UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

MAY - 4 2012

Mr. Donald R. Glaser
Regional Director
Mid-Pacific Region
U.S. Bureau of Reclamation
2800 Cottage Way, MP-3700
Sacramento, California 95825-1898

Mr. Mark W. Cowin
Director
California Department of Water Resources
P.O. Box 942836, Room 1115-1
Sacramento, California 94236-0001

Dear Mr. Glaser and Mr. Cowin:

On January 12, 2012, Plaintiffs, Plaintiff-Intervenor, and Federal Defendants to the Consolidated Salmonid Cases (Case 1:09-cv-01053-LJO –DLB) signed and filed with the Federal court a joint stipulation (Document 659-2) that included Central Valley Project and State Water Project operations for April and May 2012. On March 16, 2012, NOAA's National Marine Fisheries Service (NMFS) transmitted to the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) the real-time operations technical memorandum (tech memo) required as part of the joint stipulation (Paragraph 2.a.v).

Pursuant to my April 27, 2012, letter and NMFS determination, my staff reconvened the OMR tech memo planning committee (planning committee) on May 1, 2012, to re-evaluate the trigger and action response from the tech memo based on the new information received from the first experimental period. Various proposals and suggestions for adjustments were vetted through the planning committee, Delta Conditions Team, Delta Operations for Salmonids and Sturgeon (DOSS) Team, and the Water Operations Management Team (WOMT). Enclosure 1 provides the proposals that the groups discussed. The following provides a general summary.

- April 30th: DCT met and discussed proposals from:
  - Brad Cavallo (Attachment 1 to Enclosure 1)
  - Barb Byrne (Attachment 2 to Enclosure 1)
- May 1st:
  - DOSS met and reviewed four different proposals, but did not provide advice regarding a preferred proposal.

  - The tech memo planning committee met in the morning and discussed various options for adjusting the trigger and/or the response. There was no consensus on the best approach.
  - WOMT met and discussed the four proposals and directed that a sub-group of WOMT meet the next day to further screen the proposals and advise WOMT.
- May 2nd:
  - A sub-group of WOMT met and screened the options into two proposals to present to the full WOMT group, including the pros and cons of each proposal.
  - WOMT met, discussed the two proposals, and developed a hybrid approach to recommend to NMFS. There was not full agreement regarding the recommended option.

Subsequent to the special WOMT call on May 2, NMFS was apprised of an error in the initial calculation of the Railroad Cut trigger that was presented to WOMT on May 2. Enclosure 2 provides the update assumptions used to calculate the Railroad Cut trigger of **24** sentinel steelhead. The intention of the tech memo is to divide the month of May into two stipulation periods. Therefore, NMFS is providing the adjustment and clarifying that the stipulation periods in May should be May 1-15 and May 16-31[1].

NMFS determines that implementing the following proposal will meet the needs of the stipulation study experimental design, adequately protect steelhead, and minimizes the impact to water supply. As such, NMFS finds that the proposal and adjustments will not jeopardize the continued existence of Central Valley steelhead.

- Railroad Cut trigger of 24 sentinel steelhead.
- Combined export limit of 100% of the 3-day average of Vernalis flows (D-1641 limit) for at least the May 1-5 period, even if the Railroad Cut trigger is met during that time period.
- If the Railroad Cut trigger is met, export reductions shall be initiated [2] (but no earlier than May 5) to produce a 5-day running average of the tidally filtered OMR flow of -1,250 cfs, or 1,500 cfs combined exports, whichever is greater.
- After 5 days of the most positive OMR (or minimum exports), the Projects can return to the experimental OMR flow, or D-1641, whichever is controlling, for the remainder of the period.

This proposal was selected because had the best real-time adaption of the Railroad Cut trigger while remaining closely tied to the in-depth analysis in the underlying Opinion (*i.e.*, it retained the general calculations of the Railroad Cut trigger while adjusting various assumptions based on the results of the first sentinel steelhead release), created the greatest likelihood of experimental value while still maintaining minimum protections for steelhead, and allowed for increased exports by both lengthening the initial OMR treatment period and shortening the action response time.

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[1] The tech memo, page 16, stated the stipulation periods as May 1-14 and May 15-31.
[2] The tech memo, page 15, provides up to 48 hours to manage exports

NMFS appreciates the continued coordination of the parties towards the implementation of the joint stipulation and the technical memorandum, and especially for developing proposals and providing helpful advice on screening the numerous proposals that were received this period.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Regional Administrator

Enclosures:

1. Proposals considered for implementation during the current experimental period of May 1-15, 2012
2. Explanation of updates to assumptions used to calculate the Railroad Cut trigger

ENCLOSURE 1

Proposals considered for implementation during

the current experimental period of May 1-15, 2012

Proposals for adjustments to the sentinel steelhead trigger and/or action response for the current experimental period of May 1-15

Proposals discussed during the Delta Conditions Team (DCT) meeting on April 30, 2012, 2:00 p.m.:

1. See attachment 1 for the proposal from Brad Cavallo (Cramer Fish Sciences).
2. Barb Byrne (NMFS) verbally presented a proposal during the DCT call. Attachment 2 is Barb's written proposal that was sent to the planning committee prior to its meeting.

DOSS meeting on May 1, 2012, 9:00 a.m.: In addition to the above, the following proposals were discussed:

3. Implement the March 16, 2012, technical memorandum, with the adjustments provided in the April 27, 2012, NMFS determination.
4. Josh Israel proposed keeping the Railroad Cut trigger calculation the way it was proposed in the tech memo, but if the trigger is met, rather than the action response of changing exports to meet an OMR of -1,250 cfs or 1,500 cfs combined exports through the rest of the experimental period, go to minimum for 5 days, then go back to the initial OMR for the experimental period. This would serve 3 purposes: (1) preserve the integrity of the study, as proposed; (2) minimizes water cost by limiting minimums to 5 days; and (3) maximizes learning opportunity by seeing how fish react to less negative OMR (after the trigger is met), seeing how fish react to 5 days at minimum exports (which is indirectly testing the action response of Action IV.2.3), and finally, seeing how fish respond to OMR returning to the experimental OMR flow.

Proposals discussed at the planning committee meeting on May 1, 2012, 11:00 a.m.: The above proposals were discussed.

Proposals discussed at the WOMT subgroup meeting on May 2, 2012, 9:00 a.m.: The above proposals were discussed. The following proposals were presented to WOMT for its consideration at the special WOMT meeting:

- Option 1: 10 days sustained 1:1 exports:Vernalis flow per D-1641, then transition to 5 days at minimum exports. No sentinel steelhead trigger at Railroad Cut.
    - Experimental value:
        - Better because longer sustained OMR at the same level
        - May not be as good because by day 10, less sentinel fish in the area of the Railroad Cut receivers to track
    - Fish protection potentially higher for wild steelhead if wild steelhead respond to the higher flows at Vernalis at the end of the experimental period
    - Water cost higher because of the expected higher Vernalis flow in the latter 5 days of the experimental period

- Option 2: fish trigger adjusted to 19 sentinel steelhead at Railroad Cut (based on spreadsheet calculation), transition to minimums (most positive OMR or combined exports) for 5 days, then go back up to 1:1 D-1641 export limit
    - Experimental value less because:
        - If hit trigger sooner, less days of not sustained higher OMR
        - If not hit the trigger throughout the experimental period, then can't test fish response from high (more negative) OMR transitioning to low (least negative) OMR
    - Fish protection:
        - Same as option 1 if at the end of the period
        - Potentially less if trigger is met earlier, and if steelhead respond to higher Vernalis flows at the end of the period
    - Water supply consideration:
        - If trigger met around day 5-7, then water supply impact minimized
        - If trigger met around day 10, then water supply impact is the same as option 1

Final proposal from the special WOMT call on March 2, 2012, 12:00 p.m.:

- Railroad Cut trigger of 19 sentinel steelhead (based on a quick calculation during the planning committee meeting), applying the experimental steelhead release and fate from the first experimental period.
- Combined export limit of 100% of the 3-day average of Vernalis flows (D-1641 limit) for at least the May 1-5 period, even if the Railroad Cut trigger is met during that time period.
- If the Railroad Cut trigger is met, export reductions shall be initiated (but no earlier than May 5) to produce a 5-day running average of the tidally filtered OMR flow of -1,250 cfs, or 1,500 cfs combined exports, whichever is greater. Because it was previously agreed that the projects can phase in the operation over 48 hours, this action may look more like 7 days of more negative OMR.
- After 5 days of the most positive OMR (or minimum exports), the Projects can return to the experimental OMR flow for the remainder of the period.

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TECHNICHAL MEMORANDUM

TO: Delta Conditions Team and Stipulation Acoustic Tagging Study Leads
FROM: Brad Cavallo
DATE: April 30 2012
SUBJECT: Revaluation of Railroad Cut Trigger for Stipulation Study

On April 16th one-hundred and sixty-three (163) acoustically tagged steelhead smolts originating from the Mokelumne River Fish Hatchery were released near Buckley Cove on the San Joaquin River (just downstream from Stockton). These fish were released as part of the "sentinel steelhead study" specified in the March 16th NMFS technical memorandum required by the joint stipulation agreement (Document 659-2) for the Consolidated Salmonid Cases (Case 1 :09-cv-01053-LJO -DLB).

As of April 30th, 40 acoustically tagged fish, roughly 25% of the total fish released as part of the "sentinel steelhead study" have reached receiver arrays located at Railroad Cut on Old and Middle River corridors. This rate of detection exceeds by a factor of five the "trigger" defined in the stipulation technical memorandum and occurred despite OMR flows being near -2,500 cfs rather than the -3,500 cfs originally planned for the experiment (Figure 1). Additional releases of sentinel steelhead are planned for May 1st and May 15th and there is concern that these releases will produce similar results; exceeding the stipulation study trigger and forcing an immediate reduction of South Delta exports.

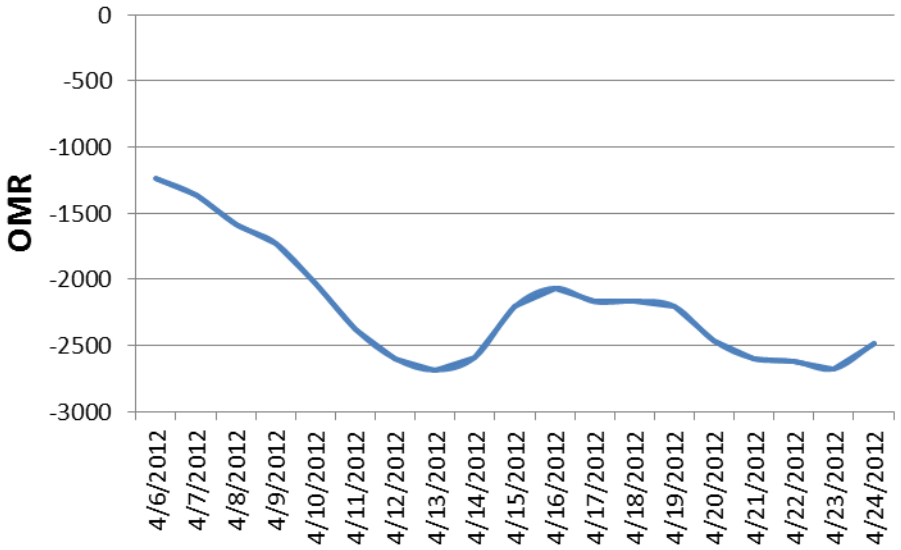


Figure 1. Five-day moving average of OMR conditions during April, 2012.

In light of result from the April 16th release, and in recognition of concerns about forthcoming release, Cramer Fish Sciences staff conducted an analysis of the conditions and factors which could contribute to exceeding the stipulation study trigger.

Specifically, we created a simple simulation model (in Microsoft Excel) which allowed us to evaluate the influence of two key factors: 1) route selection at four junctions to the interior Delta, and 2) survival rate per kilometer (km). The stipulation study trigger calculations applied a survival rate of 0.97/km, thus we explored values between 0.95/km and 0.99/km. For simplicity, and because we currently lack more detailed information, this survival rate was applied to all migration corridors evaluated. For route selection, we used the range of fish entrainment indicated by DSM2 Hydro analysis and PTM analysis (@ 2 days) presented at the February 7th stipulation workshop: Turner Cut: 9% to 15%; Colombia Cut (10% to 20%); Middle River (10% to 20%); Old River (5% to 13%). Lastly, once fish entered one of the interior Delta routes (via any junction) we assumed all fish would continue moving southward and would fail to reach Railroad Cut only due to mortality. In reality, some fraction of fish entering the interior Delta may turn around and return to mainstem San Joaquin River; however the rate at which this occurs is currently unknown.

Results of analyses conducted with our simple simulation model indicate that under a variety survival and routing conditions, a relatively large number of sentinel steelhead smolts can be expected to arrive at the Railroad Cut Receiver Array (Figure 2).

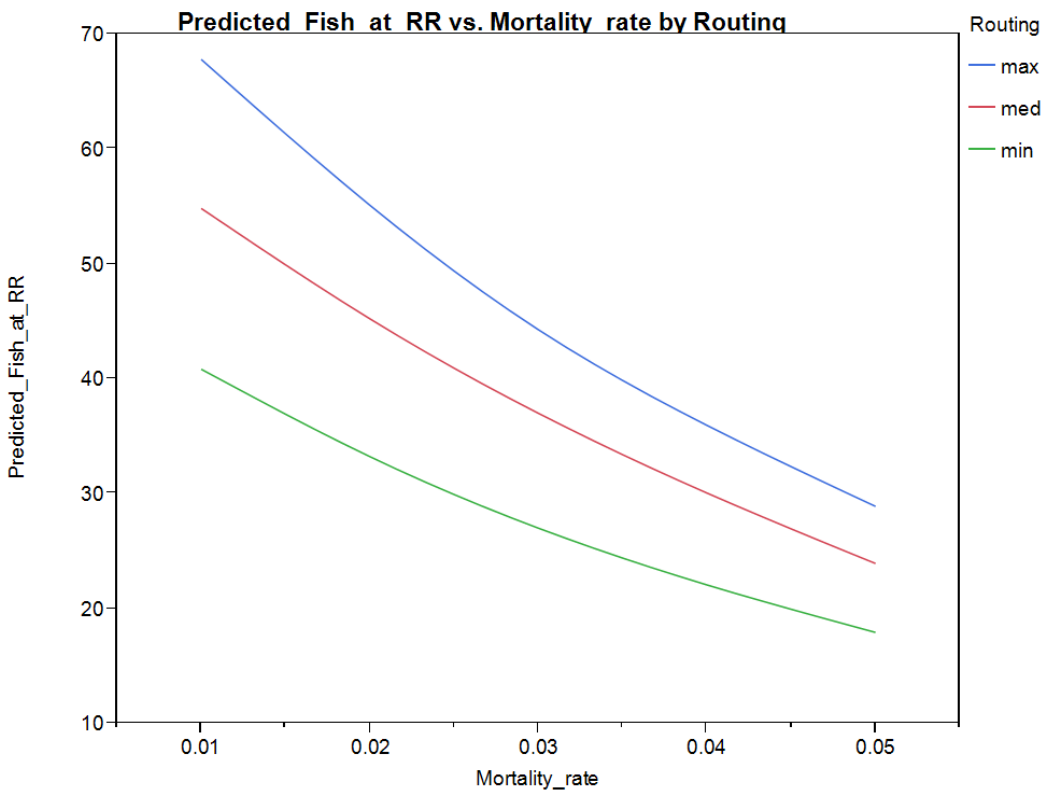


Figure 2. Predicted number of fish arriving at Railroad Cut receiver arrays (y-axis) as a function of mortality rate (x-axis) and three routing levels (legend). Routing levels refer to the minimum, median, and maximum of ranges for each junction as defined in the text.

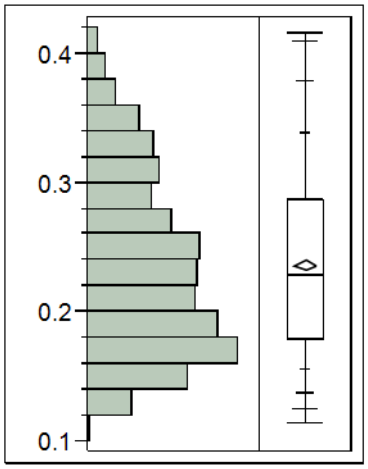
Indeed, the results suggest that 40 sentinel fish arriving at the Railroad Cut receiver array is a very likely event. To provide a more complete assessment of this probability, and in particular to inform expectations for forthcoming releases of stipulation study sentinel fish, we conducted a bootstrap re-sampling exercise. Using the same model assumptions described previously, we randomly resampled 1,000 times among the range of survival rates and routing probabilities and estimated the fraction of fish which would be expected. The results of this resampling exercise are depicted in Figure 3. The mean response was that 24% of sentinel fish would be expected to arrive at Railroad Cut arrays, with a minimum of 11% and a maximum of 41%.

Collectively, the results of the analyses presented here indicate a relatively large fraction of sentinel steelhead should be expected to arrive at the Railroad Cut receiver array regardless of OMR conditions, and thus, the trigger defined in the stipulation technical memorandum was in error. These results suggest the trigger should be re-evaluated for the remaining two releases of sentinel steelhead smolts.

The bootstrap resampling results may provide basis for establishing a new experimental trigger. OMR flows during the first release of sentinel fish were roughly -2500 and produced results very near the mean response of the resampling simulation. If more negative OMR flows cause more fish to reach Railroad Cut (as has been hypothesized), then OMR flows of -3,800 cfs (for example) would be expected to significantly increase the fraction of sentinel steelhead arriving at Railroad Cut. Though there is no objective definition of "significant" possible in these circumstances, an observation of sentinel fish greater than the 90% percentile from the bootstrap resampling provides a reasonably conservative metric. For example, a revised trigger criteria might state: "If the proportion of sentinel fish arriving at Railroad Cut exceeds 34% (the 90th percentile of observations from simulations studies), then the trigger will have been reached."

The Delta Conditions Team and stipulation study investigators should discuss these findings and discuss appropriate revisions to the original stipulation study trigger.

fraction_at_RR_cut



Quantiles

100.0%	maximum	0.41483
99.5%		0.40994
97.5%		0.37775
90.0%		0.33865
75.0%	quartile	0.2866
50.0%	median	0.22759
25.0%	quartile	0.1791
10.0%		0.15491
2.5%		0.13639
0.5%		0.12463
0.0%	minimum	0.11355

Moments

Mean	0.2366853
Std Dev	0.0686293
Std Err Mean	0.0021703
Upper 95% Mean	0.240944
Lower 95% Mean	0.2324265
N	1000

Figure 3. Results from bootstrap resampling exercise of sentinel study routing and survival probabilities.

Attachment 2

DRAFT IDEA FOR SENTINEL TRIGGER ADJUSTMENT – Barb Byrne – 5.1.2012

When the OMR technical memo was drafted, limited information was available about steelhead movement through the south Delta and the trigger level and action response were set to levels intended to manage risk for steelhead entering the Delta from above Mossdale or from the Calaveras or Mokelumne rivers. The data from the first release group of sentinel steelhead suggest that entrainment of tagged steelhead into south Delta channels (or predation in south Delta channels, or predation in the mainstem San Joaquin following by movement of predators into south Delta channels) under even fairly positive OMR levels, comparable to the OMR levels that would be expected if implementing Action IV.2.1, is higher than was expected – exceeding the trigger level of 9 fish five-fold even before the end of the experimental period.

It may be appropriate to use the tag detection information from the first experimental period to update the exposure trigger level for subsequent experimental periods. Because conditions during the first experimental period were similar to the conditions expected under Action IV.2.1 implementation, one option is to set the trigger level for subsequent periods to the total number of sentinel tags detected at the Railroad Cut receivers throughout the April 15-30 experimental period (total of 49). This option incudes tags detected throughout the experimental period (desirable), but includes over a week at combined exports of 1500 cfs, which would tend to result in more positive OMRs than if exports had continued to track the Vernalis flows as allowed under D-1641 (less desirable).

Another option is to set the trigger level for subsequent periods to the total number of sentinel tags detected at the Railroad Cut receivers throughout the April 15-21 partial experimental period, when exports were restricted (by D-1641) to 100% of Vernalis flows (30, based on the 4/22 early morning download). This option does not include tags detected when exports are less than Vernalis flow (desirable), but also does not includes tag detections from more than half of the experimental period (less desirable).

The action response should remain that same, that is, operations will, within 48 hours, target an OMR of -1,250 (or 1500 combined exports) once the exposure trigger level is exceeded.

DRAFT

ENCLOSURE 2

Explanation of updates to assumptions
used to calculate the Railroad Cut trigger

The table below (modeled after Table 4 of the OMR Technical Memorandum) shows the trigger calculation for the May 1-May 15 experimental period, with updated assumptions highlighted in yellow.

ROW ID	VALUE	FORMULA	DESCRIPTION
Calculation of average travel distance between Railroad Cut receivers and the SWP and CVP			
A1	12	Fixed value	Approximate distance (km) from Railroad Cut receiver on Old River to SWP Clifton Court intake
A2	18	Fixed value	Approximate distance (km) from Railroad Cut receiver on Middle River to SWP Clifton Court intake
A3	2	Fixed value	Approximate distance (km) from SWP Clifton Court intake to CVP intake
A4	13.73	=(A11*A1)+[A12*(A1+A3)]	Average approximate distance(km) from Railroad Cut receiver on Old River to SWP or CVP intake, weighted according to estimated split of facility entry (value assumed in A13)
A5	19.73	=(A11*A2)+[A12*(A2+A3)]	Average approximate distance(km) from Railroad Cut receiver on Middle River to SWP or CVP intake, weighted according to estimated split of facility entry (value assumed in A13)
A6	0.34[i]	**Assumption**	Of fish passing the Railroad Cut receivers, assumed proportion that are in Old River
A7	17.7	=(A6*A4) + [(1-A6)* (A5)]	Average approximate distance (km) traveled by all fish reaching the SWP or CVP, weighted by origin (Old River or Middle River) and split of facility entry.
Calculation of exposure trigger			
A8	167[ii]	**Assumption**	Number of Acoustically Tagged Fish in release group. *Set to the actual release group size for each treatment period.*
A9	2%	Fixed value	Loss at the SWP and CVP not to exceed this value (percent of release group)
A10	3.34	=A8*A9	Loss at the SWP and CVP not to exceed this value (number of fish from release group)
A11	0.13	=A13	Of fish that enter the CVP or SWP, assumed proportion that enter the SWP
A12	0.87	=(1-A13)	Of fish that enter the CVP or SWP, assumed proportion that enter the CVP
A13	0.13[iii]	**Assumption**	Of fish that enter the CVP or SWP, assumed proportion that enters the SWP.
A14	4.33	Fixed value	SWP approximate salvage-to-loss factor

ROW ID	VALUE	FORMULA	DESCRIPTION
Calculation of exposure trigger, continued			
A15	0.68	Fixed value	CVP approximate salvage-to-loss factor
A16	0.187617261	=1*[1/(1+A14)]	For each fish entering the SWP, expected SWP salvage
A17	0.595238095	=1*[1/(1+A15)]	For each fish entering the CVP, expected CVP salvage
A18	0.812382739	=1*[A14/(1+A14)]	For each fish entering the SWP, expected SWP loss
A19	0.404761905	=1*[A15/(1+A15)]	For each fish entering the CVP, expected CVP loss
A20	TRUE	Logical formula as used in excel: =IF(A16*A14=A18, TRUE, FALSE)	Check that expected SWP salvage (A16) * SWP approximate salvage-to-loss factor (A14) = expected SWP loss (A18)
A21	TRUE	Logical formula as used in excel: =IF(A17*A15=A19, TRUE, FALSE)	Check that expected CVP salvage (A17) * CVP approximate salvage-to-loss factor (A15) = expected CVP loss (A19)
A22	TRUE	Logical formula as used in excel: =IF(A16+A18=1, TRUE, FALSE)	Check that expected SWP salvage (A16) + expected SWP loss (A18) = 1
A23	TRUE	Logical formula as used in excel: =IF(A17+A19=1, TRUE, FALSE)	Check that expected CVP salvage (A17) + expected CVP loss (A19) = 1
A24	0.459111349	=(A11*A18)+(A12*A19)	Expected loss per fish that enter the SWP or CVP, given the assumed entry proportion to each facility and the loss rate at each facility
A25	7.274923621	=A10/A24	How many fish from the release group may encounter the SWP & CVP without exceeding the loss trigger?
A26	**4.36%**	**=A25/A8**	**What percent of fish from the release group may encounter the SWP & CVP without exceeding the loss trigger?**
A27	0.79	=A11*A25*A18	Expected SWP Loss if A25 fish enter the facilities at the expected ratio
A28	2.55	=A12*A25*A19	Expected CVP Loss if A25 fish enter the facilities at the expected ratio
A29	TRUE	Logical formula as used in excel: =IF(A27+A28=A10, TRUE, FALSE)	Check that SWP loss + CVP Loss add up to loss trigger
A30	0.065[iv]	**Assumption**	Assumed mortality rate (per km) between the Railroad Cut receivers and the SWP and CVP.
A31	0.31	=(1-A30)^A7	Survival from the Railroad Cut receivers to the SWP and CVP, based on the average distance in A7.
A32	24	=A25/A31	How many fish from the release group may encounter the Railroad Cut receivers without exceeding the loss trigger?
A33	**14.4%**	**=A32/A8**	**What percent of fish from the release group encounter the Railroad Cut receivers without exceeding the loss trigger?**

[i] The "Bi-Weekly Report" from Hanson Environmental, Inc. prepared from data downloaded on April 27, 2012, reported that of the 48 tags detected at the Railroad cut receivers , 44 sentinel tags were detected in Middle River and 29 sentinel tags were detected in Old River. Of the 29 sentinel tags detected in Old River, 25 were also detected in Middle River, leaving just four sentinel tags as having been detected only in Old River. Because a full tag detection history from all Railroad Cut receivers, including time of each detection, is not yet available, NMFS assumed that half of the 25 sentinel tags detected in both channels traveled through Old River (12.5 sentinel tags) and half traveled through Middle River (12.5 sentinel tags). Of fish passing the Railroad Cut receivers, the proportion that is in Old River is estimated as (4+12.5)/48=0.34.

[ii] 167 sentinel steelhead were released from May 1-2, 2012.

[iii] Based on a preliminary sentinel tag detection analysis (through 4/30) from Josh Israel (Reclamation), of the 15 sentinel tags detected at the receivers just inside the SWP and CVP, 2 sentinel tags were detected at the SWP. Of fish that enter the CVP or SWP, the proportion that enter the SWP is estimated as 2/15=0.1333.

[iv] Based on a preliminary sentinel tag detection analysis (through 4/30) from Josh Israel (Reclamation), of the 49 tags that were detected at the RR Cut receivers through April 30, 2012, 15 tags were detected at the receivers just inside the SWP and CVP. This information, per the calculation method shown below, was used to update the south Delta mortality estimate to 6.5% per km.

Updated mortality estimate based on the reported number of tags at Railroad Cut and entering the CVP or SWP.			
ROW ID	**VALUE**	**FORMULA**	**DESCRIPTION**
B1	49	Fixed value	Number of tags detected at Railroad Cut receivers
B2	15	Fixed value	Number of tags detected entering the CVP or SWP
B3	34	B1-B2	Number of tags that "died" between the Railroad Cut receivers and the CWP or SWP
B4	0.69387755	B3/B1	Percent of tags that "died" between the Railroad Cut receivers and the CWP or SWP
B5	17.6708333	A7 *(from above table)*	Average distance (km) for all fish reaching facilities, weighted by origin (and split of facility entry)
B6	0.9352045	(B2/B1)^(1/B5)	Migration survival rate (per km)
B7	0.0647955	1-B6	Updated Estimate of Migration Mortality Rate (per km)