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

APR 12 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, NMFS transmitted to the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) the real-time operations technical memorandum required as part of the joint stipulation (Paragraph 2.a.v).

On April 4, 2012, NOAA's National Marine Fisheries Service (NMFS) issued a letter to Reclamation and DWR with its determination that operating to an OMR flow of no more negative than -2,500 cfs from April 8-14, 2012, as measured by a 5-day running average that may not be more negative than -3,125 cfs, is consistent with the intent and objective of OMR flow management, as provided in the technical memorandum.

On April 6, 2012, at 5:00 pm, DWR submitted to NMFS a proposal that stated the Delta Conditions Team (DCT), DWR, and the Public Water Agencies (PWA) were requesting that the Federal and State water projects target an OMR flow of -3,500 cfs throughout the remainder of April 2012. However, upon further inquiry, NMFS determined that the proposal was neither submitted nor reviewed by the DCT. Therefore, NMFS requested that the proposal be reviewed by the DCT, in accordance with the process provided in the joint stipulation (page 5, paragraph iv). The DWR/PWA proposal was subsequently reviewed by the DCT and discussed at its Monday afternoon, April 9, 2012, meeting, and also reviewed immediately thereafter by the Delta Operations for Salmonids and Sturgeon (DOSS) group at its Tuesday morning, April 10, 2012, meeting.

The enclosure provides DOSS advice to the Water Operations Management Team (WOMT) and NMFS. DOSS advised WOMT and NMFS to: (1) *not* adopt the proposed change to OMR of -3,500 cfs for the remainder of the April 8-14, 2012 time period (and therefore, continue implementing the OMR limit of -2,500 cfs[1] as provided in the April 4, 2012, NMFS determination), and (2) the proposal to operate to an OMR limit of -3,500 cfs from April 15-30, including the acoustically tagged steelhead exposure criterion, was consistent with the OMR values and criteria contained in the March 16th NMFS technical memorandum.

NMFS determines, similar to its April 4, 2012, determination, that since the OMR flow of no more negative than -2,500 cfs for April 8-14, 2012, is consistent with the joint stipulation and associated technical memorandum, that it will avoid jeopardizing the continued existence of Central Valley steelhead[1]. NMFS concurred with DOSS that the DWR/PWA proposal to operate to an OMR limit of -3,500 cfs from April 15-30, 2012 (unless the acoustically tagged steelhead exposure criterion, as defined in the technical memorandum, is exceeded), is equivalent to the OMR values and criteria contained in the technical memorandum, and therefore, will be implemented as planned.

The joint stipulation (page 4, paragraph v) provides examples of relevant available scientific information and considerations, in addition to the hydrodynamics and Particle Tracking Model runs, that should be considered in the development of the real-time operations technical memorandum and screening criteria. Enclosed are sources of information provided in the joint stipulation, and how NMFS and the technical memorandum planning/drafting committee and DOSS utilized and considered each source of information.

NMFS appreciates the continued coordination of the parties towards the implementation of the joint stipulation and the technical memorandum.

Sincerely,

Rodney R. McInnis

Rodney R. McInnis
Regional Administrator

Enclosures:
1. DOSS advice
2. DWR/PWA proposal
3. Use of data in the implementation of the joint stipulation

[1] The 5-day running average of OMR flow during this period shall be no more than 25% more negative than -2,500 cfs (*i.e.*, -3,125 cfs).

Enclosure 1

DOSS Advice for operations for the remainder of the April 8-April 14, 2012, time period

Old and Middle River Flow Management per the 2012 Joint Stipulation, in lieu of Action IV.2.1 of the NMFS Biological Opinion for the Long-Term Operations of the Central Valley Project and State Water Project (NMFS Opinion)

<u>Summary of Advice from the Delta Operations for Salmonids and Sturgeon (DOSS) group:</u>

Background:

The California Department of Water Resources (DWR) and the Public Water Agencies (PWA) submitted a proposal (Attachment 1) to NMFS on April 6, 2012, to operate to an Old and Middle River (OMR) flow of no more negative than -3,500 cfs for the rest of April. This proposal was subsequently submitted to the Delta Conditions Team for discussion and consideration during its meeting on Monday afternoon, April 9, 2012, and the DOSS meeting on Tuesday morning, April 10, 2012. The proposal represents a change in operations from the expected operations for the remainder of week of April 8-14, during which an OMR target of -2,500 cfs is currently being implemented. DOSS reviewed the proposal and some additional information received from individual members of the Delta Conditions Team (DCT).

DOSS advice for Tuesday 4/10/12:

<u>Remainder of April 8-14, 2012, time period</u>: For the remainder of the April 8-14 time period, DOSS advises to *not* adopt of the DWR/PWA proposed change to a target OMR of -3,500 cfs (and therefore, continue implementing the OMR limit of -2,500 cfs as provided in the April 4, 2012, NMFS determination. Compliance will be measured using a 5-day running average that may be no more than 25% more negative than the target OMR, *i.e*. no more negative than -3,125 cfs.).

<u>Rationale for Advice for remainder of April 8-14, 2012, time period</u>:
DOSS did not advise adoption of the proposal because there was not full confidence that the evidence provided was sufficient to show that the proposed operations were as protective to San Joaquin basin steelhead as the RPA Action (Action 4.2.1) the stipulated operations are intended to replace, and not enough time to conduct additional analysis using DSM2 Hydro data. One important concern was that the individual hydrodynamic effects (measured over small spatial and temporal scales) were not evaluated in combination, making it difficult to evaluate the overall change in protection that might result from the cumulative effect of the reported changes to individual effects.

<u>April 15-30</u>: For the first experimental period of April 15-April 30, DOSS advises WOMT and NMFS to accept the DWR/PWA proposal to operate to an OMR limit of -3,500 cfs from April 15-30, unless the acoustically tagged steelhead exposure criterion, as defined in the technical memorandum, is exceeded. An OMR target of -3,500 cfs over this period is consistent

with both the operations proposed for April 15-30 in the OMR technical memorandum (see Table 1 of the OMR technical memorandum).

April 6, 2012

From: Delta Conditions Team, DWR and Public Water Agencies

To: DOSS

Subject: Alternative Operations during April 2012

The Department of Water Resources (DWR) and public water agencies (PWA) are providing an alternative operations plan to the Delta Operations for Salmonids and Sturgeon (DOSS) Group for April, 2012. The March 16, 2012 Technical Memorandum to Guide Adaptive Management of OMR during April and May 2012 (Tech Memo) provides the opportunity for the Delta Conditions Team (DCT), convened by DWR, to provide information to assist DOSS in evaluating effects of planned water operations on salmonids.

In the January 19, 2012 Joint Stipulation Regarding CVP and SWP Operations in 2012 (Stipulation), the parties agreed that the National Marine Fisheries Service (NMFS) should develop real-time operations screening criteria based on a variety of relevant available scientific information including results from trawls and rotary screw traps, salvage, hydrodynamics, empirical data from previous VAMP studies, survival equations, and a modified Delta Passage Model (Section 2.a.v.), and a broadened steelhead acoustic tagging and release program (Section 2.a.vi.). However, the March 16, 2012 Tech Memo and subsequent March 28, 2012 DOSS Advice for operations from April 1-April 7, 2012 present an operations management plan for the first two weeks of April based solely on the results of PTM (Section III.) The alternative operations plan presented here has been developed considering the additional information indicated in the Stipulation, specifically, the hydrodynamics and previous VAMP information.

The proposal has been developed based upon our understanding of the broader range of scientific factors (in addition to PTM analysis) that are specified in the stipulation. We believe that consideration of these other factors results in a plan that provides protection for fisheries in balance with current adverse water supply conditions, recognizing the extreme shortage in supply for CVP Contract Water Users specifically, who are currently receiving a 30% allocation.

THE PROPOSAL

DWR and the PWA proposes targeting -3,500 cfs Old and Middle rivers (OMR) flow in April, provided for in the January 19, 2012 Joint Stipulation Regarding CVP and SWP Operations in 2012 (Stipulation), unless 1) salmonid loss density criteria, defined in the National Marine Fisheries Service (NMFS) 2009 Biological Opinion for Long Term Operations of the Central Valley Project and State Water Project (BO), Reasonable and Prudent Alternatives (RPA) Action IV.2.3, are exceeded, or 2) acoustically tagged steelhead exposure criteria, defined in the Technical Memo, are exceeded.

RATIONALE:

We cite three lines of evidence that the proposed -3,500 OMR flow in April will not pose increased risk to survival of steelhead smolts. Foremost, the DSM2 Hydro simulations show clearly that the difference of flow diverted to the interior Delta at the Old and Middle River junctions with the San Joaquin will increase by less than half of 1% (0.5%) as negative OMR increases from -2500 cfs to -3500 cfs. Second, the PTM results are not reliable for predicting smolt movements, because they do not correspond with results from recoveries of CWT marked smolts during VAMP experiments. Finally, fish density triggers are in place to signal the need to curtail negative OMR flows if more fish enter Old and Middle River than expected.

Change in proportion of flow entering the interior Delta will be negligible. At the present inflow from the San Joaquin River at Vernalis (1730 cfs on Apr 4), the installation of HORB causes the percentage of flow entering the mouths of Old River and Middle River to increase by less than 0.3% from that without HORB (Attachment 1, Table 1). Further, that tiny increase shows almost no change in response to export pumping volume/OMR flows (Attachment 1, Figure 1 and Table 2). No change in the percentage of flow entering Old River is detectable as negative OMR flows change from -2,500 cfs to -5,000 cfs, and the percentage of flow entering Middle River actually decreases as OMR flows become more negative (Attachment 1, Table 1). Further, decreasing OMR flows have a very small effect on the duration of positive OMR flows (Attachment 1 Figure 2), magnitude of maximum negative OMR flow velocities (Attachment 1, Figure 3), or extent of negative average flows in the Delta (Attachment 1, Figure 4).

DSM2 Hydro outputs express volumes of flow and their direction at 15-minute increments, which are similar to the time steps within which juveniles arriving at a channel junction make the choice of which route to take leading out of the junction. Further, the telemetry studies cited in the Technical Memorandum have consistently shown that juvenile salmonids exit channel junctions in proportion to the flow splits exiting the junction. In contrast, none of the telemetry studies have shown that the fraction of fish choosing different exits at a junction is highly related to particle fates 28 days later. Further, the PTM results are widely divergent from both the the DSM2 Hydro results and the CWT results (as discussed below).

PTM and DSM2 Hydro results on day one of the simulations show very little effect from varying OMR flows (Attachment 1, Figure 5). PTM results for both total proportion of particles to the interior and effect of varying OMR flows begin to diverge from DSM2 Hydro results on day 2. By day 15 of the PTM simulations, PTM results diverge widely from DSM2 Hydro results for both the proportion of flow to the interior Delta and the effect of varying OMR flows. Further, the DSM2 Hydro results more closely match the expected hydrodynamic conditions experienced by migrating juvenile salmonids.

Particle Tracking Model Analysis is inconsistent with Coded Wire Tag Studies. The sole reliance on Particle Tracking Model (PTM) results to simulate salmonid behavior during the first two weeks of April, 2012 is not appropriate because particles in PTM are most similar to "packets of water" moving in the system, not juvenile salmonids that are actively swimming organisms with behavioral characteristics. The PTM does not simulate any behavior for outmigrating salmon and provides results that are significantly different than available coded wire tagged (CWT) studies. To determine the efficacy of PTM results simulating salmonid behavior, DWR compared 24 juvenile Chinook experimental releases in the lower San Joaquin River to associated PTM results. The 24 experimental releases were conducted for the VAMP from 1995 to 2006. These experimental releases were conducted using CWT hatchery origin juvenile Chinook released at Mossdale and Durham Ferry, upstream of the export facilities, and recaptured at Chipps Island, downstream, at the western boundary of the Delta. The purpose of the VAMP experiments was to try to determine the effects of flow and exports on juvenile Chinook. Since there are no such juvenile steelhead experiments on the lower San Joaquin River, we use Chinook as the closest surrogate for juvenile steelhead.

The figures in Attachment 2 are a comparison of the daily passage at Chipps Island of CWT juvenile Chinook and particles from associated PTM results for individual experimental releases. All the releases occur during the months of April and May. The fish releases were made at Mossdale from 1995 through 2004, and then at Durham Ferry, just upstream, from 2005 through 2006. There are usually 2 experimental releases each year, but there were 3 in 1995 and 1998, and only 1 in 1997 and 2004. All of the PTM studies used the same release dates and hydrology as the fish studies and used a constant 5,000 particles in each of the PTM studies. There are no figures past 2006 because, after 2006, FWS started using radio tagging instead of CWT tagging. Both the CWT and PTM data are presented in terms of percentages of CWT recoveries and particle passage at Chipps to standardize and evaluate the results from year to year. The left y-axes are the percentage of CWT Chinook recovered at Chipps, and the right y-axes are the percentage of particles passing Chipps Island on a daily time step.

Two characteristics are apparent from the graphs in Attachment 2: the trend of the timing of CWT Chinook recoveries at Chipps Island compared to PTM results, and the trend of the magnitude of CWT Chinook recoveries at Chipps Island compared to PTM results. The only years for which the timing of the CWT recoveries at Chipps were associated with the timing of the particles past Chipps were 1995, 1998 and 2006. Those were the three very high San Joaquin River flow years; flows greater than 20,000 cfs. The rest of the years, the CWT timing of recoveries at Chipps was much earlier than the particle timing past Chipps. Most years, there was little overlap between the CWT recoveries and particles passing Chipps. In the lowest flow years, 2000 through 2004, there was no overlap between the timing of the CWT recoveries at Chipps and the passing of particles past Chipps. In those lowest flow years, the CWT Chinook passed Chipps Island within about two weeks, regardless of the PTM results. The CWT Chinook actively swim downstream when compared to the neutrally buoyant particles.

The magnitude of recoveries of CWT Chinook at Chipps Island compared to the magnitude of particles passing Chipps Island was also not well associated. The only year for which the magnitude of CWT Chinook recovered at Chipps was relatively similar to the magnitude of particles passing Chipps Island was 1998. For the other two high flow years, 1995 and 2006, the recoveries of CWT Chinook at Chipps Island were relatively low. For the low flow years 1999 through 2001, the recoveries of CWT Chinook was relatively high compared to particles passing Chipps Island.

Fish density triggers protect smolts. In the event that more smolts turn into the interior Delta than expected, two fish density triggers are in place to detect the fish and reduce negative OMR flows. One trigger is determined from steelhead captures at the Delta Fish facilities, and the other is related to detections of acoustically tagged steelhead passing through routes leading to the pumps.

Attachment 1

Table 1. Change in Flow to Interior Delta with HORB In vs Out Under Varying Inflow and OMR Flows

Proportion of Flow Entering Interior Delta Over 24 Hours: HORB In - Out

From Upstream+Downstream: 1500 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-21.72%	-22.17%	-22.67%
TRN	1.23%	1.20%	1.19%
COL	0.62%	0.66%	0.73%
MRV	0.21%	0.22%	0.17%
ORV	0.26%	0.25%	0.26%
FMN	0.00%	0.00%	0.00%
FRV	0.02%	0.02%	0.02%
JPT	-0.10%	-0.12%	-0.13%

From Upstream: 1500 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-14.10%	-14.41%	-14.76%
TRN	0.14%	0.09%	0.12%
COL	0.12%	0.14%	0.22%
MRV	0.00%	0.00%	0.00%
ORV	0.09%	0.08%	0.08%
FMN	0.00%	0.00%	0.00%
FRV	-0.03%	-0.02%	0.03%
JPT	-0.10%	-0.11%	-0.14%

From Downstream: 1500 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-7.63%	-7.76%	-8.03%
TRN	1.09%	1.11%	1.07%
COL	0.51%	0.52%	-0.36%
MRV	0.21%	0.22%	0.17%
ORV	0.17%	0.17%	0.18%
FMN	0.00%	0.00%	0.00%
FRV	0.05%	0.04%	-0.01%
JPT	0.00%	0.00%	0.01%

From Upstream+Downstream: 3000 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-33.30%	-33.67%	-34.03%
TRN	2.39%	2.44%	2.57%
COL	1.46%	1.45%	1.53%
MRV	0.51%	0.44%	0.41%
ORV	0.55%	0.53%	0.54%
FMN	0.00%	0.00%	0.00%
FRV	0.02%	0.02%	0.02%
JPT	-0.09%	-0.10%	-0.10%

From Upstream: 3000 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-32.18%	-32.51%	-32.80%
TRN	2.25%	2.12%	1.97%
COL	-0.07%	-0.04%	0.06%
MRV	0.00%	0.00%	0.00%
ORV	0.10%	0.08%	0.08%
FMN	0.00%	0.00%	0.00%
FRV	0.06%	0.09%	0.13%
JPT	-0.12%	-0.14%	-0.15%

From Downstream: 3000 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-1.11%	-1.17%	-1.24%
TRN	0.14%	0.32%	0.61%
COL	1.53%	1.49%	1.48%
MRV	0.51%	0.44%	0.41%
ORV	0.45%	0.45%	0.45%
FMN	0.00%	0.00%	0.00%
FRV	-0.04%	-0.08%	-0.11%
JPT	0.03%	0.04%	0.05%

From Upstream+Downstream: 6000 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-35.30%	-35.35%	-35.39%
TRN	2.18%	2.35%	2.62%
COL	1.96%	2.09%	2.26%
MRV	1.93%	1.71%	1.60%
ORV	1.29%	1.25%	1.20%
FMN	0.00%	0.00%	-0.01%
FRV	-0.23%	0.01%	0.01%
JPT	-0.04%	-0.05%	-0.05%

From Upstream: 6000 cfs Inflows

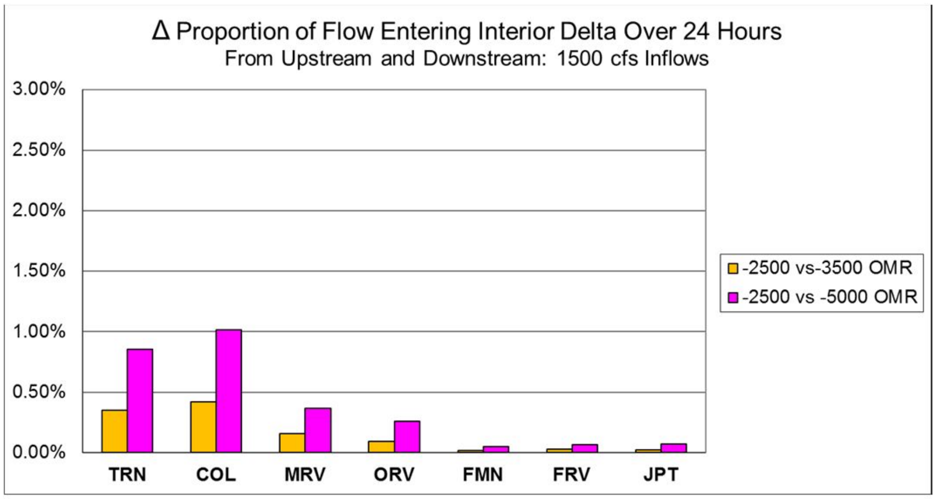
Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	-35.30%	-35.35%	-35.39%
TRN	1.69%	1.88%	2.17%
COL	1.51%	1.47%	1.43%
MRV	0.00%	0.00%	0.00%
ORV	0.04%	0.03%	0.06%
FMN	0.00%	0.00%	-0.01%
FRV	-0.15%	0.36%	0.40%
JPT	-0.18%	-0.19%	-0.20%

From Downstream: 6000 cfs Inflows

Junction	OMR Flows		
	-2500 cfs	-3500 cfs	-5000 cfs
HOR	0.00%	0.00%	0.00%
TRN	0.49%	0.48%	0.45%
COL	0.45%	0.62%	0.83%
MRV	1.93%	1.71%	1.60%
ORV	1.25%	1.22%	1.14%
FMN	0.00%	0.00%	0.00%
FRV	-0.08%	-0.36%	-0.39%
JPT	0.15%	0.15%	0.15%

Table 1. Change in proportion of flow to interior Delta with HORB In vs HORB out under varying San Joaquin River inflows and OMR flows. Inflows in the first week of April, 2012 most closely correspond to the 1,500 cfs inflows level.

Figure 1. Change in DSM2 Hydro Based Prediction of Movement into the Interior Delta



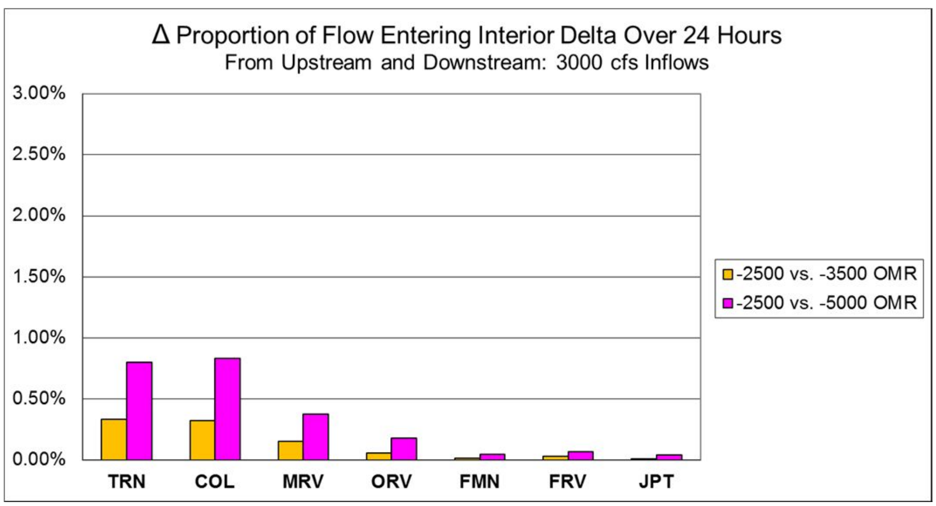


Figure 1. Change in the proportion of flow to the interior Delta (which closely correlates with expected changes in the movement of juvenile salmonids into the interior Delta) at junctions along the San Joaquin River as OMR flows decrease from -2500 to -3500 and from -2500 to -5000 cfs. The top panel shows values at San Joaquin River inflows of 1,500 cfs. The bottom panel shows values at San Joaquin River inflows of 3,000 cfs. The figure illustrates that changes in OMR flows are expected to have very little influence on the routing of fish.

Table 2. Change in DSM2 Hydro Based Prediction of Movement into the Interior Delta

Δ Proportion of Flow Entering Interior Delta Over 24 Hours

From Upstream+Downstream: 1500 cfs Inflows

-2500 cfs OMR [~2863 cfs exports] vs. -3500 cfs OMR [~3927 cfs exports]

Junction	OMR Flows		Δ Proportion
	-2500 cfs	-3500 cfs	
TRN	15.11%	15.46%	0.35%
COL	14.28%	14.70%	0.42%
MRV	18.11%	18.27%	0.16%
ORV	15.24%	15.33%	0.09%
FMN	2.38%	2.40%	0.02%
FRV	16.83%	16.85%	0.03%
JPT	6.56%	6.58%	0.02%

-2500 cfs OMR [~2863 cfs exports] vs. -5000 cfs OMR [~5523 cfs exports]

Junction	OMR Flows		Δ Proportion
	-2500 cfs	-5000 cfs	
TRN	15.11%	15.96%	0.86%
COL	14.28%	15.30%	1.02%
MRV	18.11%	18.48%	0.37%
ORV	15.24%	15.50%	0.26%
FMN	2.38%	2.43%	0.05%
FRV	16.83%	16.89%	0.06%
JPT	6.56%	6.64%	0.07%

From Upstream+Downstream: 3000 cfs Inflows

-2500 cfs OMR [~2989 cfs exports] vs. -3500 cfs OMR [~4053 cfs exports]

Junction	OMR Flows		Δ Proportion
	-2500 cfs	-3500 cfs	
TRN	19.12%	19.45%	0.33%
COL	16.14%	16.46%	0.32%
MRV	18.66%	18.81%	0.15%
ORV	15.97%	16.03%	0.06%
FMN	2.38%	2.39%	0.01%
FRV	16.81%	16.84%	0.03%
JPT	6.59%	6.60%	0.01%

-2500 cfs OMR [~2989 cfs exports] vs. -5000 cfs OMR [~5649 cfs exports]

Junction	OMR Flows		Δ Proportion
	-2500 cfs	-5000 cfs	
TRN	19.12%	19.92%	0.80%
COL	16.14%	16.98%	0.83%
MRV	18.66%	19.03%	0.37%
ORV	15.97%	16.15%	0.18%
FMN	2.38%	2.42%	0.04%
FRV	16.81%	16.88%	0.07%
JPT	6.59%	6.63%	0.04%

Table 2. Data used for Figure 1. Proportion of flow and change in proportion of flow (which are closely correlated with the expected movement and changes in the expected movement, respectively, of juvenile salmonids into the interior Delta) at junctions along the San Joaquin River as OMR flows decrease from -2500 to -3500 and from -2500 to -5000 cfs.

Figure 2. Change in % Positive Flows: OMR -3500 vs. -2500

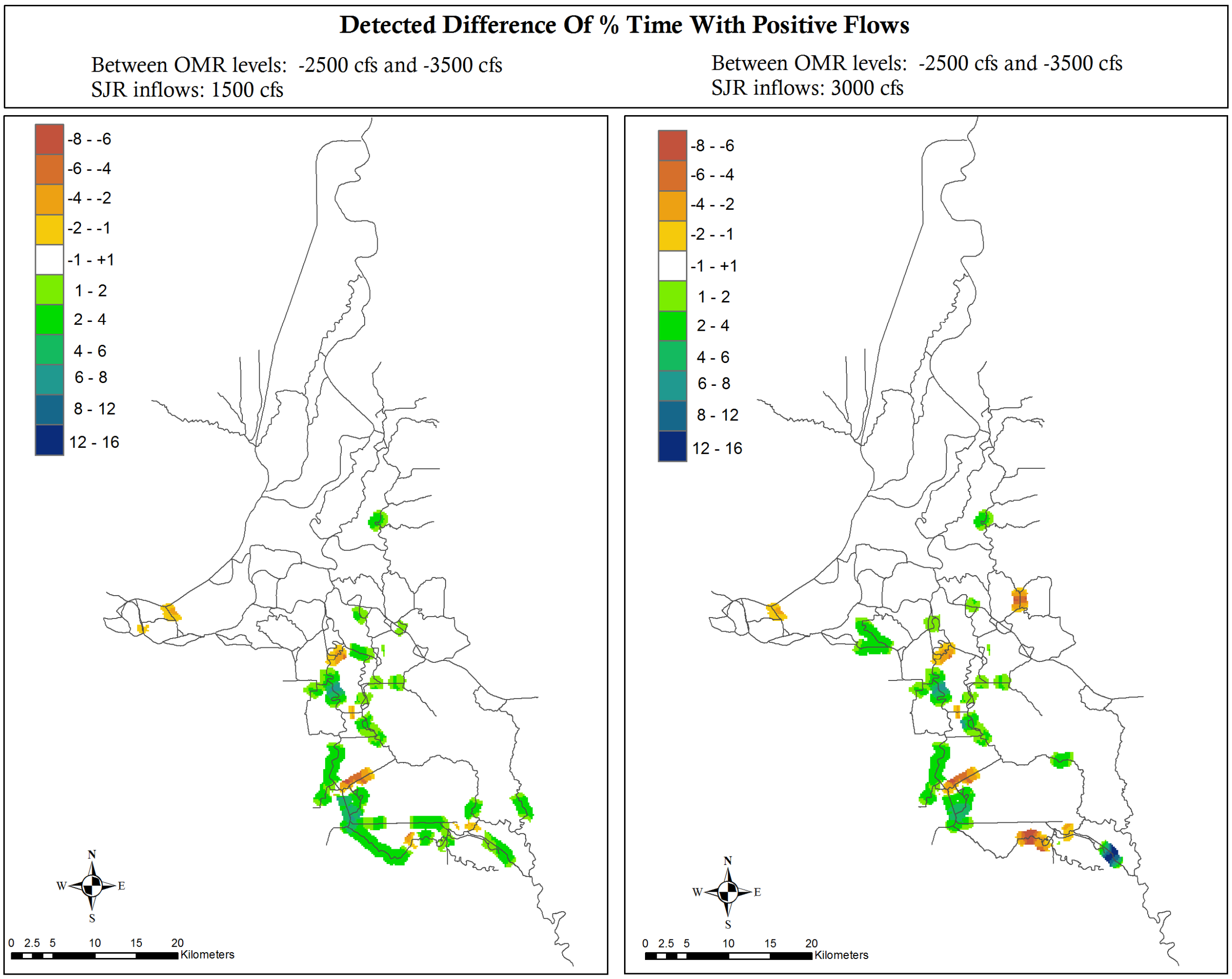


Figure 2. Percentage change in the occurrence of positive flows as OMR moves from -3500 cfs to -2500 cfs with San Joaquin River inflows at 1,500 cfs (left panel) and at 3,000 cfs (right panel). Yellow, orange, and red indicate 1 to 6% increase in occurrence of negative flows. Green and blue indicate positive flow increase in occurrence from 1 to 16%. The figure illustrates that more positive OMRs produce only slight changes, mostly in close proximity to export facilities, in the occurrence of positive flows.

Figure 3. Change in Maximum Negative Velocities: OMR -3500 vs. -2500

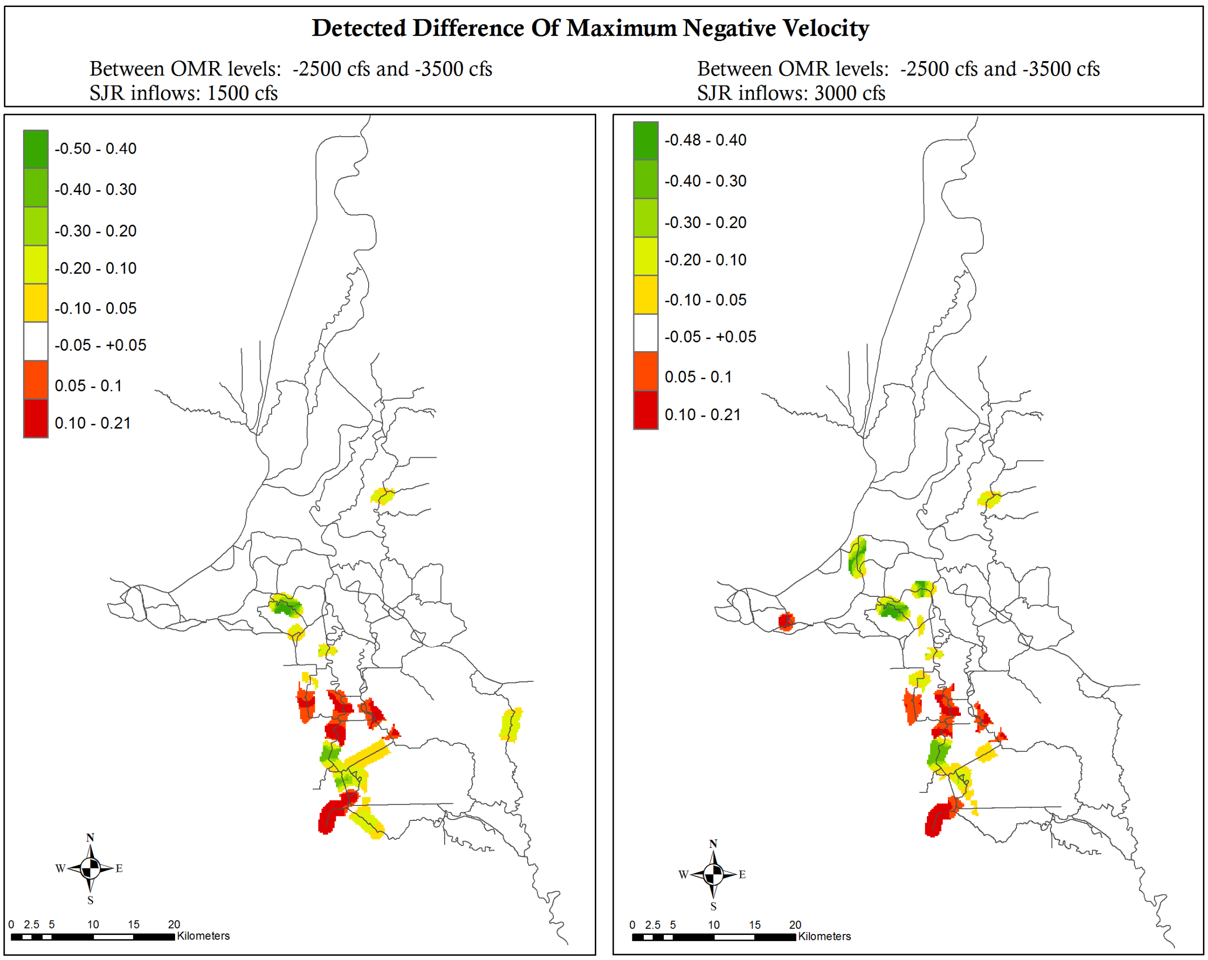


Figure 3. Change in maximum negative velocities as OMR moves from -3500 cfs to -2500 cfs with San Joaquin River inflows at 1,500 cfs (left panel) and at 3,000 cfs (right panel). Orange and red indicate 0.05 to 0.21 increase in negative velocities. Yellow and green indicate 0.05 to 0.50 decrease in negative velocities. The figure illustrates that more positive OMRs produce only slight changes, mostly in close proximity to export facilities, in the magnitude of negative velocities.

Figure 4. Change in Average Daily Flows: OMR -3500 vs. -2500

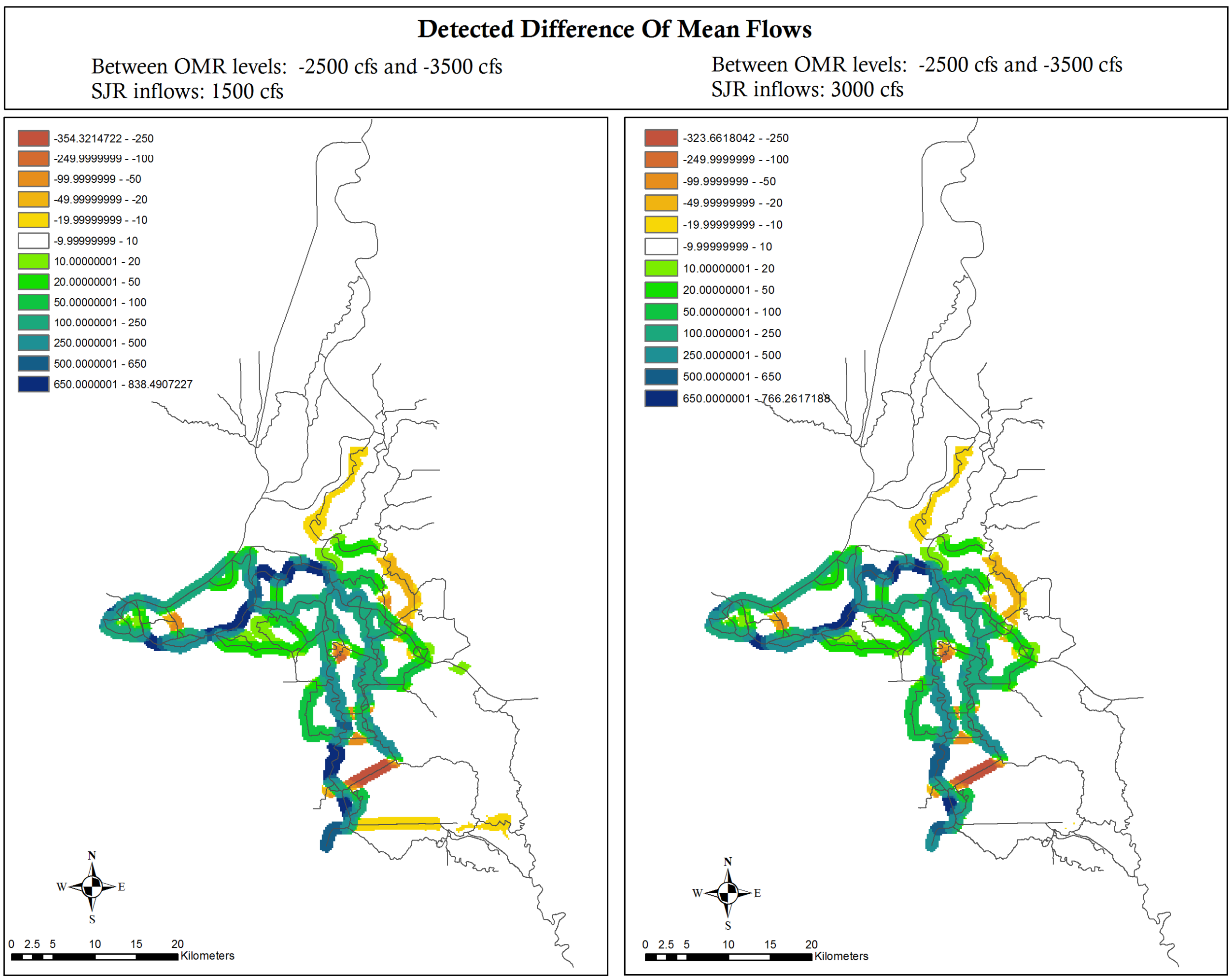


Figure 4. Change in the average daily (or "net") flows as OMR moves from -3500 cfs to -2500 cfs with San Joaquin River inflows at 1,500 cfs (left panel) and at 3,000 cfs (right panel). Yellow, orange, and red indicate 10 to 350 cfs decreases in mean daily flows. Green and blue indicate 10 to 850 cfs increases in mean daily flows. The figure illustrates that more positive OMRs produce only slight changes in daily mean flows. Areas where greatest changes (dark blue) are observed are areas not identified as areas of concern by NMFS.

Figure 5. PTM Results at Appropriate Time Scale, Compared to DSM2 Hydro Results

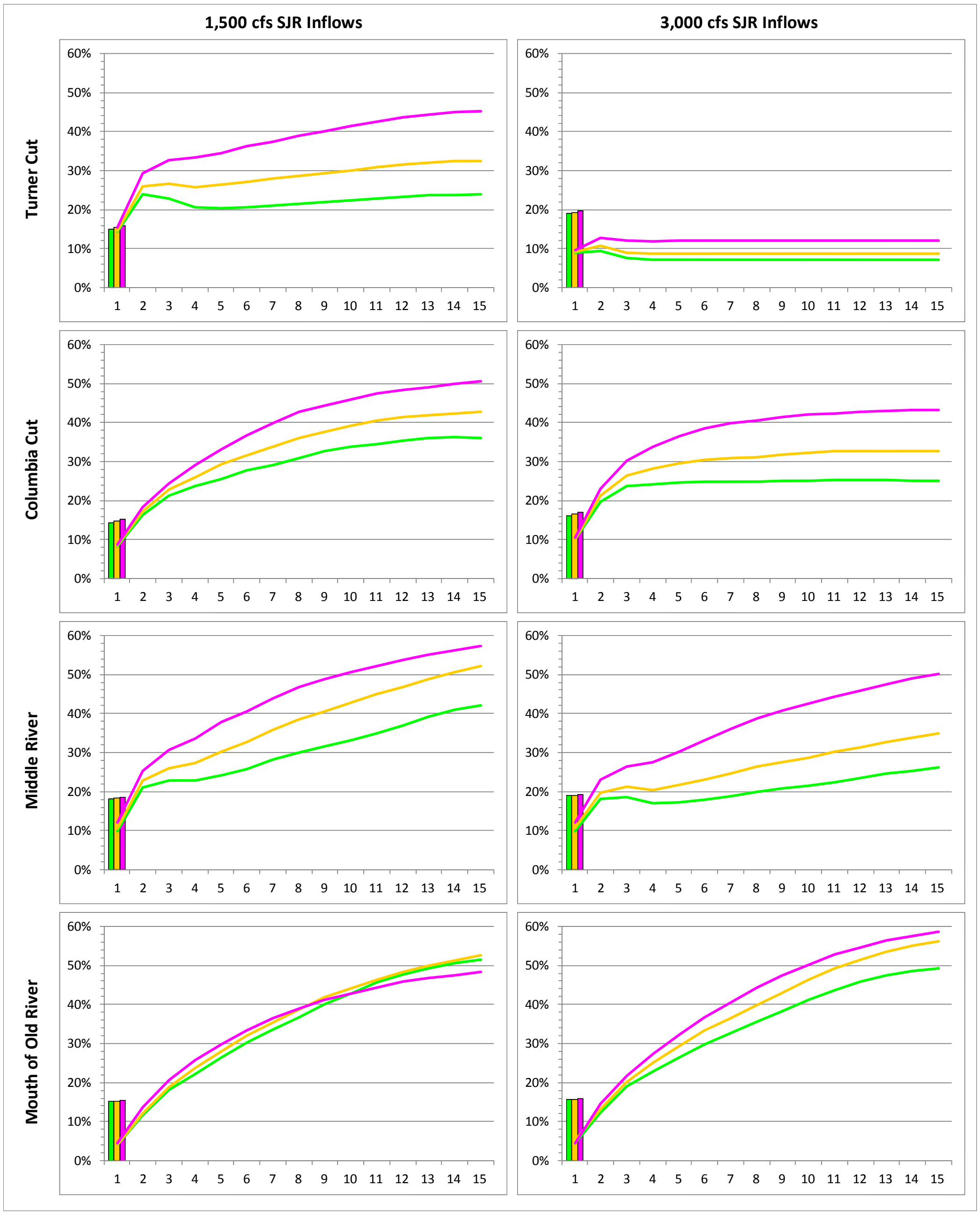
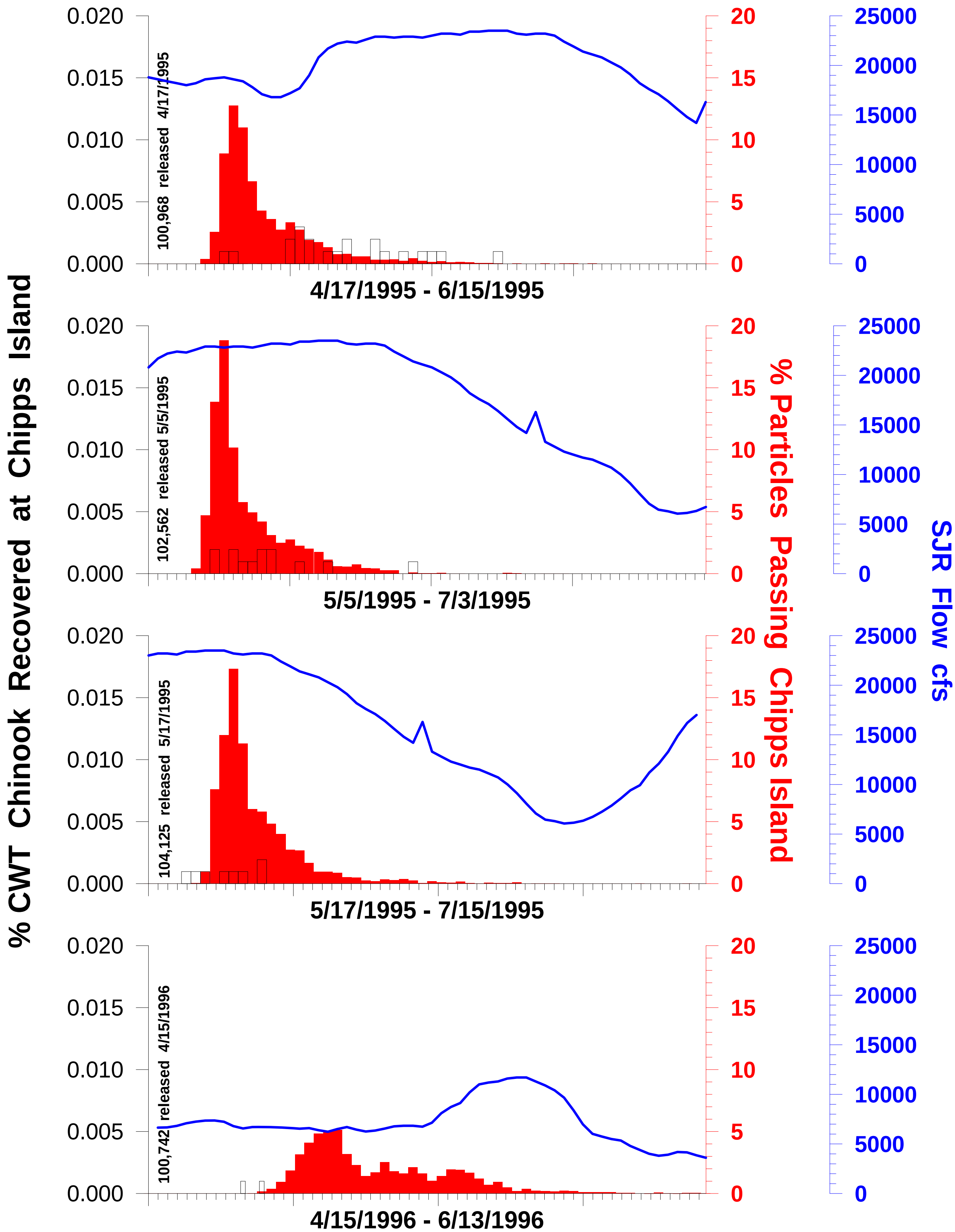
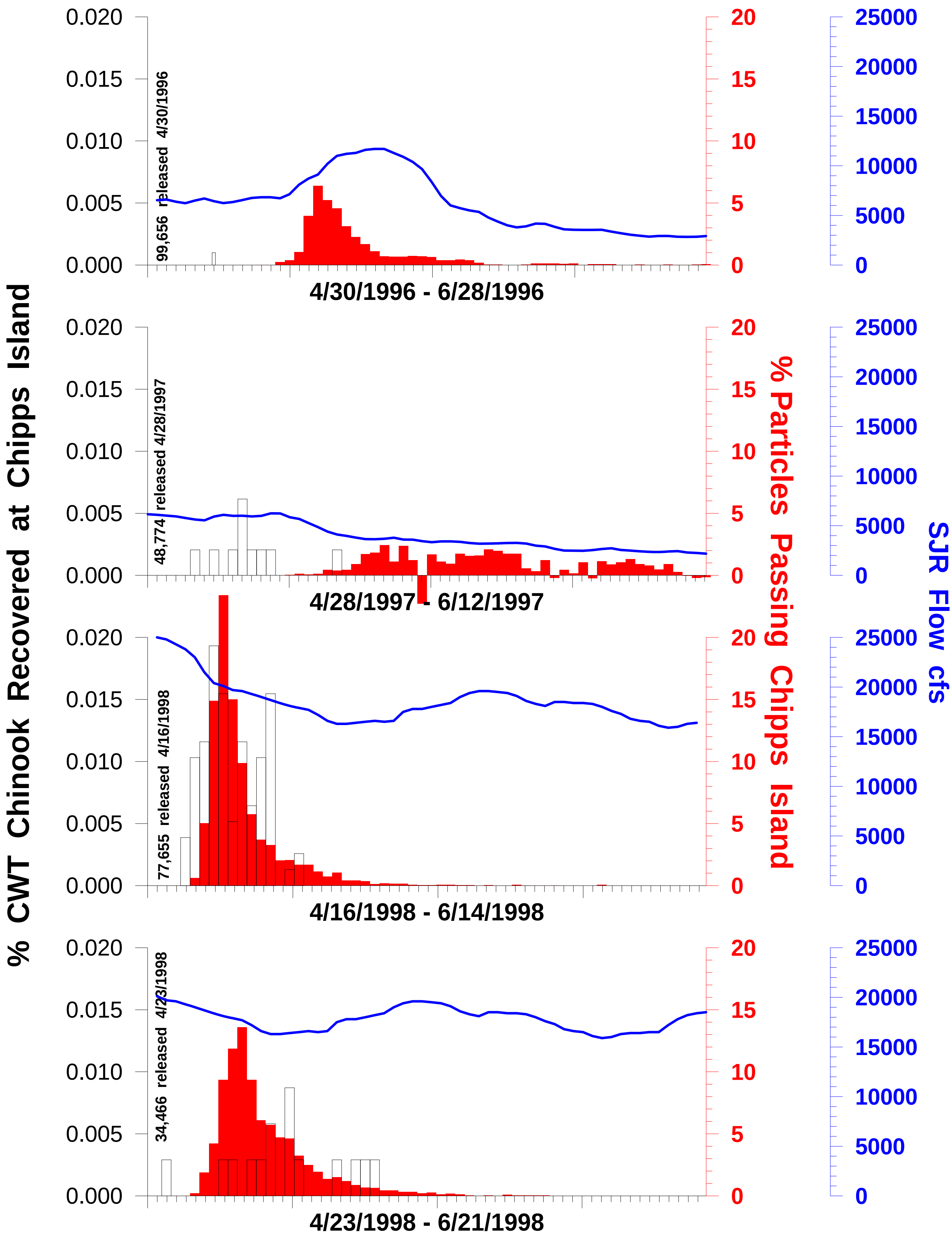


Figure 5. Daily PTM results for particles injected just upstream of key junctions which move into the interior Delta (lines) and comparable results for DSM2 Hydro analysis (bars) at two levels of San Joaquin River inflows (left and right panels). Green lines/bars represent -2500 cfs OMR. Orange lines/bar represent -3500 cfs OMR. Magenta lines/bars represent -5000 cfs OMR. The figure illustrates that PTM results are extremely sensitive to the time period over which the fate of particles is evaluated. Given their rapid migration through the Delta, juvenile salmonids would be expected to spend only about one day in the vicinity of any junction. PTM and DSM2 Hydro results at this time period show very little effect from varying OMR flows. PTM results at 15 days diverge widely from DSM2 Hydro results for both the proportion of flow to the interior Delta and the effect of varying OMR flows . The DSM2 Hydro results more closely match the expected hydrodynamic conditions experienced by migrating juvenile salmonids.

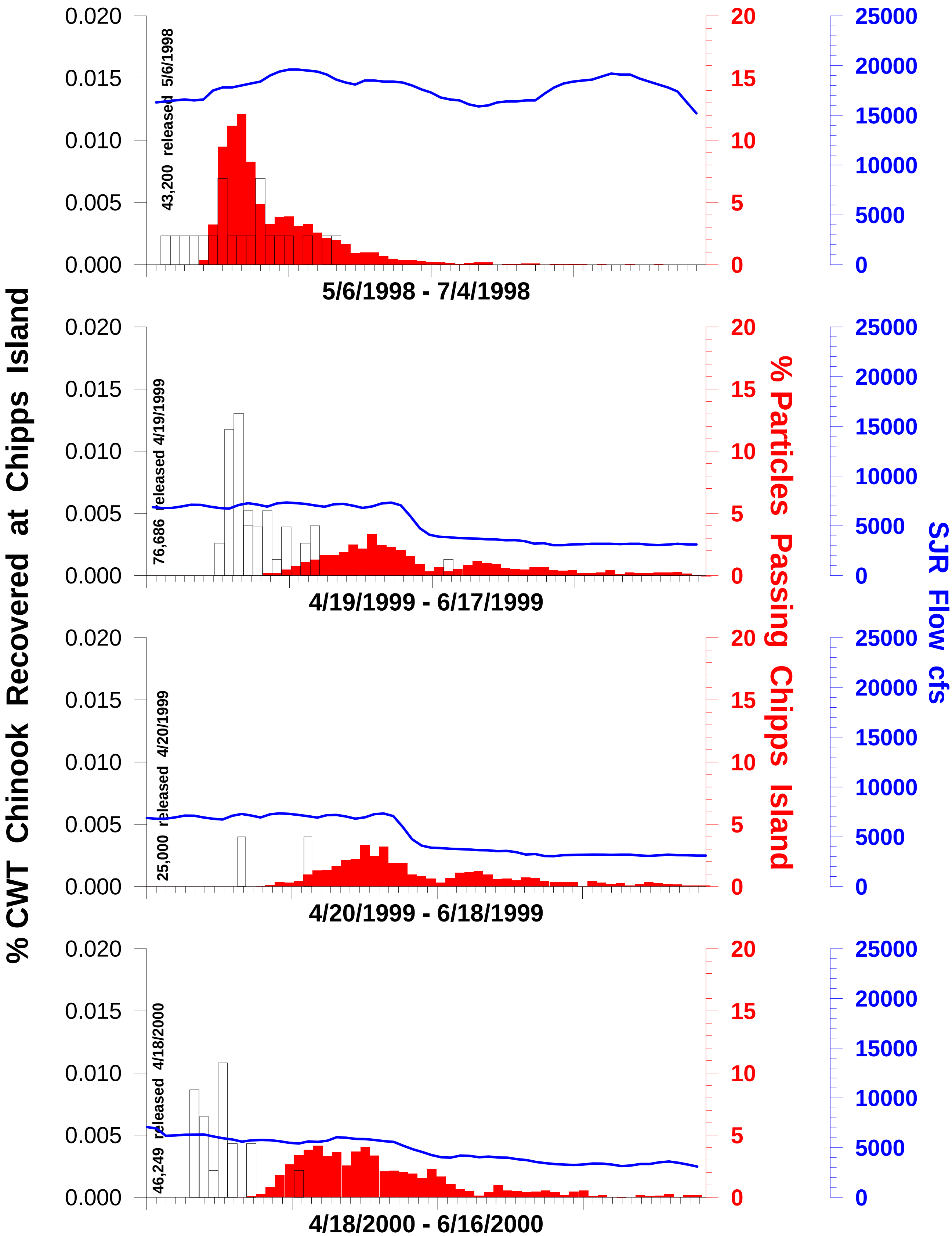
Attachment 2



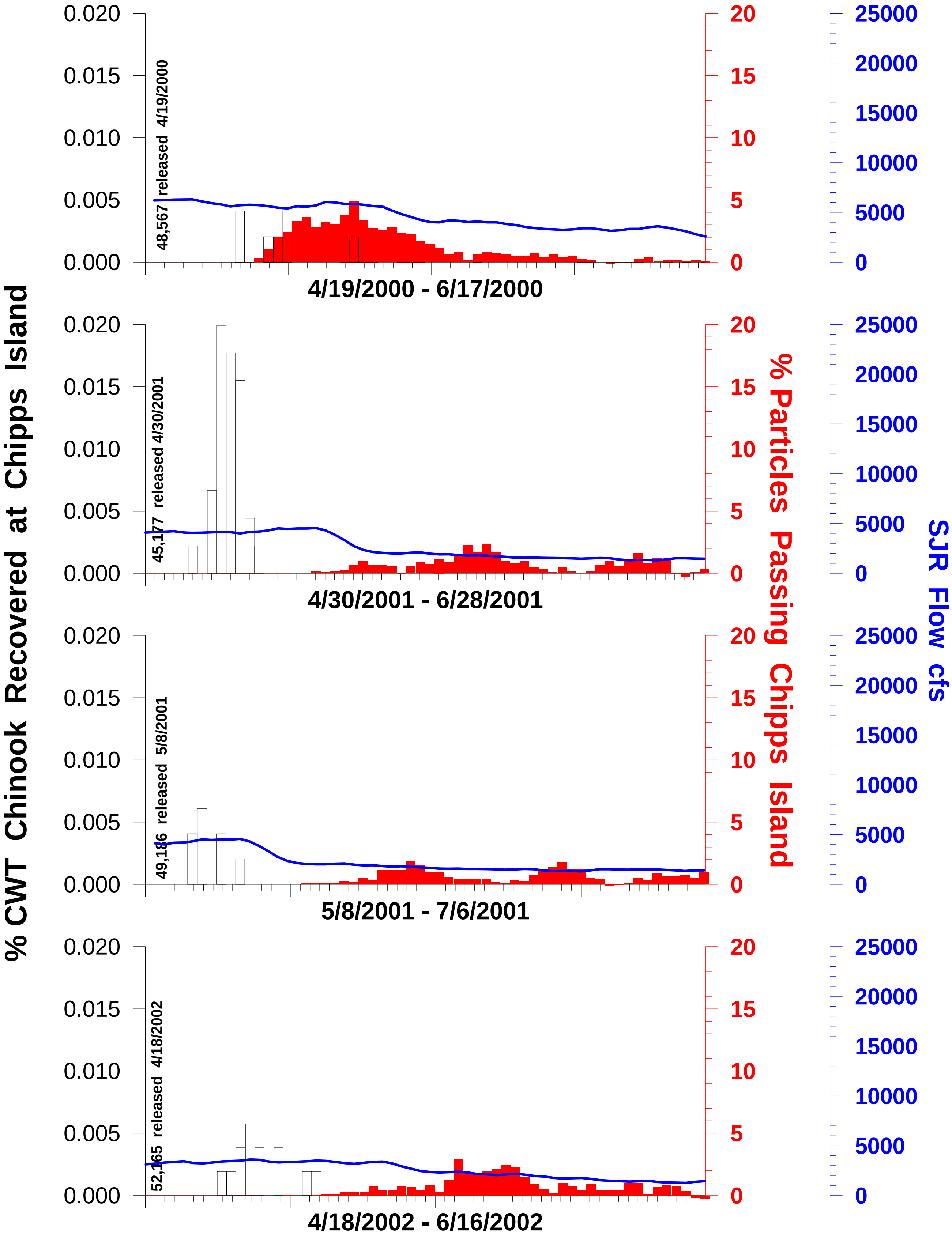
% CWT Chinook Recovered at Chipps Island
% Particles Passing Chipps Island
SJR Flow cfs
100,968 released 4/17/1995
4/17/1995 - 6/15/1995
102,562 released 5/5/1995
5/5/1995 - 7/3/1995
104,125 released 5/17/1995
5/17/1995 - 7/15/1995
100,742 released 4/15/1996
4/15/1996 - 6/13/1996
0.000
0.005
0.010
0.015
0.020
0
5
10
15
20
0
5000
10000
15000
20000
25000



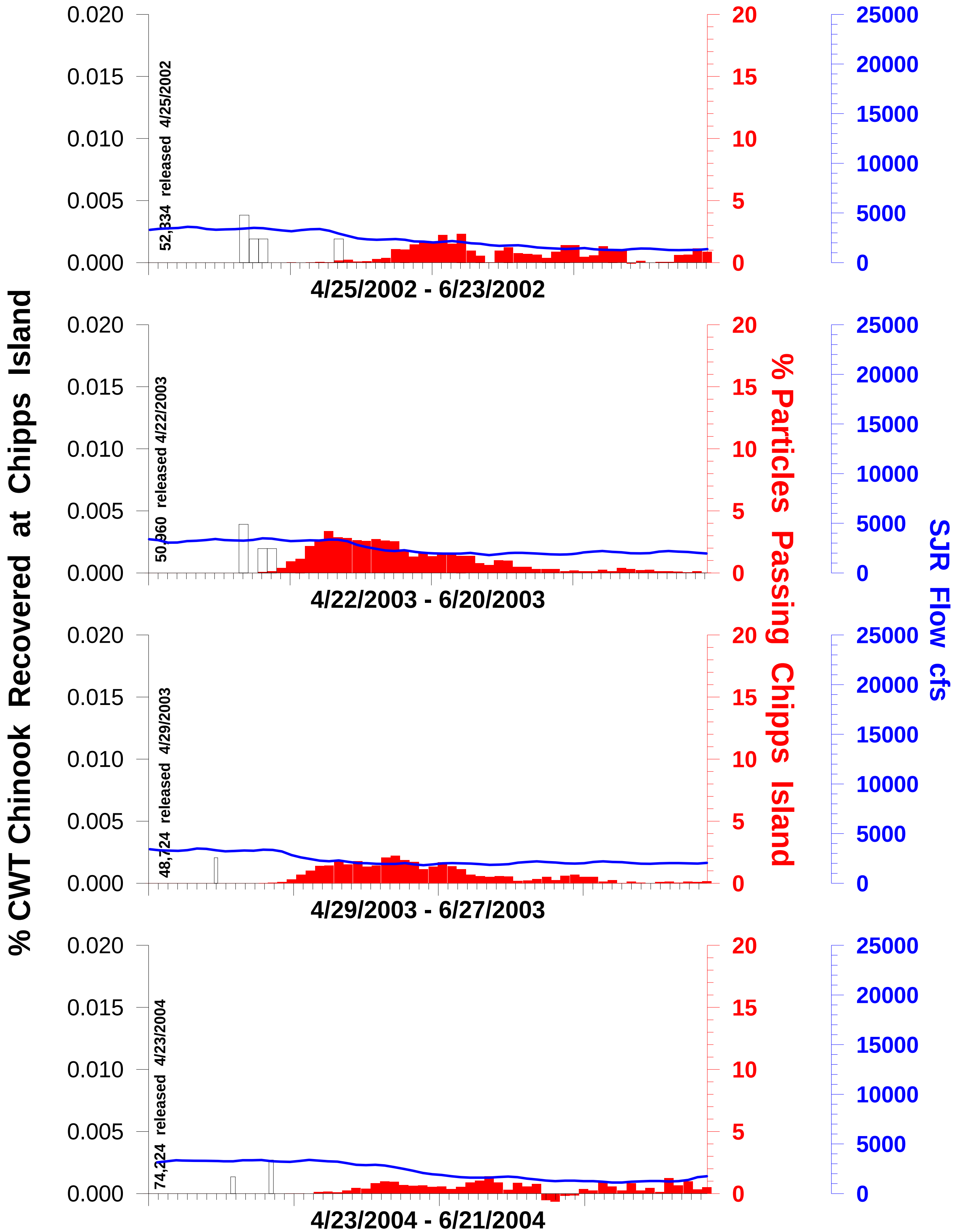
% CWT Chinook Recovered at Chipps Island
% Particles Passing Chipps Island
SJR Flow cfs
99,656 released 4/30/1996
4/30/1996 - 6/28/1996
48,774 released 4/28/1997
4/28/1997 - 6/12/1997
77,655 released 4/16/1998
4/16/1998 - 6/14/1998
34,466 released 4/23/1998
4/23/1998 - 6/21/1998
0.000
0.005
0.010
0.015
0.020
0
5
10
15
20
0
5000
10000
15000
20000
25000



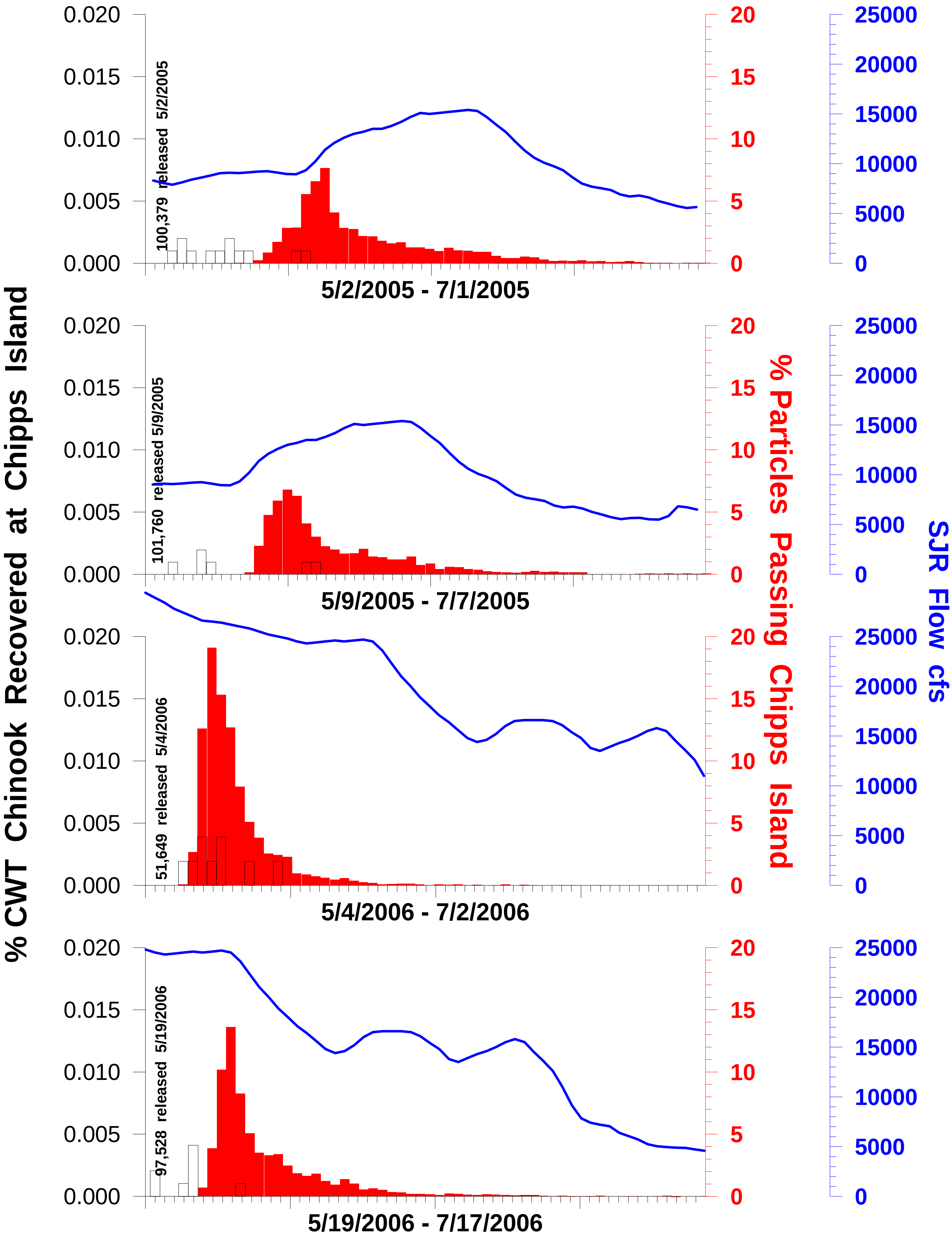
% CWT Chinook Recovered at Chipps Island
% Particles Passing Chipps Island
SJR Flow cfs
43,200 released 5/6/1998
5/6/1998 - 7/4/1998
76,686 released 4/19/1999
4/19/1999 - 6/17/1999
25,000 released 4/20/1999
4/20/1999 - 6/18/1999
46,249 released 4/18/2000
4/18/2000 - 6/16/2000

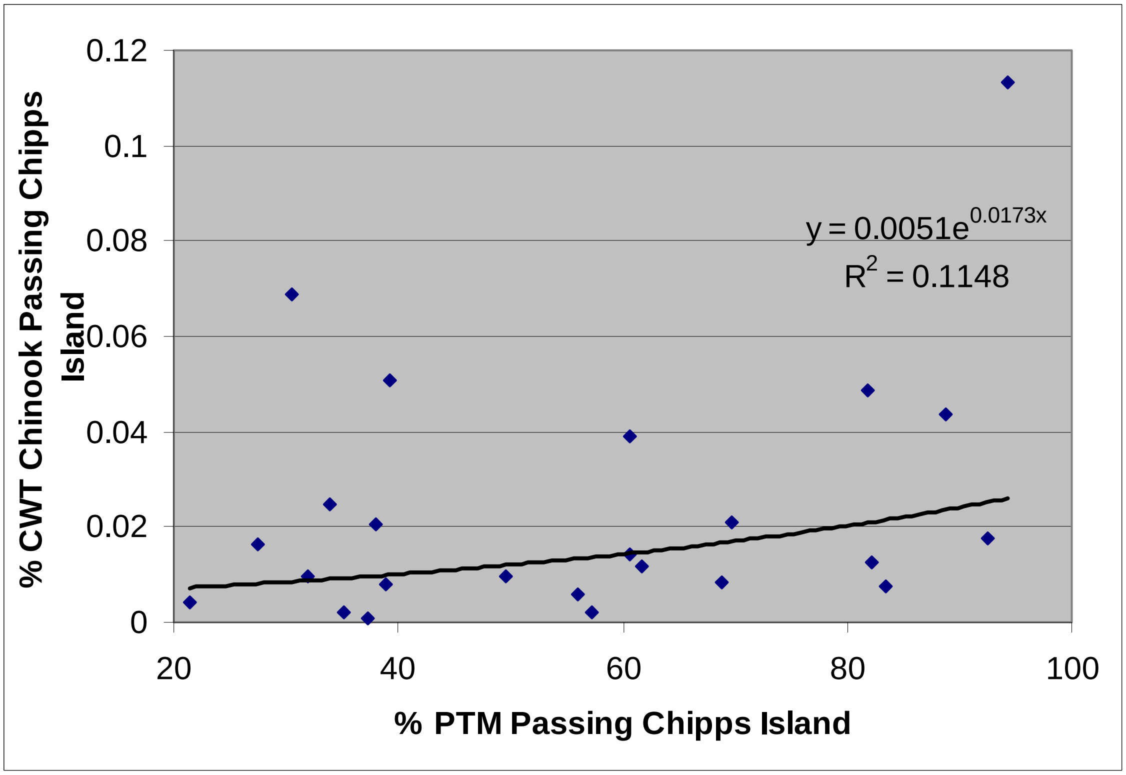


% CWT Chinook Recovered at Chipps Island
% Particles Passing Chipps Island
SJR Flow cfs
0.020
0.015
0.010
0.005
0.000
20
15
10
5
0
25000
20000
15000
10000
5000
0
48,567 released 4/19/2000
4/19/2000 - 6/17/2000
45,177 released 4/30/2001
4/30/2001 - 6/28/2001
49,186 released 5/8/2001
5/8/2001 - 7/6/2001
52,165 released 4/18/2002
4/18/2002 - 6/16/2002

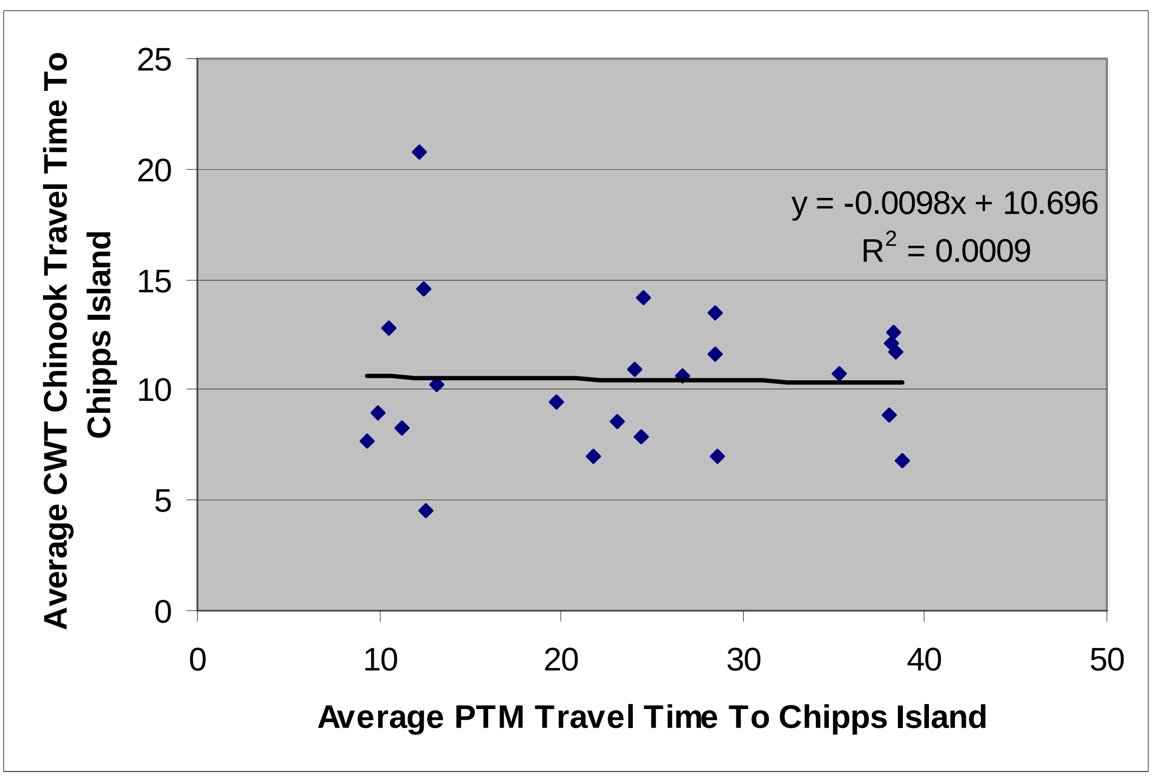


% CWT Chinook Recovered at Chipps Island
% Particles Passing Chipps Island
SJR Flow cfs
52,334 released 4/25/2002
4/25/2002 - 6/23/2002
50,960 released 4/22/2003
4/22/2003 - 6/20/2003
48,724 released 4/29/2003
4/29/2003 - 6/27/2003
74,224 released 4/23/2004
4/23/2004 - 6/21/2004
0.000
0.005
0.010
0.015
0.020
0
5
10
15
20
0
5000
10000
15000
20000
25000


% CWT Chinook Recovered at Chipps Island
% Particles Passing Chipps Island
SJR Flow cfs
100,379 released 5/2/2005
5/2/2005 - 7/1/2005
101,760 released 5/9/2005
5/9/2005 - 7/7/2005
51,649 released 5/4/2006
5/4/2006 - 7/2/2006
97,528 released 5/19/2006
5/19/2006 - 7/17/2006
0.000
0.005
0.010
0.015
0.020
0
5
10
15
20
0
5000
10000
15000
20000
25000



0.12
0.1
0.08
0.06
0.04
0.02
0
20
40
60
80
100
% CWT Chinook Passing Chipps Island
% PTM Passing Chipps Island
y = 0.0051e^0.0173x
R^2 = 0.1148



25
20
15
10
5
0
0
10
20
30
40
50
Average CWT Chinook Travel Time To Chipps Island
Average PTM Travel Time To Chipps Island
y = -0.0098x + 10.696
R^2 = 0.0009

Enclosure 3

Use of Data in the Implementation of the January 12, 2012, Joint Stipulation

The January 12, 2012, joint stipulation page 4, paragraph V says, "Real-time operations screening criteria will be developed based on hydrodynamics and particle Tracking Model ('PTM') runs, and other relevant available scientific information and considerations…" The following is the list of other information specified in the joint stipulation, and how NMFS and the technical memorandum planning/drafting committee used each in the development of the technical memorandum, and considered them through the Delta Operations for Salmonids and Sturgeon (DOSS) group, Water Operations Management Team (WOMT), and NOAA's National Marine Fisheries Service (NMFS) determination processes:

a. <u>The fraction of particles that reach Chipps Island</u>: NMFS' March 16, 2012, technical memorandum (tech memo) specifically considers the fraction of particles that reach Chipps Island in its PTM screening criteria
b. <u>Particle residence time</u>: The tech memo specified 28 days to allow particles to resolve their fates, but provided for an amendment if the fates of a significant number of particles are not resolved within 28 days. As part of the DOSS advice from April 3, 2012, DOSS advised WOMT and NMFS to amend the simulation period, to be determined by the number of days in which 50% of inserted particles have reached some fate in the scenario (either the baseline scenario or any of the three operational scenarios) with the slowest dynamics. By measuring particle fluxes on the same day after particle insertion for all scenarios, differences in particle residence times were captured by the PTM screening criterion specified in the tech memo.
c. <u>Results showing particle capture at various diversions in the delta</u>: The tech memo specifically considers the fraction of particles that are captured at the Federal and State fish facilities. The PTM screening criterion did not include particle entrainment into the agricultural diversions or the diversions of the Contra Costa Water District. Entrainment into agricultural diversions was not considered because while particles enter agricultural diversions according to the flow split into agricultural diversions, we don't expect fish to do so, given the small intake sizes. The depletion of particles by this possibly unrealistic fate does mean that fewer particles remain in the system to meet other, more realistic fates. This issue was discussed by NMFS and DWR during development of the PTM modeling request, but there was no readily available modeling option that would allow PTM to prevent particle uptake into agricultural diversions. This issue was noted again at the February 7th workshop, and is an issue that should be considered in ongoing efforts to refine the PTM model to capture salmonid behavior. Entrainment into the CCWD diversions was not considered since changes in OMR levels were expected to result from changes to CVP and SWP export levels (and associated entrainment).
d. <u>Relevant available information from</u>:
    a. *trawls and rotary screw trap (RST) information*: Most of these data were already considered to evaluate timing of steelhead entry into the Delta during April and May. A review of historical catch data suggest that steelhead enter the Delta from Mossdale, the Calaveras, and the Mokelumne throughout April and May. Given

the expected scarcity of San Joaquin basin steelhead, and the lower efficiency of trawls and RSTs to sample juvenile steelhead (compared to sampling for juvenile Chinook salmon), NMFS' preliminary conclusion was that these monitoring tools were not well suited to estimating the precise temporal onset and conclusion of migration in a specific year. At the February 7 workshop, NMFS presented that preliminary conclusion and asked if anyone felt that those monitoring tools had sufficient power to measure Delta entry on a finer temporal scale than "entering through April and May." No one spoke up to suggest that, for example, a steelhead observed in the Mossdale trawl on April 8th would indicate migration into the Delta but that no catch of steelhead in the Mossdale trawl on April 9th would indicate that migration had ended. One participant did suggest a temperature off-ramp; *i.e.*, to assume that the migration period is over once temperatures reach some level. While this option was discussed in the drafting of the tech memo, NMFS had concern over including a temperature offramp in May.

b. *salvage*: The "Railroad Cut exposure trigger" described in the tech memo, to be implemented from mid-April through May, is designed to trip when the number of fish passing the acoustic receivers on Old and Middle rivers near Railroad Cut exceeds the number that would be expected to result in 2% loss of the release group at the fish collection facilities. While presumed loss (itself related to salvage) at the fish collection facilities is used to set the exposure trigger level, and a second trigger based on entry of acoustically-tagged fish into the fish collection facilities may be used if data are available during April-May 2012, salvage or loss of wild steelhead is not used for managing OMR flows during April and May 2012 for two reasons. First, steelhead from the San Joaquin Basin are scarce and absence in salvage may not indicate absence in the Delta. Second, it is not possible (under current practices at the fish collection facilities) to distinguish wild steelhead observed in salvage as originating from Sacramento or San Joaquin basin tributaries.

c. *hydrodynamics*: The PTM approach used for the first two weeks of April depend on DSM2 Hydro runs based on forecasted hydrology.

d. *empirical data from previous VAMP studies*: Empirical data from previous VAMP studies was used primarily in the assessment of the effects of the rock barrier. NMFS concluded that a rock barrier was likely to improve the survival of fish entering the Delta from upstream of the head of Old River. Most years of VAMP studies evaluated survival through two through-Delta routes – the mainstem San Joaquin River and Old River – and do not allow analysis of the possible effects of OMR management on route selection and survival in south delta channels. Acoustic tag data from the 2010 VAMP study did provide some survival estimates in more spatially resolved Delta reaches; one of these survival estimates was used in the calculation of the exposure trigger to be used mid-April through May. Because of intensive post-processing needs, the acoustic tag data from the 2011 VAMP experiment and six-year steelhead study are not yet available for analysis.

e. *survival equations*: Survival equations based on Ken Newman's analysis of through-delta survival in the mainstem San Joaquin and Old River routes based on coded-wire tagged fish were used to evaluate the expected effects of the operation of a rock barrier at the head of Old River. As mentioned previously, NMFS concluded that a rock barrier was likely to improve the survival of fish entering the Delta from upstream of the head of Old River.

f. *modified Delta Passage Model (DPM)*: Cramer Fish Sciences is working on a modified DPM that captures south delta channel complexity (as acknowledged in the tech memo) but NMFS has not yet been provided any proposal for a "revised-DPM-based" approach to OMR management during April-May 2012. The existing DPM (being used in BDCP) includes junctions at the head of Old River and the Mokelumne and models through-delta survival only via two routes: the mainstem SJR and Old River routes. This version of DPM is not spatially explicit enough to evaluate hydrodynamic effects on the survival of Calaveras/Mokelumne steelhead during outmigration under different OMRs. DPM was also mentioned in the joint stipulation on page 5, line 17 as it pertains to the Delta Conditions Team (DCT), but the DCT has not, to date, provided any data or outputs utilizing the DPM.