @ CI	26-Dec	17-Jan	8-Feb		14-Feb
5% @ CI	10-Jan	6-Feb	4-Mar		20-Feb
25% @ CI	11-Feb	4-Mar	25-Mar		5-Mar
50% @ CI	11-Mar	23-Mar	4-Apr		9-Mar
75% @ CI	25-Mar	3-Apr	12-Apr		14-Mar
95% @ CI	11-Apr	18-Apr	25-Apr		8-Apr
100% @ CI	16-Apr	28-Apr	10-May		11-Apr

# Were a significantly greater proportion of juvenile WRCS caught above Knights Landing smolt-sized?

- ❖ **YES**, based on RBDD RST data 57% of the WRCS were smolt sized compared to 20% average in previous years (range 10 – 47%).
- ❖ The Team believes that the larger fish observed in the RBDD RSTs corresponds with the longer residency period in the upper river observed in 2014, and potentially with the shorter Delta residency period observed following downstream emigration.

# Were WRCS larger sized in WY 2014 when passing Chipps Island?

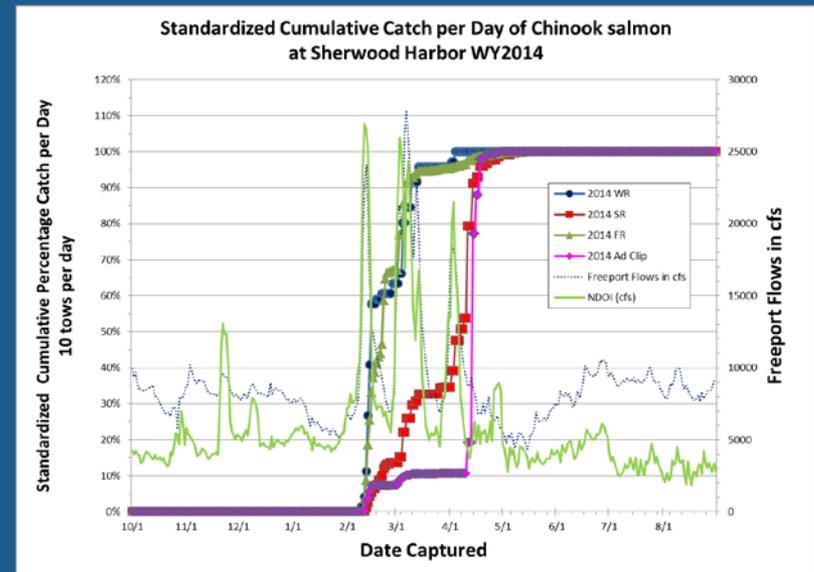
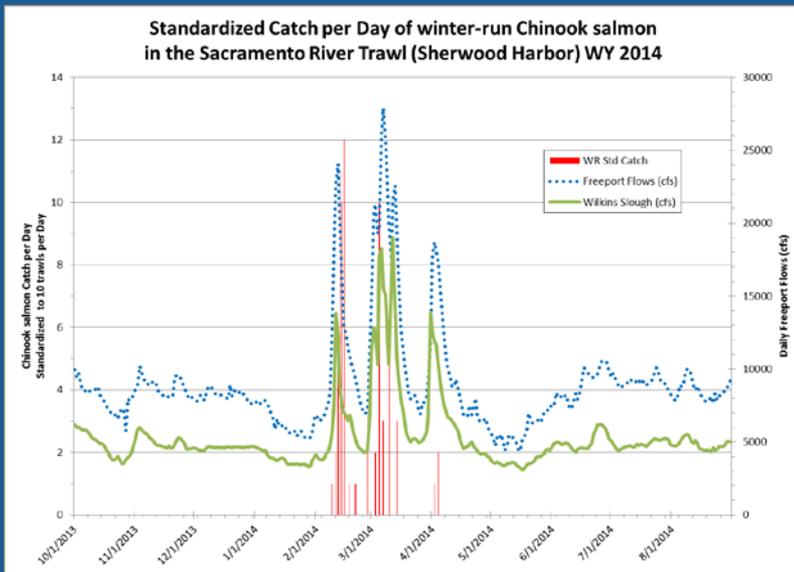
- ❖ **NO**, the available data from the Chipps Island trawl suggests that the average size of WRCS sized fish differed little from the previous years.
- ❖ Team believes that this data provides a biased evaluation of the size of WRCS due to the length-at-date criteria – classification of fish using genetics will provide a more accurate distribution of fish lengths.

Fork lengths of WRCS –sized salmon at Chipps Island

WY	Mean (mm)	Median (mm)	Kurtosis	Skewness	Min (mm)	Max (mm)	SEM (mm)
2008	114.1	114	0.33	0.29	97	139	2.79
2009	114.6	111	1.21	1.08	93	151	2.64
2010	115.1	112	2.47	1.53	100	152	2.66
2011	114.9	114	7.02	-1.62	68	132	2.49
2012	118.3	118	2.54	1.18	100	163	3.71
2013	116.7	113	4.77	1.46	80	185	3.92
2014	113.5	111	0.40	0.87	93	164	3.66

# Did the remainder of the WRCS population rearing upstream in the Sacramento River enter the Delta during the 10-day storm in early April 2014?

- ❖ **YES.** Based on data from the Sacramento River trawl at Sherwood Harbor, the last 5% of WRCS sized fish moved through this location with the April storm pulse. No WRCS sized fish were observed after April 4, 2014. The Drought Operations Plan was implemented on April 8, 2014.



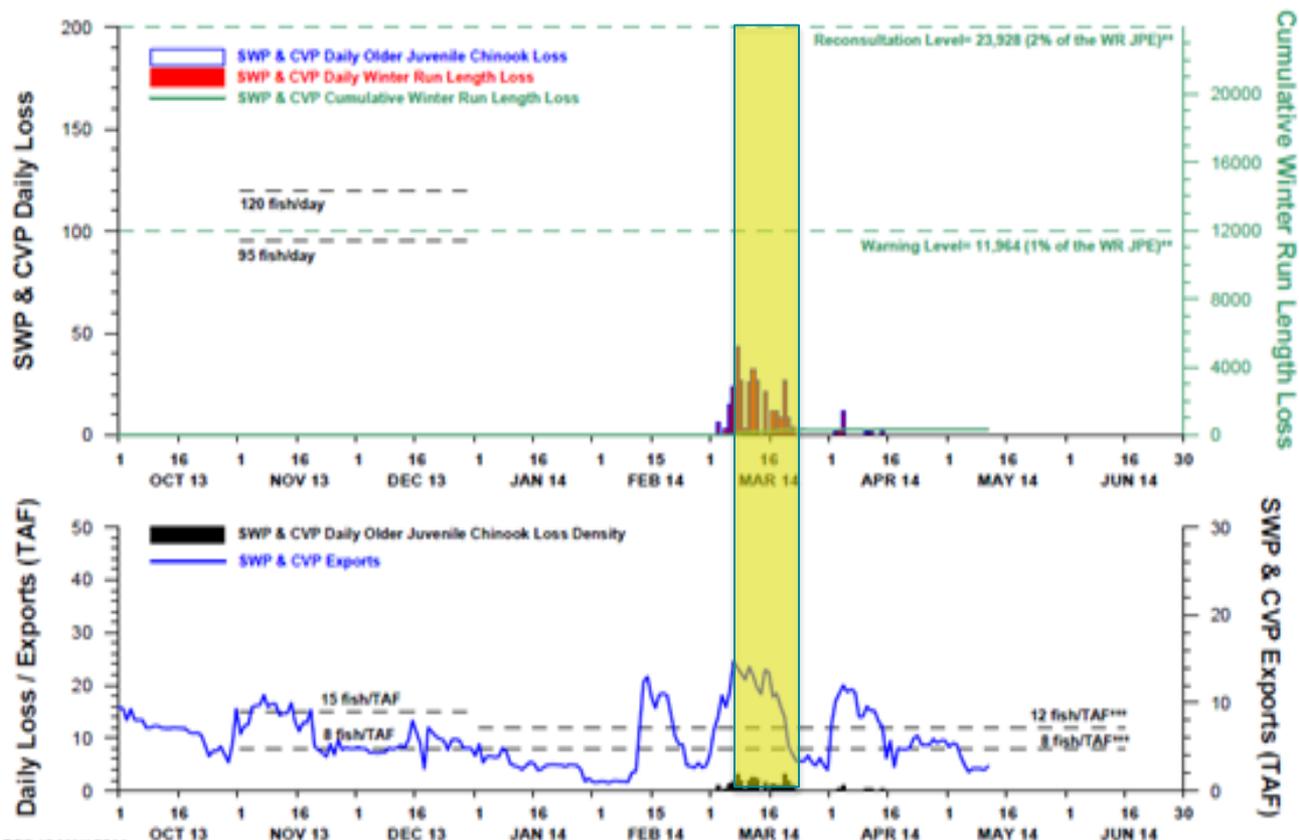
# Distribution of WRCS and risk of exposure from Drought Operations in WY 2014.

- ❖ In WY 2014, the DCC gates were not open when any of the RPA action triggers were exceeded, but gate operations were triggered by the DCC matrix criteria (1 fish in the Sacramento Beach seines 2/8/14). Gates were open from February 1 to February 10, 2014.
- ❖ Duration of the period of salvage of WRCS (Older juveniles) shorter than in previous years – 42 days in 2014, average of 150 days for WY 2007 through 2013.
- ❖ Low occurrence of a WRCS sized fish in the Central and Southern Delta Beach seines in WY2014 (1 out of 18 surveys – 5.6%) - comparable to 18 out of 225 surveys for WY 2008-2013 (8%).
- ❖ Salvage occurred when exports were increased in March above the lower levels seen in most of WY 2014, in part related to the flexibility of meeting the OMR criteria – majority of salvage occurred during these periods.



# Loss of Older Juveniles (including WRCS) in WY 2014.

## NON-CLIPPED WINTER RUN & OLDER JUVENILE CHINOOK LOSS AT THE DELTA FISH FACILITIES 01 OCT 2013 THROUGH 11 MAY 2014



DWR-DES 12 MAY 2014

Preliminary data from DFW; subject to revision.

\*\*Older juvenile Chinook defined as all Chinook greater than or equal to the minimum winter run length-at-date criteria and less than the maximum size included in the length-at-date criteria (Delta model) for which a race is assigned on a given sampling date.

\*\*\*Based on the final juvenile production estimate (JPE), which comes out to 1,196,387 non-clipped winter run (WR) Chinook entering the Delta during water year 2014.

\*\*\*\*Used to roughly estimate whether the daily loss is greater than 8 fish/TAF multiplied by the volume exported in TAF or 12 fish/TAF multiplied by the volume exported in TAF. The daily JPE based older juvenile Chinook loss density triggers of 11.90 fish/TAF (first stage) and 23.93 fish/TAF (second stage) are not controlling this water year.



# Summary

- ❖ No apparent effects of drought conditions to adults based on available data.
- ❖ Substantial difference between estimated JPI and JPE in WY2014 – loss of a large proportion of estimated fry population in upper river
- ❖ Longer period of rearing in upriver locations in WY 2014.
- ❖ Higher percentage of smolt-sized WRCS passed RBDD than in previous years.
- ❖ Late precipitation events and flows delayed downstream emigration to the Delta.

- ❖ Movement through Delta was rapid compared to previous years, shorter in-delta transit times than in previous years.
- ❖ DCC open and closed before first “pulse” of WRCS seen in monitoring efforts at Knights Landing and Sherwood Harbor.
- ❖ Shorter duration of salvage seen at the facilities – potentially reduced exposure period based on transition times through Delta.
- ❖ Increase of salvage/loss to export increases and more negative daily OMR levels in March.

# Drought Assessment Team Recommendations to Management

- ❖ Monitor disease, pathogens, condition of fish.
- ❖ Commit more staff and resources.
- ❖ Reorganize data collection to enhance utility.
- ❖ Life cycle model for all life history phases impacted by drought conditions.
- ❖ Continued monitoring of the BY 2013 WRCS.
- ❖ Apply current drought knowledge to future climate change scenarios.

# Thank You