

## Use of Surrogate Tagged Salmonids in Monitoring Efforts

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## Why do we use Surrogates?

- Population of interest is rare or protected
  - Yearling spring-run Chinook salmon are relatively rare in CV watersheds – small populations of this life strategy present.
  - Wild steelhead, yearling spring-run Chinook salmon, and winter-run Chinook salmon are protected under Federal and/or State ESA .
- Need a large enough “population” to see fish in monitoring efforts.
- Availability or ease of use compared to “wild” fish.
  - Hatchery stocks are readily available.



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## Example 1: Yearling Spring-run Chinook Salmon

- Theoretically surrogates will behave in a similar fashion to equivalently sized wild fish in the target population.....so.....
- Overlapping size with late-fall and winter-run Chinook salmon emigrating at same time.
- Assume similar swimming and physiological attributes with equivalent sized surrogates.
- Hatchery produced late-fall run are readily available for tagging – not listed.



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## Example 1 continued: Yearling Spring-run Chinook Salmon

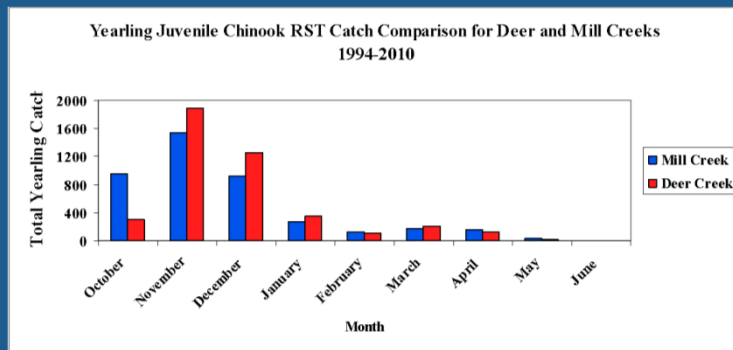
- Can tag and hold surrogates until ready to release (within reason).
- Can release on imminent precipitation events that trigger wild fish to move.
- Known population of “surrogates” released – makes quantification of recaptures possible as percentage of released population. However no current estimate of survival in upper river to Delta.
- Estimate a population level of “take” under the ESA for a surrogate population, extrapolate to the target population.



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## Yearling Spring-run Chinook salmon for Deer and Mill Creeks 1994-2010



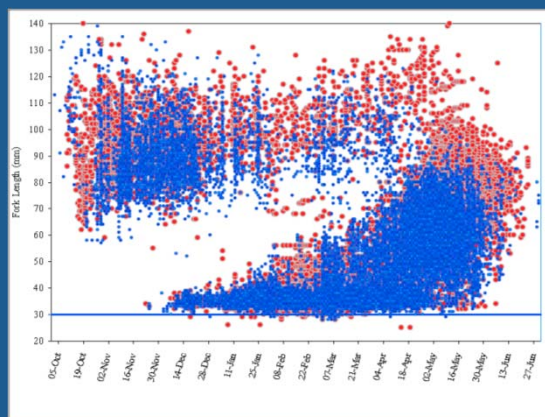
Johnson and Merrick 2012. Juvenile salmonid monitoring using rotary screw traps in Deer Creek and Mill Creek, Tehama County, California. Summary Report: 1994-2010. RBFO Technical Report No. 04-2012



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## Length at date plot of all juvenile Chinook salmon caught in the Deer Creek and Mill Creek RSTs October through June, 1994-2010



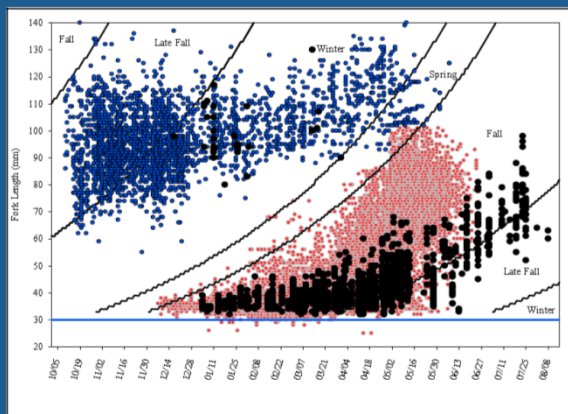
Johnson and Merrick 2012. Juvenile salmonid monitoring using rotary screw traps in Deer Creek and Mill Creek, Tehama County, California. Summary Report: 1994-2010. RBFO Technical Report No. 04-2012



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## Length-at-date fork lengths of yearling vs. young of year Chinook salmon sampled in the Mill Creek RST 1996-2010



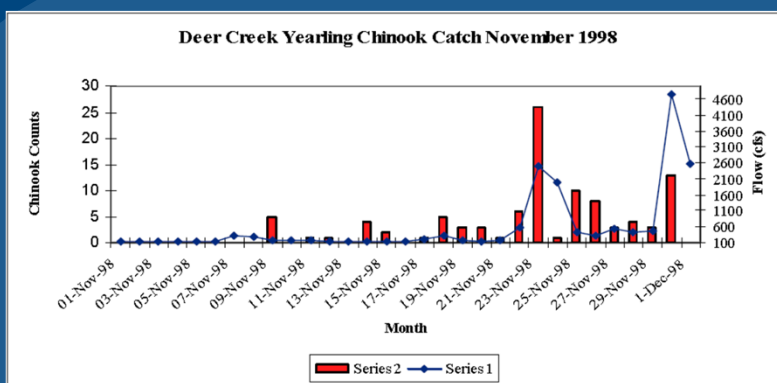
Johnson and Merrick 2012. Juvenile salmonid monitoring using rotary screw traps in Deer Creek and Mill Creek, Tehama County, California. Summary Report: 1994-2010. RBFO Technical Report No. 04-2012



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## Response of juvenile emigration to increases in flow – Deer Creek



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## Example 2: Hatchery Winter–run Chinook Salmon

- All winter-run Chinook salmon (WRCS) produced at the Livingston Stone National Fish Hatchery (LSNFH) are adipose fin clipped and CWT'd for identification.
- Hatchery produced WRCS have overlapping sizes with naturally produced late-fall run and yearling spring-run Chinook salmon.
- This is a listed population under the Federal and State ESA's and take of this population must be accounted for.
- Can tag and hold hatchery population until ready to release (within reason).
- Can release on imminent precipitation events that trigger wild fish to move.



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## Example 2: Hatchery Winter –run Chinook Salmon

- Known population of “surrogates” released – makes quantification of recaptures possible as percentage of released population.
- Similar to Juvenile Production Calculations (JPE) for wild WRCS, survival of hatchery WR CS in the upper Sacramento River to Delta is calculated. Loss at pumps adjusted to “Delta population”.
- Estimate a population level of “take” under the ESA for a surrogate population, extrapolate to the target population.



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## Recovery of Surrogate Fish

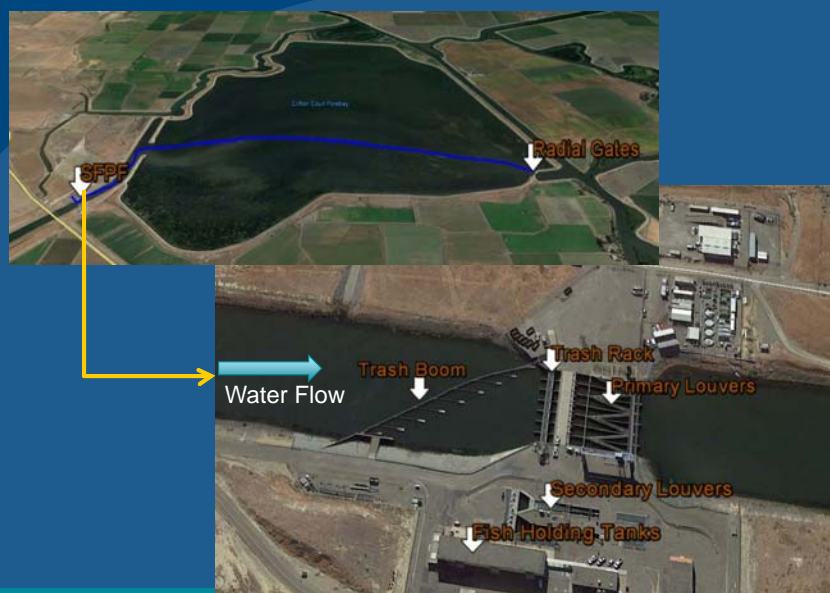
- Clipped Chinook salmon are recovered and enumerated in various monitoring efforts throughout Central Valley (Tisdale and Knights Landing RSTs, Sacramento and Chipps Island trawls, Beach Seines, and CVP and SWP fish salvage)
- CWTs are read and individual fish are assigned to release groups by the tag code.
- Allows for positive identification of captured fish and its "history".
- By tracking release groups via CWTs can determine *relative* rate of migration through system, days at large, and spatial distribution.
- Recovery of CWT fish at CVP and SWP allows for calculation of loss of targeted populations.



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## Skinner Fish Protective Facility (SFPF)



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## Tracy Fish Collection Facility (TFCF)



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## Current Loss Calculation at SFPF

$$\begin{aligned}\psi'_T &= N_4 \left( \frac{1}{S'_{CCF} E'_{PL} E'_{SL}} - S_{CHTR} \right) \\ &= N_4 \left( \frac{1}{S'_{CCF} E_L} - S_{CHTR} \right)\end{aligned}$$

### Problems:

1. Assumes  $S'_{CCF} = 0.25$  (but  $< 0.25$ )
2. Assumes  $S_{PP} = 1$  (but  $< 1$ )
3. Assumes  $S_{SP} = 1$  (but  $< 1$ )
4.  $E'_{PL} E'_{SL} = E_L$  (Combined louver efficiency)



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## Current Loss Calculation at TFCF

$$\psi'_T = N_4 \left( \frac{1}{S'_{PP} E'_{PL} E'_{SL}} - S_{CHTR} \right)$$

### Problems:

1. Assumes  $S'_{PP} = 0.85$  (but 0.49 in a recent study)
2. Assumes  $S_{SP} = 1$  (but  $< 1$ )
3. Does not include maintenance/cleaning loss
4.  $E'_{PL} E'_{SL} = E_L$  (Same issues as to SFPF)



## Salvage and Loss of Surrogate Late-fall Chinook salmon at the CVP and SWP

CONFIRMED HATCHERY (ADPOSE FIN CLIPPED) CHINOOK SALMON LOSS AT THE SWP & CVP DELTA FISH FACILITIES, 2012/2013

Release Date	CWT Race	Hatchery	Release Site	Release Type	Confirmed Loss	Number Released <sup>1</sup>	Total Entering Delta	% Loss of Number Released <sup>2</sup>	% Loss of Total Entering Delta <sup>3</sup>	First Concern Level	Second Concern Level	Date of First Loss <sup>4</sup>	Date of Last Loss <sup>5</sup>
1/19/2012	F	Mokelumne River Hatchery	Mokelumne River	**	599.45	100,633	n/a	0.596	n/a	n/a	n/a	12/9/2012	4/8/2013
11/29/2012	LF	Coleman NFH	Battle Creek	Production	41,004.8	95,842	n/a	0.500	n/a	n/a	n/a	12/9/2012	4/21/2013
12/19/2012	LF	Coleman NFH	Battle Creek	Spring Bumpgate	74.95	72,974	n/a	0.103	n/a	0.5%	1.0%	12/31/2012	3/23/2013
1/9/2013	LF	Coleman NFH	Battle Creek	Spring Bumpgate	138.70	79,000	n/a	0.176	n/a	0.5%	1.0%	1/29/2013	3/27/2013
1/29/2013	LF	Coleman NFH	Battle Creek	Spring Bumpgate	24.40	85,600	n/a	0.028	n/a	0.5%	1.0%	2/5/2013	3/31/2013
2/7/2013	W	Loringdon State NFH	Castwell Pans	Production	8.99	152,662	96,525	0.005	0.009	0.5%	1.0%	2/29/2013	3/29/2013
4/9 to 4/18/2013	S	Feather River Hatchery	Shov's Pump	**	4.33	1,034,101	n/a	0.0004	n/a	n/a	n/a	4/29/2013	5/2/2013
4/10 to 4/11/2013	F	Coleman NFH	Battle Creek	Production	2.33	1,563,900	n/a	0.0001	n/a	n/a	n/a	5/2/2013	5/4/2013
4/17 to 4/18/2013	F	Mokelumne River Hatchery	Sherman Island RS	**	0.00	112,447	n/a	0.000	n/a	n/a	n/a	5/4/2013	5/4/2013

UNCONFIRMED HATCHERY (ADPOSE FIN CLIPPED) CHINOOK SALMON LOSS AT THE SWP & CVP DELTA FISH FACILITIES, 2012/2013

Facility	Unknown CWT Loss <sup>1</sup>	Unread CWT Loss <sup>2</sup>	Unknown Hatchery Loss <sup>3</sup>	Acoustic Tag Loss <sup>4</sup>	Number of Unassigned CWT <sup>5</sup>
SWP	53.56	0.00	0.00	17.93	1
CVP	5.20	0.00	0.00	0.00	0
TOTAL	58.76	0.00	0.00	17.93	1

SWP and CVP adpose fin clipped Chinook lost from 8/1/2012 through 6/23/2013.

<sup>1</sup>Number released with the adpose fin clipped and a co-dred wire tag (CWT).

<sup>2</sup>% Loss of Number Released = (Confirmed Loss/Number Released)\*100.

<sup>3</sup>% Loss of Total Entering Delta = (Confirmed Loss/Total Entering Delta)\*100.

<sup>4</sup>Date of first and last loss accounts for all CWT loss even those from species studies where salvage and loss=0.

<sup>5</sup>Adpose fin clipped Chinook was observed during fish count, but tag code could not be determined (e.g., damaged tag, lost tag, no tag, or Chinook accidentally released).

Adpose fin clipped Chinook was collected during fish count and has not been processed yet.

CWT has been read, but hatchery release information not yet available.

Adpose fin clipped Chinook released due to presence of tubers.

CWT cannot currently be assigned to a salvage record with certainty since the CWT was lost and then found. CWT may be assigned to a salvage record if new information is available.

\*\* Information not yet available.

DWR-DES Revised 6/24/2013

Preliminary data from DFW, DWR, FWE, and Reclamator, subject to revision.





## Responses to Surrogate Loss under RPA Actions

### RPA Action IV.2.3 Old and Middle River Flow Management

<p><b>January 1 - June 15</b>  <b>First Stage Trigger</b>  <b>(increasing level of concern)</b></p>	<p>(1) Daily SWP/CVP older juvenile Chinook salmon<sup>14</sup> loss density (fish per taf) is greater than incidental take limit divided by 2000 (2 percent WR JPE ÷ 2000), with a minimum value of 2.5 fish per taf, or (2) daily SWP/CVP older juvenile Chinook salmon loss is greater than 8 fish/taf multiplied by volume exported (in taf) or (3) CNFH CWT LFR or LSNFH CWT WR cumulative loss greater than 0.5% for each surrogate release group, or (4) daily loss of wild steelhead (intact adipose fin) is greater than 8 fish/taf multiplied by volume exported (in taf)<sup>15</sup></p>	<p>Reduce exports to achieve an average net OMR flow of (minus) -3,500 cfs for a minimum of 5 consecutive days. The five day running average OMR flows shall be no more than 25 percent more negative than the targeted flow level at any time during the 5-day running average period (e.g., -4,375 cfs average over five days). Resumption of (minus) -5,000 cfs flows is allowed when average daily fish density is less than trigger density for the last 3 days of export reduction<sup>16</sup>. Reductions are required when any one criterion is met.</p>
<p><b>January 1 - June 15</b>  <b>Second Stage Trigger</b>  <b>(analogous to high concern level)</b></p>	<p>(1) Daily SWP/CVP older juvenile Chinook salmon loss density (fish per taf) is greater than incidental take limit (2 percent of WR JPE) divided by 1000 (2 percent of WR JPE ÷ 1000), with a minimum value of 2.5 fish per taf, or (2) daily SWP/CVP older juvenile Chinook salmon loss is greater than 12 fish/taf multiplied by volume exported (in taf), or (3) daily loss of wild steelhead (intact adipose fin) is greater than 12 fish/taf multiplied by volume exported (in taf)</p>	<p>Reduce exports to achieve an average net OMR flow of (minus) -2,500 cfs for a minimum 5 consecutive days. Resumption of (minus) -5,000 cfs flows is allowed when average daily fish density is less than trigger density for the last 3 days of export reduction. Reductions are required when any one criterion is met.</p>



## Response to trigger exceedance

- When cumulative loss of each surrogate release group reaches 0.5% exports are reduced to achieve an Old and Middle River flow of -3500 cfs.
- More positive OMR condition is maintained for at least 5 days



## Issues with surrogate group methodology

- Currently do not have a survival factor for upstream portion of migration for SR surrogates – makes denominator in % loss much larger than reality for the spring-run surrogate groups. Population that actually enters Delta is smaller than the number in release population.
- Lag time in reading CWTs may be days to weeks but is getting better. Makes it difficult to respond promptly to loss at facilities.
- Issues with current loss calculations. This is being worked on in another venue.
- Issue with accounting for a “rare event” in salvage – may miss surrogate fish in a particular 30 minute count. This is also being addressed in another venue.
- Is release population big enough? Compare loss % of LF production to surrogates. Should be equivalent but typically it is not.



## Questions?



