Annual Report of Activities
October 1, 2015, to
September 30, 2016

Delta Operations for
Salmonids and Sturgeon (DOSS)
Technical Working Group
October 2016

Cover Photo: *Sunset at Mildred Island on the Middle River corridor in the Delta.*
Credit: *Jan McCleery*

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Acronyms and Abbreviations

Term	Definition
BiOp	Biological Opinion
CDEC	California Data Exchange Center
CNFH	Coleman National Fish Hatchery
CPUE	catch per unit effort
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWT	coded wire tag
DAT	Data Assessment Team
DCC	Delta Cross Channel
DCT	Delta Conditions Team
DFW	California Department of Fish & Wildlife
DPS	distinct population segment
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
ePTM	Enhanced Particle Tracking Model
ESA	Endangered Species Act
FRH	Feather River Hatchery
FWS	U.S. Fish & Wildlife Service
I:E	inflow-to-export ratio
IRP	independent review panel
JPE	juvenile production estimate
KLCI	Knights Landing Catch Index
LOBO	Long-term Operations of the CVP and SWP Biological Opinions
LSNFH	Livingston Stone National Fish Hatchery
MAF	million acre-feet
NGO	non-governmental organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OMR	net tidal flow measurement in Old and Middle Rivers combined
PTM	particle tracking model
RBDD	Red Bluff Diversion Dam

Term	Definition
Reclamation	U.S. Bureau of Reclamation
RKM	river kilometer
RPA	Reasonable and Prudent Alternative
RST	rotary screw trap
SCI	Sacramento Catch Index
SWG	Smelt Working Group
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TUCP	Temporary Urgency Change Petition
USGS	U.S. Geological Survey
VAMP	Vernalis Adaptive Management program
WOMT	Water Operations Management Team
WY	water year

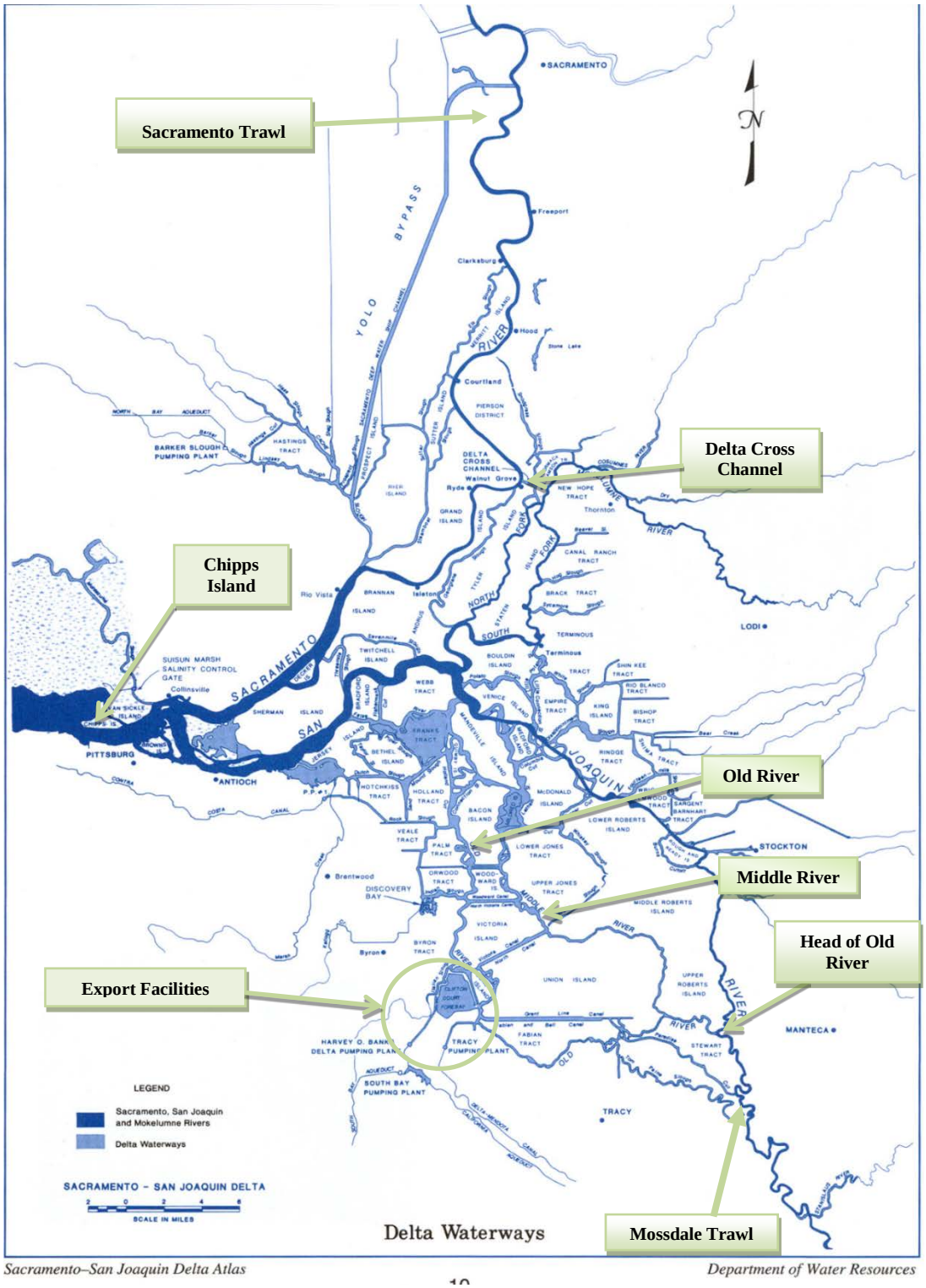

Figure 1-1. Delta map with DOSS-related points of interest.

CHAPTER 1 BACKGROUND

1.1 Background

On 6/4/09, the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) issued its Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project (CVP) and State Water Project (SWP, NMFS BiOp). The NMFS BiOp's reasonable and prudent alternative (RPA) Action IV.5 called for the formation of the Delta Operations for Salmonids and Sturgeon (DOSS) Technical Working Group. DOSS is a technical team that includes biologists, hydrologists, and operators with relevant expertise from the U.S. Bureau of Reclamation (Reclamation), California Department of Water Resources (DWR), California Department of Fish and Wildlife (DFW), U.S. Fish and Wildlife Service (FWS), State Water Resources Control Board (SWRCB), U.S. Geological Survey (USGS), U.S. Environmental Protection Agency (EPA), and NMFS that provides advice to NMFS and to the Water Operations Management Team (WOMT) on issues related to fisheries and water resources in the Delta and recommendations on measures to reduce adverse effects of Delta operations of the CVP and SWP export facilities to salmonids and green sturgeon. Some key features in the DOSS "area of interest" are shown in Figure 1.1.

The purposes of DOSS are to:

1) provide recommendations to WOMT and NMFS for real-time management of operations consistent with implementation procedures provided in the RPA;

2) review annually project operations in the Delta and the collected data from the different ongoing monitoring programs;

3) track the implementation of Delta RPA Actions IV.1 through IV.4;

4) evaluate the effectiveness of RPA Actions IV.1 through IV.4 in reducing mortality or impairment of essential behaviors of listed species in the Delta;

5) oversee implementation of the 6-year acoustic tag experiment for San Joaquin fish provided for in RPA Action IV.2.2;

6) coordinate with the Smelt Working Group (SWG) to maximize benefits to all listed species; and

7) coordinate with the other technical teams identified in the RPA to ensure consistent implementation of the RPA.

1.2 Participants

The DOSS technical team includes participants from the following member agencies:

- United States Bureau of Reclamation (Reclamation)
- United States Fish & Wildlife Service (FWS)
- National Marine Fisheries Service (NMFS)
- California Department of Water Resources (DWR)
- California Department of Fish and Wildlife (DFW)

- State Water Resources Control Board (SWRCB)
- United States Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)

1.3 Summary of Key Delta RPA Actions

Key RPA actions relating to Delta operations are summarized below:

1. **Delta Cross Channel (DCC) Gate Operations (IV.1.1–IV.1.2)**
   - **Action IV.1.1**: Monitor and provide alerts to trigger changes in DCC operations to provide timely information for DCC gate operations that will reduce loss of emigrating winter-run Chinook, spring-run Chinook, California Central Valley (CV) steelhead, and green sturgeon.
   - **Action IV.1.2**: Modify DCC gate operations to reduce direct and indirect mortality of emigrating juvenile salmonids and green sturgeon from October through June.
2. **Old and Middle River (OMR) Flow Management (Action IV.2.3):**

   Reduce the vulnerability of emigrating juvenile winter-run, yearling spring-run, and California CV steelhead within the lower Sacramento and San Joaquin rivers 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. Enhance the likelihood of salmonids successfully exiting the Delta at Chips Island by creating more suitable hydraulic conditions in the mainstem of the San Joaquin River for emigrating fish, including greater net downstream flows.
3. **San Joaquin Inflow-to-Export (I:E) Ratio (Action IV.2.1):**

   Manage the inflow-to-export ratio to reduce the vulnerability of emigrating California CV steelhead within the lower San Joaquin River to entrainment into the channels of the south Delta and at the pumps from diversion of water by the CVP and SWP export facilities in the south Delta. Enhance the likelihood of salmonids successfully exiting the Delta at Chipps Island by creating more suitable hydraulic conditions in the mainstem San Joaquin River for emigrating fish, including greater net downstream flows.
4. **6-Year Acoustic Tag Experiment (Action IV.2.2)**

   Reclamation and DWR shall fund a 6-year research-oriented action to assess the behavior and movement of outmigrating salmonids in the lower San Joaquin River, and to evaluate causes of mortality. The DOSS group shall conduct annual reviews of the study results and prepare a status review of the action at the end of the 6-year period to assess the success of Action IV.2.1 in increasing survival through the Delta for San Joaquin River basin salmonids but, in particular, California CV steelhead. Based on the findings of the status review, DOSS will make recommendations to NMFS, Reclamation, DFW, DWR, and FWS on future actions to be undertaken in the San Joaquin River basin as part of an adaptive management approach to the basin's salmonid stocks.

5. Reduce Likelihood of Entrainment or Salvage at the Export Facilities (Action IV.3)

Reduce losses of winter-run and spring-run Chinook salmon, California CV steelhead, and green sturgeon by reducing exports when large numbers of juvenile Chinook salmon are migrating into the upper Delta region, at risk of entrainment into the central and south Delta, and then to the export facilities in the following weeks.

CHAPTER 2 SUMMARY OF DOSS DISCUSSIONS AND ADVICE/RECOMMENDATIONS

2.1 Weekly Discussion Topics

- CVP AND SWP operations
- Delta fish monitoring, salvage, loss, and loss densities
- Hatchery releases
- DCC operations
- OMR flow management
- I:E ratio
- Coordination with other technical teams (e.g., Delta Smelt Working Group)
- Drought operations

2.2 Other Discussion Topics

- Temporary Urgency Change Petitions (TUCPs) submitted to SWRCB response, and project descriptions submitted to NMFS
- FWS Determinations regarding OMR flow restrictions
- Sampling effort at fish collection facilities
- Debris management at the fish collection facilities
- Spring run surrogate releases
- Interim winter-run juvenile production estimate (JPE)-based fish density triggers
- Juvenile Salmon Acoustic Telemetry System (JSATS) receivers available for use to track winter-run Chinook salmon movement
- CWT recoveries in Delta Juvenile Fish Monitoring Program (DJFMP) & Rotary Screw Trap (RST) monitoring
- Monitoring data discussion

2.3 Summary of WY 2016 RPA Action Implementation

2.3.1 DCC Alerts (Action IV.1.1)

RPA Action IV.1.1 describes two alerts that are signals that juvenile Chinook salmon may be migrating down the Sacramento River and indicate that DCC gate operations may need to be altered in the near future per the triggers in Action IV.1.2. In the 2009 BiOp, the first component of the first alert was triggered when there was capture of yearling-sized (>70 mm) spring-run Chinook salmon at the rotary screw traps (RSTs) in Mill Creek or Deer Creek. In October 2014[1], NMFS approved a request from Reclamation and DWR that the first component of the first alert based on fish monitoring be replaced by a hydrologic criterion which triggers when mean daily flows are greater than 95 cfs in Deer or Mill creeks[2]. The two alerts in effect during WY 2016 were thus:

> First Alert: Mean daily flow in Mill Creek or Deer Creek (a) greater than 95 cfs, or (b) more than 50 percent higher than observed on the previous day.
>
> Second Alert: Flow greater than 7,500 cfs at Wilkins Slough and water temperatures are less than 56.3°F as measured at Knights Landing.

The alerts in Action IV.1.1 were tracked by DOSS from October through 12/14/15. During this period, the first alert was triggered multiple times:

- Mill Creek flows >95 cfs:
  - 11/9-10/15
  - 11/15-16/15
  - 12/4-14/15
- Deer Creek flows >95 cfs:
  - 11/9-10/15
  - 11/16/15
  - 12/4/15
  - 12/7-8/15
  - 12/10-14/15

2.3.2 DCC Gate Operations (Action IV.1.2)

RPA Action IV.1.2 manages DCC gate operations to reduce the direct and indirect mortality of emigrating juvenile salmonids and green sturgeon. In October and November 2015, none of the criteria (based on water quality conditions and catch of older juvenile Chinook salmon at the Knights Landing RST or in the Sacramento Trawl) requiring DCC gate closure for fish protection were met. While the DCC gates were closed occasionally during October and November, those closures were to manage for Delta water quality standards in D-1641.

[1] Implementation of the first component of the first alert was first modified during WY 2014. In August 2013, NMFS approved a request from Reclamation and DWR that, for October and November 2013, the first component of the first alert based on fish monitoring be replaced by a hydrologic criterion which triggers when mean daily flows are greater than 110 cfs in Deer or Mill creeks.
[2] Based on the flow data reported for CDEC stations DCV (for Deer Creek) and MLM (for Mill Creek)

The DCC gates were closed on 12/1/15 per the operations table in Action IV.1.2. On 12/4/15, Reclamation opened the DCC gates to alleviate elevated salinity conditions in the Delta interior. NMFS granted flexibility[3] to allow the water quality component of the action triggers for the December 1-14 period to be based on exceedances of water quality *concern levels* rather than D-1641 water quality *criteria*. The DCC gates remained open under this flexibility through 12/14/15. The DCC gates were closed on 12/15/15, and did not open again until 5/27/16. The operations table in Action IV.1.2 requires 14 days of gate closure for the May 21-June 15 period each year; in WY 2016 (as in most years), the general implementation was to open the gates on Friday mornings and close the gates on Mondays at noon. From June 15-September 31, there are no RPA requirements for DCC operations and the Projects usually have the gates open throughout this period.

2.3.3 San Joaquin River Inflow-to-Export (I:E) Ratio (Action IV.2.1)

The year type for the San Joaquin Basin at the onset of RPA Action IV.2.3 on 4/1/16 was designated as "Critical", which required a 1:1 ratio of Vernalis inflow to combined CVP and SWP exports (I:E ratio), or minimum health and safety combined CVP and SWP pumping of 1,500 cfs, whichever was greater. The April forecast indicated an improved inflow outlook and the yeartype changed to "Dry", which required a 2:1 I:E ratio, or minimum health and safety combined CVP and SWP pumping of 1,500 cfs, whichever was greater. On 4/12/16, in conjunction with Oakdale Irrigation District and South San Joaquin Irrigation District, Reclamation proposed[4] to augment the required minimum flows on the Stanislaus River with an additional 75,000 acre-feet during the 31-day spring pulse flow period at Vernalis (per D-1641) provided that the incremental flow could be re-diverted in the Delta to supplement water supplies south of the Delta. Reclamation also proposed to modify CVP and SWP pumping under Action IV.2.1 to allow the additional incremental release district water to be pumped at a ratio of 1:1. NMFS supported[5] this request for flexibility, concurring with Reclamation's conclusion that the benefit of the proposed augmented pulse flow outweighed the potential increase in entrainment risk in the south Delta.

2.3.4 6-Year Acoustic Tag Experiment (Action IV.2.2)

Steelhead release dates and environmental conditions for the 2016 field season of the 6-year acoustic tag experiment are summarized in Table 2-1. Receiver data were recovered in August by USGS and will be converted into the individual tag's detection histories for use at the University of Washington's Columbia Basin Research Laboratory to estimate route entrainment and survival along the San Joaquin River and south-Delta migration corridors.

[3] The 12/2/15 request from Reclamation and the 12/4/15 response from NMFS are posted under "Biological Opinion Actions" at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/

[4] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/bureau_of_reclamation_s_april_12__2016__request_for_nmfs_concurrence_on_flex_of_san_joaquin_river_ie_ratio.pdf

[5] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/nmfs_determination_on_san_joaquin_river_ie_flex_-_april_14__2016.pdf

Table 2-1: Tagging and release dates and average hydrologic and operation conditions during 2016 steelhead releases for the six-year study.

				14-Day average					
2016 Tagging Dates	**2016 Release Dates**	**Release Group size**	**Head of Old River Barrier**	**Vernalis Temp (°F)**	**Vernalis (cfs)**	**Total Exports (cfs)**	**I:E**	**Old River @ Head (cfs)**	**OMR (cfs)**
February 23-25	February 24-27	480	Construction started on March 10 with closure on April 1	61.5	908	5672	0.2: 1.0	1042	-5167
March 15-18	March 16-19	480		63.7	2341	5688	0.4: 1.0	1703	-4248
April 26-28	April 27-30	480	Closed April 3	61.0	2613	210	1.0: 1.0	595	-2830

2.3.5 Old and Middle River Flow management (Action IV.2.3)

The objective of this action is to reduce the vulnerability of emigrating juvenile winter run, yearling spring run, and CV California CV steelhead within the lower Sacramento and San Joaquin rivers to entrainment into the channels of the south Delta and at the pumps because of the diversion of water by the export facilities in the south Delta. The action to manage Old and Middle River (OMR) flow at no more than -5,000 cfs is in effect from January 1 through June 15, or until the average daily water temperature at Mossdale is >72°F for 7 consecutive days in June, whichever is earlier. In WY 2016, temperatures at Mossdale ("MSD" station data reported on CDEC) exceeded 72°F for the first seven days of June. Effective 6/8/16, the OMR flow restrictions were lifted.

The older juvenile loss density of 2.70 fish/TAF on 1/2/16 exceeded the first stage action trigger of 2.5 fish/TAF. The first day of the required action response (at least 5 days of OMR no more negative than -3,500 cfs) was Sunday, 1/3/16. Rapid genetic testing results received late on 1/5/16 showed the older juvenile (which resulted in exceeding the loss density) was a fall-run Chinook, not a winter-run Chinook. On Wednesday, 1/6/16, NMFS informed WOMT that, based on the genetic results "…the CVP and SWP do not need to continue to operate to the action response of the first stage trigger in RPA Action IV.2.3, but rather, can revert back to an OMR no more negative than -5,000 cfs."

A summary of OMR limits in effect during WY 2016 and whether or not controlling is provided in Appendix A; a summary of observed OMR flows from December into June is provided in Appendix C.

2.3.6 Reduce Likelihood of Entrainment or Salvage at Export Facilities (Action IV.3)

The objective of RPA Action IV.3 is to reduce the loss of winter-run Chinook salmon, spring-run Chinook salmon, California CV steelhead, and green sturgeon by reducing Project exports when large numbers of juvenile Chinook salmon are migrating into the upper Delta region and are at risk of entrainment into the south and central Delta. Exports are reduced based on established loss or loss-density triggers for Chinook salmon in the RPA action. During November and December (the months when this RPA action is in effect) of WY 2016, no loss or loss-density triggers were exceeded that required action under RPA Action IV.3. A summary of catch, salvage, loss at the CVP and SWP, and combined loss density during WY 2016 is provided in Appendix D (for Chinook salmon) and Appendix E (for California CV steelhead).

2.4 Other Topics

2.4.1 Juvenile Production Estimate for Winter-run Chinook Salmon

NMFS issued the juvenile production estimate (JPE) for brood-year 2015 winter-run Chinook salmon 1/28/16[6]. The JPE for juvenile winter-run estimated to enter the Delta in WY 2016 (juveniles from brood year 2015) was 101,716 natural-origin fish, and 148,000 juveniles from Livingston Stone National Fish Hatchery (LSNFH). The authorized incidental take for naturally-produced winter-run has been established in the NMFS BiOp as 2 percent of the JPE to allow for errors in fish identification due to use of the length-at-date criteria to determine salmon race *(i.e.,* differentiating winter-run from fall run, late-fall run, and spring-run Chinook salmon). In WY 2016, DWR contracted with Cramer Fish Sciences to provide genetics-based run classification of unclipped juvenile Chinook salmon collected at the CWP and SWP salvage facilities. The use of genetic data to determine race of juvenile Chinook salmon observed at the CVP/SWP Delta pumping facilities eliminates the uncertainty that was included in previous annual incidental take limits for winter-run. Therefore, the authorized level of incidental take *(i.e.* , reported as loss at the Delta fish facilities) under the ESA for the combined CVP/SWP Delta pumping facilities for WY 2016 was set at **1,017 natural (non-clipped or wild)** winter-run (1% of the JPE). The incidental take for hatchery winter-run is set at **1,554 hatchery-produced** winter-run (1% of the LSNFH release).

Action IV.2.3 (OMR flow management) includes a loss-density trigger based on the JPE. The two levels of the JPE-based OMR trigger for WY 2016 RPA implementation were 2.5 fish/TAF and 5.0 fish/TAF (minimum density if JPE-based OMR trigger is less than these densities). The 2.5 fish/TAF and 5.0 fish/TAF triggers were implemented on an interim basis beginning on 1/1/16 and prior to NMFS' formal determination on the brood-year 2015 JPE.

2.4.2 Onset of Rapid Genetic Testing Protocol

Some of the action response triggers in Actions IV.2.3 and IV.3 of the NMFS BiOp are based on loss or loss density of unclipped "older juvenile" Chinook salmon, defined based on Chinook race classifications made using length-at-date tables. These "older juvenile" triggers are primarily intended to protect natural-origin winter-run Chinook salmon. Because race classification by genetics

[6] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/winter-run_juvenile_production_estimate__jpe__-_january_28__2016.pdf

(especially for winter-run Chinook salmon) is more accurate than the classification based on length-at-date tables (which can result in false positive assignments), in WY 2015 DWR and Reclamation piloted a rapid genetic testing protocol. The objective of the protocol is to process genetic samples that were collected from juvenile salmonids salvaged at the SWP and CVP as soon as practicable after salvage to assess the race assignment that was based on the existing length-at-date table in order to avoid or minimize the duration of export reductions that were triggered by loss of "older juveniles" (a size-based designation) that were not genetic winter-run.

Reclamation and DWR more formally implemented this procedure again during WY 2016, in coordination with the DFW, FWS, and the NMFS. As in WY 2015, the procedure is a precautionary approach that is intended to avoid (or minimize the duration of) export reductions triggered based on older juveniles that are not genetic winter-run. Actions to reduce pumping at the CVP and SWP export facilities are initiated when the older juvenile Chinook salmon trigger threshold is exceeded. However, if results of tissue genetic analysis indicate that the loss or loss density of genetic winter-run Chinook did not exceed the trigger threshold, then export reductions will be cancelled (as occurred in early January 2016; see section 3.3.3 ("Old and Middle River Flow management" for details). NMFS supported the use of this protocol, with the two additional conditions that all unclipped Chinook salmon have tissue samples collected for subsequent analysis, and that the annual incidental take limit was set at 1% of natural winter-run (the 2% of the JPE for incidental take assumes 50% misclassification of winter-run Chinook based on the length-at-date tables). Results from genetic testing during WY 2016 will be provided in the 2015/2016 Incidental Take Report (not yet available, see Appendix B for details).

2.4.3 Spring-Run Surrogate Releases

Coleman National Fish Hatchery (CNFH) juvenile late fall-run Chinook salmon are used as surrogates for natural yearling spring-run emigrating from Deer, Mill, and Antelope creeks. These fish are marked with a clipped adipose fin and a unique CWT code before being released. The CNFH late fall-run Chinook salmon are considered appropriate surrogates for spring-run Chinook salmon because they are reared to a similar size to that of wild spring-run yearlings and, to the extent possible, released in the upper Sacramento River based on turbidity and flow events that mimic natural storm events in spring-run Chinook salmon natal streams.

Table 2-2. Summary of all CNFH late fall-run releases and DOSS input to CNFH on the spring-run surrogate releases

Release Type	DOSS Input	Date Released	Number of Fish Released
Production Release	No DOSS input. A large proportion of the CNFH production late-fall Chinook were released in June 2015 due to forecasts of extreme conditions at the hatchery as a result of the drought.	6/11/15-6/12/15	434,227

Production Release	No DOSS input. When possible, the December production release occurs coincident with a rainfall event.	12/9/15	261,213
First Surrogate Release	Mid-December, ~3 days after from the production release and coincident with a rainfall event	12/11/15	77,000
Second Surrogate Release	Late December, ideally preceding (by ~3-7 days) a precipitation event and at least a week after the previous surrogate release.	12/22/15	68,000
Third Surrogate Release	Mid-January, ideally preceding (by ~3-7 days) a precipitation event and at least a week after the previous surrogate release.	1/12/16	67,700

After each release, DOSS tracked the cumulative loss of each spring-run Chinook salmon surrogate group at the Delta fish facilities to ensure the cumulative percent loss did not exceed the incidental take limit of 1.0% for each individual release group. Cumulative loss exceeding 0.5% of each individual release group would trigger an action response of export reductions as specified in RPA Action IV.3 or more positive OMR flow as specified in RPA Action IV.2.3. In WY 2016, loss of 0.166%, 0.278%, and 0.412% was observed for the first, second, and third spring-run Chinook salmon surrogate release groups (Table 2-3). Since the percent loss of all release groups was less than 0.5%, no action response based on spring-run surrogate catch was triggered in WY 2016.

Table 2-1. Confirmed hatchery Chinook salmon loss at the SWP and CVP Delta fish salvage facilities.

CONFIRMED HATCHERY (ADIPOSE-FIN CLIPPED) CHINOOK SALMON LOSS AT THE SWP & CVP DELTA FISH FACILITIES, 2015/2016

Release Date	CWT Race	Hatchery	Release Site	Release Type	Confirmed Loss	Number Released[1]	Total Entering Delta	% Loss of Number Released[2]	% Loss of Total Entering Delta[3]	First Concern Level	Second Concern Level	Date of First Loss[4]	Date of Last Loss[4]
6/11/2015 to 6/12/2015	LF	Coleman NFH	Balls Ferry Boat Ramp, Sacramento River	Production	0.00	434,227	n/a	0.000	n/a	n/a	n/a	*	*
12/9/2015	LF	Coleman NFH	Battle Creek	Production	305.22	261,213	n/a	0.117	n/a	n/a	n/a	12/25/2015	2/12/2016
12/11/2015	LF	Coleman NFH	Battle Creek	Spring Surrogate	128.05	77,000	n/a	0.166	n/a	0.5%	1.0%	12/25/2015	1/21/2016
12/22/2015	LF	Coleman NFH	Battle Creek	Spring Surrogate	188.93	68,000	n/a	0.278	n/a	0.5%	1.0%	1/6/2016	3/29/2016
1/12/2016	LF	Coleman NFH	Battle Creek	Spring Surrogate	278.65	67,700	n/a	0.412	n/a	0.5%	1.0%	1/20/2016	2/12/2016
2/17/2016 to 2/18/2016	W	Livingstone NFH	Sacramento River	Winter Run Production	11.19	420,006	155400	0.003	0.00720	0.5%	1.0%	3/6/2016	3/14/2016
3/14/2016	F	Coleman NFH	Battle Creek	Fall run Production	0.00	864,486	n/a	0.000	n/a	n/a	n/a	*	*
3/18/2016	S	River Restoration	San Joaquin River	River restoration program	439.33	45,000	n/a	0.976	n/a	n/a	n/a	3/20/2016	4/6/2016
3/19/2016	S	Feather River Hatchery	San Joaquin River	River restoration program	82.156	60,000	n/a	0.136	n/a	n/a	n/a	3/21/2016	4/7/2016
2/1/2016	F	Coleman NFH	Yolo bypass inundated Rice fields at Knaggs Ranch	special study	0.00	6,145	n/a	0.000	n/a	n/a	n/a	*	*
3/1/2016	F	Feather River Hatchery	Yolo bypass at Toe drain and Sacramento river at Elkhorn	special study	0.00	94,000	n/a	0.000	n/a	n/a	n/a	*	*

UNCONFIRMED HATCHERY (ADIPOSE-FIN CLIPPED) CHINOOK SALMON LOSS AT THE SWP & CVP DELTA FISH FACILITIES, 2015/2016

Facility	Unknown CWT Loss[5]	Unread CWT Loss[6]	Unknown Hatchery Loss[7]	Acoustic Tag Loss[8]	Number of Unassigned CWTs[9]
SWP	35.30	0.00	0.00	0.00	0
CVP	7.95	0.00	0.00	0.00	0
TOTAL	**43.25**	**0.00**	**0.00**	**0.00**	**0**

SWP and CVP adipose-fin clipped Chinook lost from 10/1/2015 through 6/5/2016.
[1]Number released with the adipose-fin clipped and a coded-wire tag (CWT).
[2]% Loss of Number Released = (Confirmed Loss/Number Released)*100.
[3]% Loss of Total Entering Delta= (Confirmed Loss/Total Entering Delta)*100.
[4]Date of first and last loss accounts for all CWT loss even those from special studies where salvage and loss=0.
[5]Adipose-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 released).
[6]Adipose-fin clipped Chinook was collected during fish count and has not been processed yet.
[7]CWT has been read, but hatchery release information not yet available.
[8]Adipose-fin clipped Chinook released due to presence of sutures.
[9]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.
[10]Chinook outside of the length-at-date criteria (Delta model) are not reported.
** Information not yet available.

DWR-DES Revised 6/06/2016
Preliminary data from DFW, DWR, FWS, and Reclamation; subject to revision.

2.4.4 Salvage Facility Operations

2.4.4.1 Sampling Effort at Fish Collection Facilities

Loss or loss density of salmonids at the export facilities is the basis for several of the OMR management triggers in Action IV.2.3. DOSS did not discuss nor make recommendations on modifying the sampling procedures at the State and Federal fish collection facilities in WY 2016.

Operators at both facilities generally maintained sampling effort at the proscribed rate (e.g. 30 minutes for every 2 hours of operational time) with the exception that, starting in late May, the SWP's Skinner Fish Facility reduced sampling effort at night to handle large numbers of non-listed (e.g. young-of-year striped bass and threadfin shad) species.

2.4.5 Debris management at the fish collection facilities

In contrast to WY 2015, when the export facilities (particularly the CVP's Tracy Fish Collection Facility) encountered heavy debris problems, heavy debris was seldom a problem in WY 2016. Reduced export rates and favorable hydrology conditions in the Delta during the winter may have contributed to reduced debris loading in WY 2016 compared to WY 2015. DOSS members were informed of occasional outages at the Tracy Fish Collection Facility related to maintenance and electrical problems and design problems associated with the new traveling fish screens in the secondary channel.

2.4.6 Smelt Working Group

SWG participants who also participated in the DOSS calls provided updates each week on Smelt Working Group (SWG) advice and the status of any existing or pending determinations from FWS (for delta smelt) and DFW (for longfin smelt). Summaries of SWG advice and related determinations can be found at: http://www.fws.gov/sfbaydelta/cvp-swp/smelt_working_group.cfm.

CHAPTER 3 DROUGHT OPERATIONS

As drought conditions continued into WY 2016, SWP and CVP project operations were managed under a series of drought contingency plans and associated orders issued by the State Water Resources Control Board (SWRCB). The renewed Temporary Urgency Change Petition from WY2015 expired 12/30/15 at which time the current Drought Contingency Plan was developed and submitted 1/15/16 and is active through November 2016. The fish agencies (NMFS, USFWS and CDFW) and the project agencies (Reclamation and DWR) worked collaboratively to allow the CVP and SWP to export the water supplies needed to meet essential human health and safety needs throughout the CVP and SWP service areas while providing needed protections for and minimizing adverse effects to listed fish species. Table 3.1 provides a brief overview of the Delta RPA flexibilities implemented during WY 2016.

Table 3-1. Delta RPA flexibilities implemented during WY 2016. Links to the documents referenced in the "WY 2016 Implementation" column are available at NMFS's website: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/

RPA Action	Usual Implementation	WY 2016 Implementation
IV.1.2 (DCC operations)	DCC gate operations from 12/1/15 to 12/14/15 dependent upon water quality criteria identified in State Water Resources Control Board Decision 1641 (D-1641) and fish presence	DCC gate operations from 12/1/15 to 12/14/15 was modified such that the water quality element of triggers would be based on exceedances of water quality concern levels rather than D-1641 water quality criteria. *See (a) 12/2/2015 request from Reclamation and (b) 12/4/2015 response letter from NMFS.*
IV.2.1 (I:E ratio)	In a dry year[7], the projects shall operate to an I:E ratio (inflow at Vernalis: combined CVP and SWP exports) of not less than 2:1 based on a 14-day running average from April 1 to May 31, or 1,500 cfs combined exports if Vernalis <1,500 cfs.	Reclamation proposed to modify CVP and SWP pumping prescribed by RPA Action IV.2.1 to allow the additional incremental release of water from Oakdale Irrigation District and South San Joaquin Irrigation District to be pumped at a ratio of 1:1. Meanwhile, Reclamation and DWR would continue to pump the minimum health and safety level for an overall resulting San Joaquin River I:E ratio of approximately 1.3:1 during the period of the augmented pulse flow.

[7] The San Joaquin basin yeartype was Critical in early April (requiring an I:E ratio of not less than 1:1, or 1,500 cfs combined exports if Vernalis <1,500 cfs), until the April forecast came out and the yeartype was updated to Dry.

RPA Action	Usual Implementation	WY 2016 Implementation
		See (a) 4/12/16 request from Reclamation and (b) 4/14/16 NMFS determination letter.

The SWRCB has compiled a comprehensive chronological summary[8] of the drought actions and associated documentation during WY 2016, some of which are relevant to the NMFS BiOp RPA actions tracked by DOSS.

[8] http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/tucp.shtml

CHAPTER 4 WY 2016 OPERATIONS SUMMARY

Based on the May runoff forecasts, the final WY 2016 hydrologic year type[9] was classified as Below Normal in the Sacramento basin and Dry in the San Joaquin river basin. Both basins, however, started WY 2016 (based on the previous year's yeartype) in Critical status. The Sacramento basin yeartype shifted to Dry based on the January 2016 forecast, and to Below Normal based on the April 2016 forecast. The San Joaquin basin yeartype shifted to Dry based on the February 2016 forecast, shifted back to Critical based on the March 2016 forecast, and shifted again to Dry based on the April 2016 forecast.

A summary of WY 2016 operations and controlling factors is provided in Appendix A; a summary of Old and Middle River flows is provided in Appendix D; some summary operations charts are provided below in Figure 4-1, Figure 4-2, Figure 4-3, and Figure 4-4.

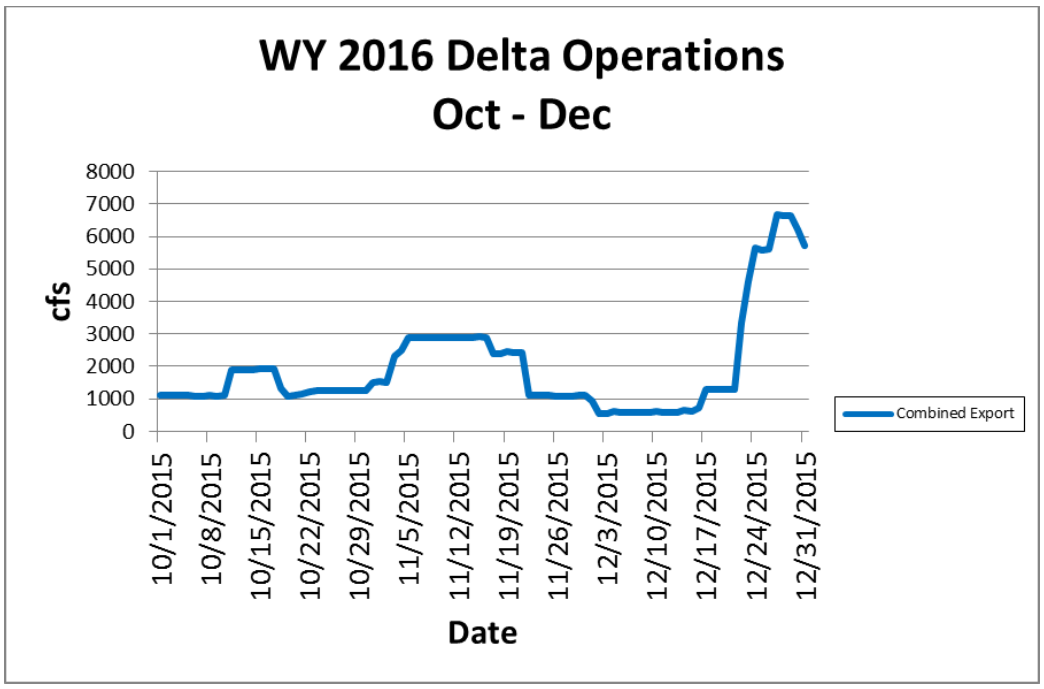

Figure 4-1: Combined exports at the CVP and SWP (in cubic feet per second) from October through December 2015.

[9] http://cdec.water.ca.gov/cgi-progs/iodir/WSI.2016

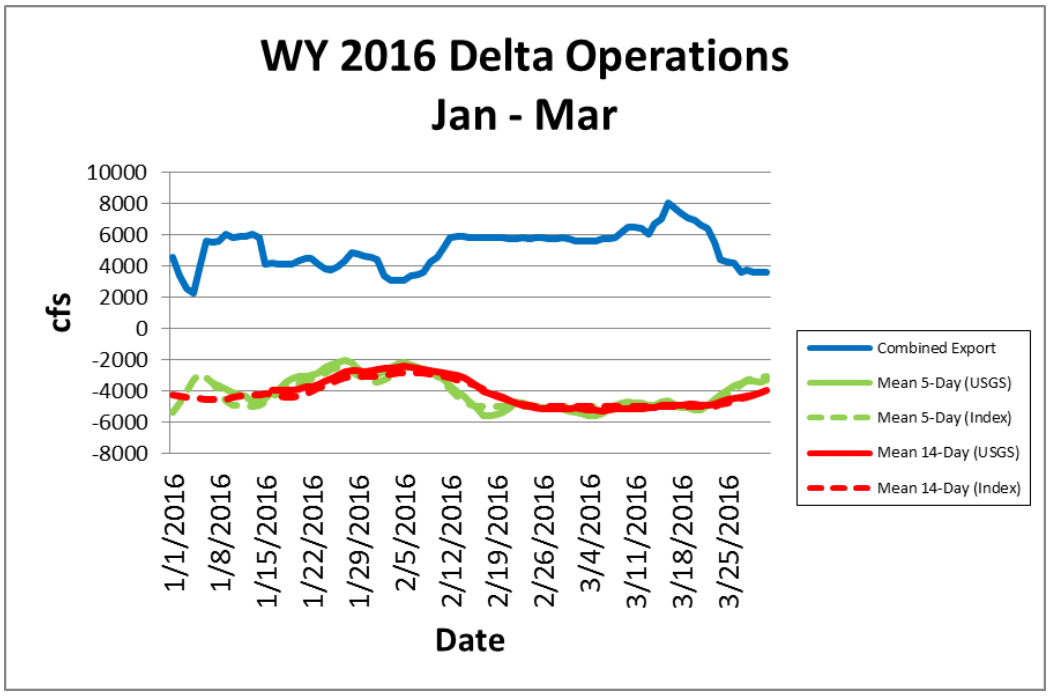

Figure 4-2: Combined exports at the CVP and SWP (blue, in cubic feet per second) and Old and Middle river flows (red and green, in cubic feet per second) from January through March 2016.

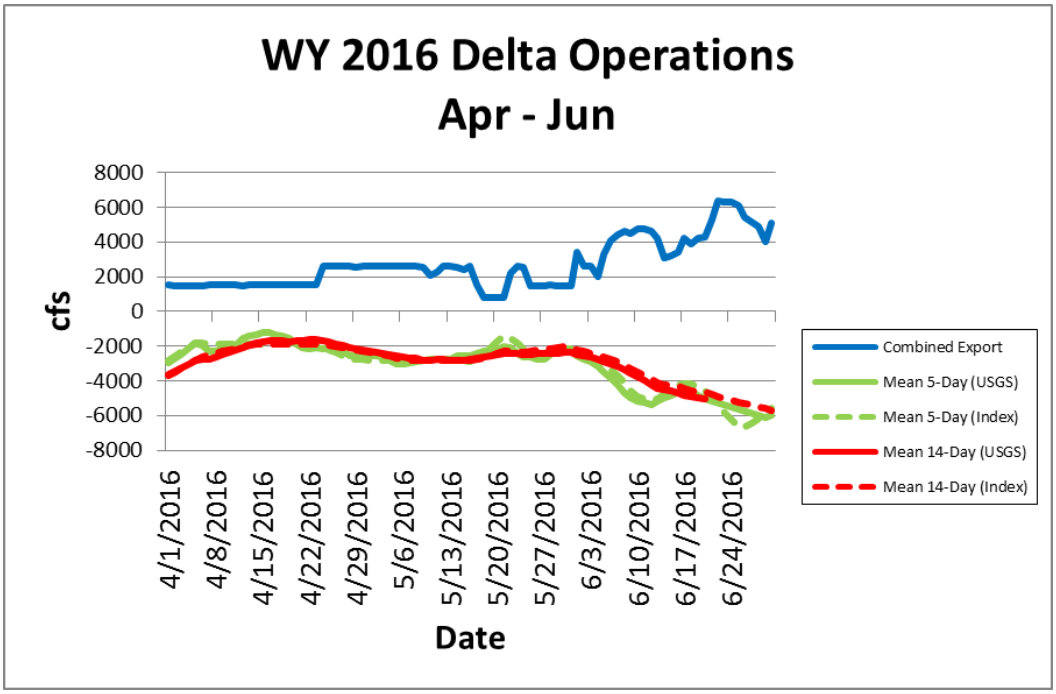

Figure 4-3: Combined exports at the CVP and SWP (blue, in cubic feet per second) and Old and Middle river flows (red and green, in cubic feet per second) from April through June 2016.

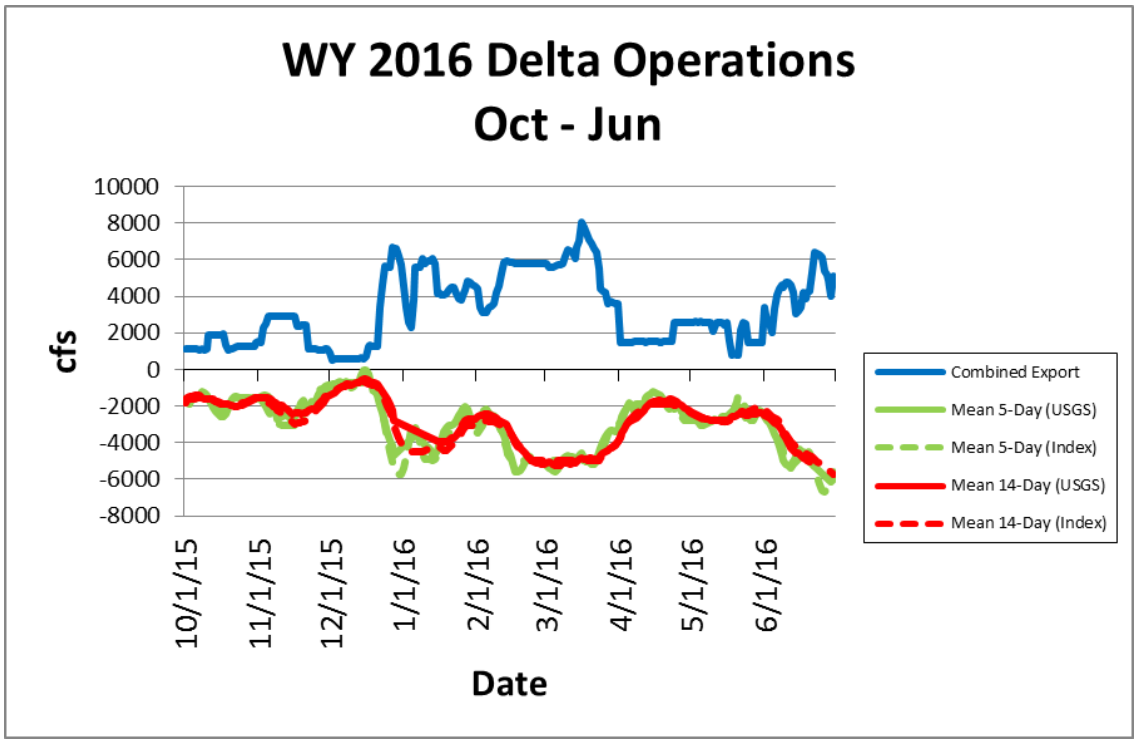

Figure 4-4: Combined exports at the CVP and SWP (blue, in cubic feet per second) and Old and Middle river flows (red and green, in cubic feet per second) from October 2015 through June 2016.

CHAPTER 5 MONITORING ACTIVITIES

5.1 WY 2016 Monitoring summary

The 2015/2016 Incidental Take Report is a document prepared by DWR and Reclamation that provides a detailed summary of WY 2016 monitoring activities. It was not yet available at the time the WY 2016 DOSS Annual Report was finalized. Once available, it will be posted on the DOSS website[10].

5.2 Review of DOSS's weekly distribution estimates

Since WY 2014, DOSS has provided weekly estimates of the distribution of ESA-listed salmonids based on review of the weekly fish monitoring data and other related data (hydrology, weather forecast, hatchery releases). These estimates are intended to give managers and stakeholders[11] an overview of salmonid distribution, and particularly to note when ESA-listed salmonids are present in the Delta. The assessment of salmonid distribution was categorized in three following geographic "bins" that add up to 100%: *Yet to enter the Delta (roughly above Knights Landing), In Delta*, and *Exited the Delta (past Chipps Island).* During each weekly call, members discussed the various factors influencing fish migration and review monitoring data to estimate the percentage for each category.

DOSS weekly estimates for the proportion of salmonids in each of the three geographic bins are provided in Appendix G. Details about each week's estimates can be found in the associated DOSS notes[12].

This year, DOSS has generated comparisons of the weekly DOSS estimates to comparable monitoring data. DOSS acknowledges that monitoring data are estimates of the fractional population passage at each monitoring location, and these comparisons have some complications based on the length-at-date run identification used to assign individuals to Chinook run (*i.e.*, potential misclassifications of unmarked hatchery fall-run as wild spring-run Chinook). Acknowledging those uncertainties, Figures 5-1 through 5-3 provide a visual comparison of the full season of DOSS weekly estimates and monitoring trends.

DOSS agreed to adjust high catch numbers (of natural-origin Chinook salmon) in monitoring data which are likely due to fall-run hatchery releases around that time. The average fork length of most fall-run hatchery production releases was near the size range of young-of-year spring-run, so many of the larger-than-average individuals in the releases would fall into the spring-run size class (Table 5-1). High catch numbers were adjusted (see adjustment details in Appendix H) for natural-origin spring-run in all data sets (Knights Landing, Sacramento trawl, beach seines, Chipps Island trawl). DOSS agreed that adjusting catch numbers for natural-origin winter-run was appropriate only for the Chipps Island trawl dataset, since the average fork length of all fall-run hatchery

[10] http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/doss.html

[11] For example, these weekly estimates were shared with both the Data Assessment Team (DAT) and Delta Conditions Team (DCT) stakeholder groups.

[12] DOSS notes available at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/doss.html.

production was far enough from the size range of young-of-year winter-run (Table 5-1) that few of the larger-than-average individuals in the release should fall into the winter-run size class. Also, anomalously high winter-run catches soon after large fall-run hatchery releases was observed only at the Chipps Island trawl monitoring location. Adjustment was not needed for the hatchery-origin winter-run Chinook data, since those fish were identified based on the coded wire tag (CWT) or acoustic-tag (AT) codes, not the length-at-date criteria.

Table 5-1. Length-at-date ranges for wild spring-run and wild winter-run for the dates that fall-run hatchery fish released from Coleman National Fish Hatchery into Battle Creek.

Date(week)	Average Fork Length (mm)	Number Released	Spring-run length-at-date (mm)	Winter-run length-at-date (mm)
3/14/2016	60-63	864,486	65-87	88-177
3/22/2016	68-74	1,373,815	69-92	93-187
4/7/2016	75	5,570,928	76-102	103-208
4/12/2016	75	2,436,541	79-106	107-215
4/29/2016	75	1,879,786	88-118	119-240

The figures below compare the weekly DOSS estimates to fish monitoring data. The estimates based on monitoring data were determined as described in Table 5-2.

Table 5-2. Calculations and data sources used to generate estimates of population distributions based on monitoring data for comparison with the weekly DOSS estimates.

	Natural-origin spring-run Chinook	**Natural-origin winter-run Chinook**	**Hatchery-origin winter-run Chinook (CWT data)**	**Hatchery-origin winter-run Chinook (AT data)**
Yet to Enter the Delta	100% minus cumulative % Knights Landing RST catch		100% minus cumulative % Sacramento Trawl catch	100% minus cumulative % AT detection at Tower Bridge array
In Delta	Cumulative % combined Sacramento Trawl & beach seines catch minus cumulative % Chipps Trawl catch			Cumulative % AT detection at Tower Bridge array minus cumulative % AT detection at Chipps array
Exited the Delta	Cumulative % Chipps Trawl catch			Cumulative % AT detection at Chipps array

Figure 5-1 and Figure 5-2 show comparisons of three ways to compare data to weekly DOSS estimates, based on (A) raw data, (B) adjusted data (high catch values adjusted only) , or (C) adjusted data (all catch values adjusted during the entire date range when hatchery releases

occurred). Panels B and C for spring-run comparisons look fairly similar since the highest values were removed in both; the difference between adjustments is more noticeable at Knights Landing (Yet to Enter the Delta) than at Chipps Island (Exited the Delta). Winter-run data only had high values in Chipps Island data, therefore Knights Landing and In Delta data were not adjusted. Further details on the adjustments are described in Appendix H.

Figure 5-3 shows hatchery winter-run data in comparison to weekly DOSS estimates. Hatchery winter-run Chinook were released in Redding in mid-February (see Section 5.4 for details); all were marked with CWTs and clipped adipose fins and a total of 570 were also acoustic-tagged. The steep slopes and overlap of the dashed, data-based "Yet to Enter the Delta" (red) and "Exited the Delta" (dark blue) lines in Figure 5-3 indicate that hatchery winter-run Chinook moved quickly into, through, and out of the Delta. The "In Delta" estimate for hatchery winter-run based on the CWT data (which uses the same monitoring locations and calculation as the "In Delta" estimates for natural-origin winter-run and natural-origin spring-run Chinook; *i.e.* "cumulative percent combined Sacramento trawl & beach seines catch minus cumulative percent Chipps Trawl catch") shows negative numbers (see data calculations in Appendix I). Some possible reasons for this are listed below:

- The "In Delta" data-based estimate is an aggregate measure; combining multiple sources of cumulative percent passage data provides more opportunity (relative to simpler measures) for the calculation to result in hard-to-interpret outcomes, especially when:
    - With such rapid passage through the Delta, the weekly resolution of our data summary has limited ability to capture the "difference" in passage timing of Delta entry and Delta exit[13].
    - If total seasonal catch is low, a single fish can represent a significant percent of total passage (for example, a single fish in the combined Sacramento trawl and beach seine data represented 5% of seasonal catch; see Table I-2 in Appendix I)[14]
- The sampling gap at Chipps Island Trawl may have falsely truncated the observed outmigration peak of CWT winter-run Chinook past Chipps Island.

[13] Natural origin winter-run and spring-run Chinook showed much less overlap in the timing of Delta entry and Delta exit, which may be why the same "In Delta" calculations for those populations did not result in negative numbers.

[14] Detections of acoustic-tagged hatchery winter-run Chinook were higher than the catches of coded wire tagged hatchery winter-run Chinook, which may be why the comparable "In Delta" calculations for the acoustic-tag-based estimates did not result in negative numbers.

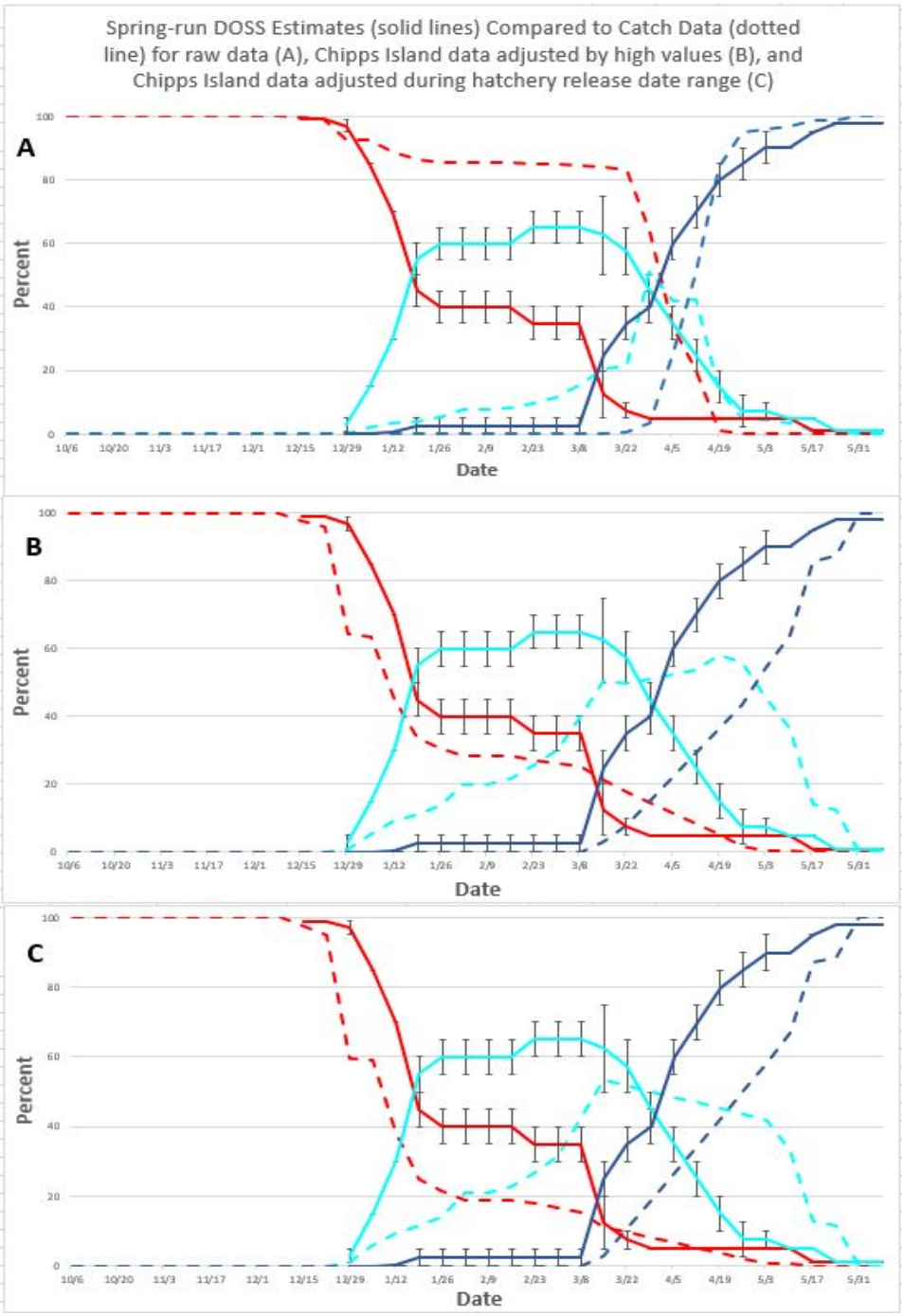

Figure 5-1 Spring-run weekly DOSS estimates compared to raw data (A), adjusted high values only (B), and adjusted hatchery release date range (C). Red lines indicate "Yet to Enter the Delta", turquoise lines indicate "In Delta", and dark blue lines indicate "Exited the Delta". Solid lines are weekly DOSS estimates and dashed lines are catch data.

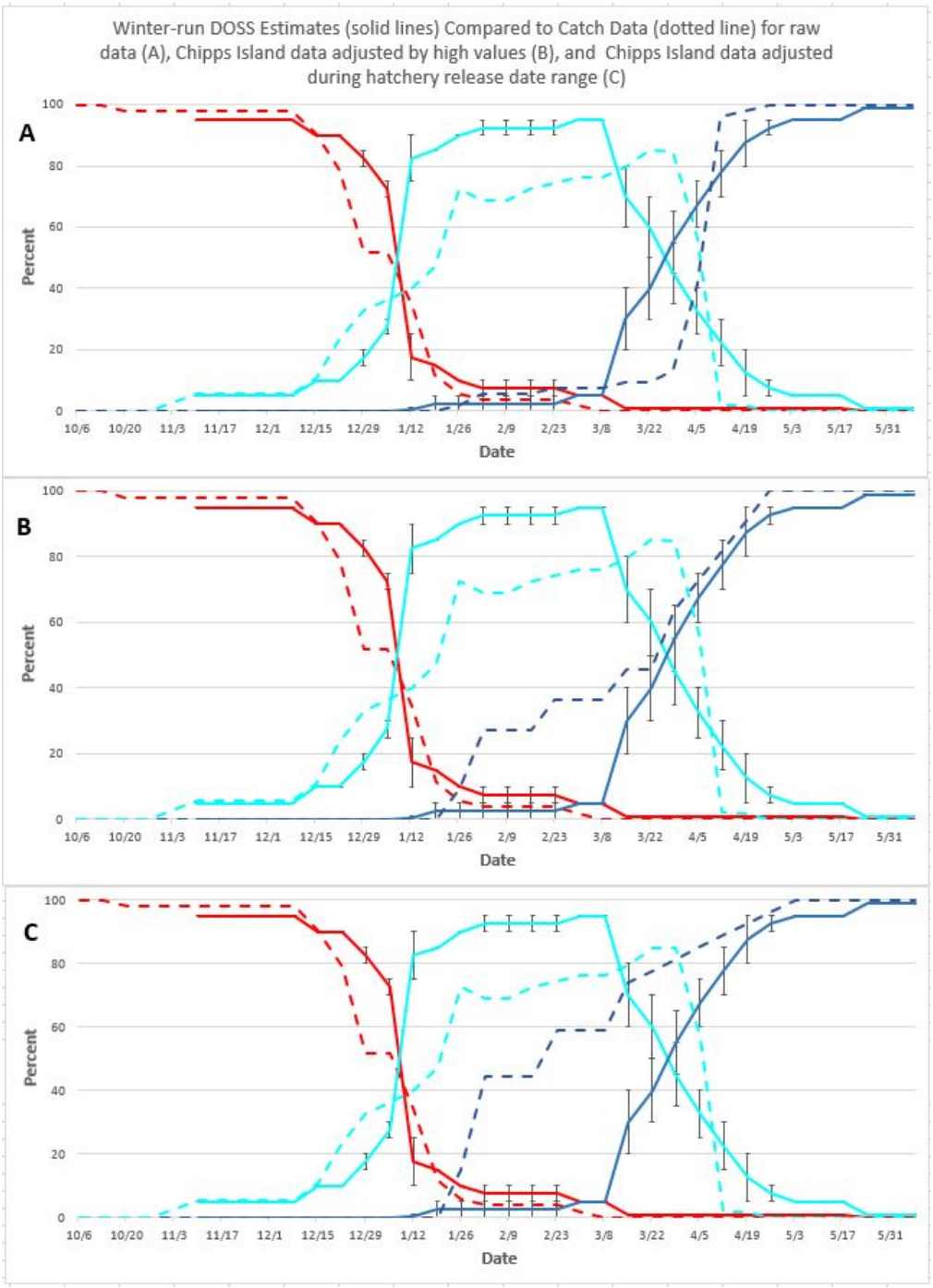

Figure 5-2 Winter-run weekly DOSS estimates compared to raw data (A), adjusted high values only (B), and adjusted hatchery release date range (C). Red lines indicate "Yet to Enter the Delta", turquoise lines indicate "In Delta", and dark blue lines indicate "Exited the Delta". Solid lines are weekly DOSS estimates and dashed lines are catch data.

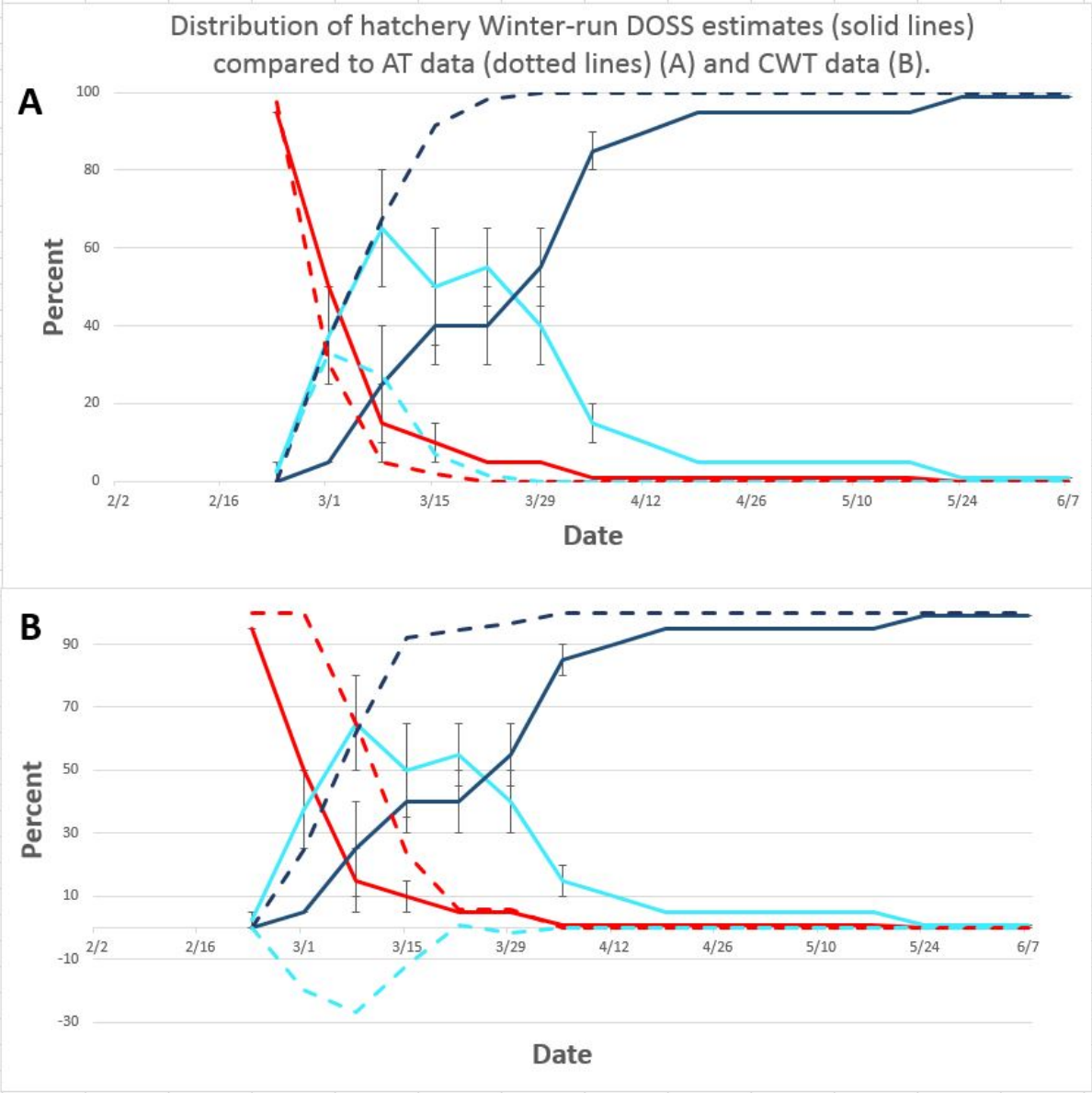

Figure 5-3 Hatchery winter-run weekly DOSS estimates compared to acoustic tag data (A) and coded wire tag data (B). Red lines indicate "Yet to Enter the Delta", turquoise lines indicate "In Delta", and dark blue lines indicate "Exited the Delta". Solid lines are weekly DOSS estimates and dashed lines are detection (for acoustic tags) or catch (for coded wire tags) data.

These comparisons highlight the complexity and limitations of interpreting migration patterns from monitoring data. One of the refinements that DOSS discussed, but did not include in this year's comparisons, is to adjust the monitoring catch data for sampling effort. Also, as is clear from the adjustments described above, unmarked hatchery fish can cause "false signals" in wild salmonid data. Ways to improve certainty in the data used to assess wild populations migrating through the Delta might include:

- 100% mark of hatchery fish to avoid the "apparent spring-run or winter-run" that result from the many millions of unmarked hatchery fall-run Chinook released into the Delta river system.
- A more refined adjustment algorithm to account for (and remove) the influence of unmarked hatchery fall-run Chinook
- Genetic testing of fish at monitoring locations (may have limited capacity to distinguish some populations of spring-run)

Development of new tools such as a predictive migration model would complement and support the technical team's interpretation of monitoring data and weekly estimates. Additional monthly or weekly reviews of monitoring data of ESA-listed fishes from other BiOp technical teams on the American and Stanislaus rivers, or technical teams working on Clear Creek or the San Joaquin River Restoration Program may improve understanding about migration timing and in-season distribution of ESA-listed species. Managers and technical staff may benefit from such reports when considering in-season exposure risks across the Central Valley and Bay-Delta.

5.3 Drought-Related Monitoring

Trawling at Jersey Point and Prisoners Point, ranging from daily to once-per-week frequency, provided some additional monitoring data on fish presence in the Central Delta in WY 2016. This information was considered by DOSS, along with other fish monitoring information, when assessing risk of salmonid entrainment into the south Delta or the export facilities.

A comprehensive summary of real-time monitoring planned for WY 2016 is provided in Section VIII (pages 26-30) of the Central Valley Project and State Water Project 2016 Drought Contingency Plan for Water Project Operations February-November 2016[15].

5.4 WY 2016 Hatchery winter-run Chinook acoustic-tracking

LSNFH released approximately 420,000 hatchery winter-run Chinook at Bonnyview Bridge in Redding – one group on 2/17/16 and the other group on 2/18/16. 285 of each release group (for a total of 570) were acoustic-tagged with JSATS tags and NOAA's Southwest Fisheries Science Center (SWFSC) tracked the movement of these acoustic-tagged fish past eight "real-time" receiver locations from Redding to Middle River.

The final tracking update was provided by the SWFSC on March 28 (Appendix F). As of the final update, 49% of the acoustic-tagged hatchery winter-run Chinook had passed the Tower Bridge receiver in Sacramento. The timing of acoustic-tagged fish passage by Tower Bridge in Sacramento is shown in Figure 6.5.

[15] http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/plans/2016dcpfebnov.pdf

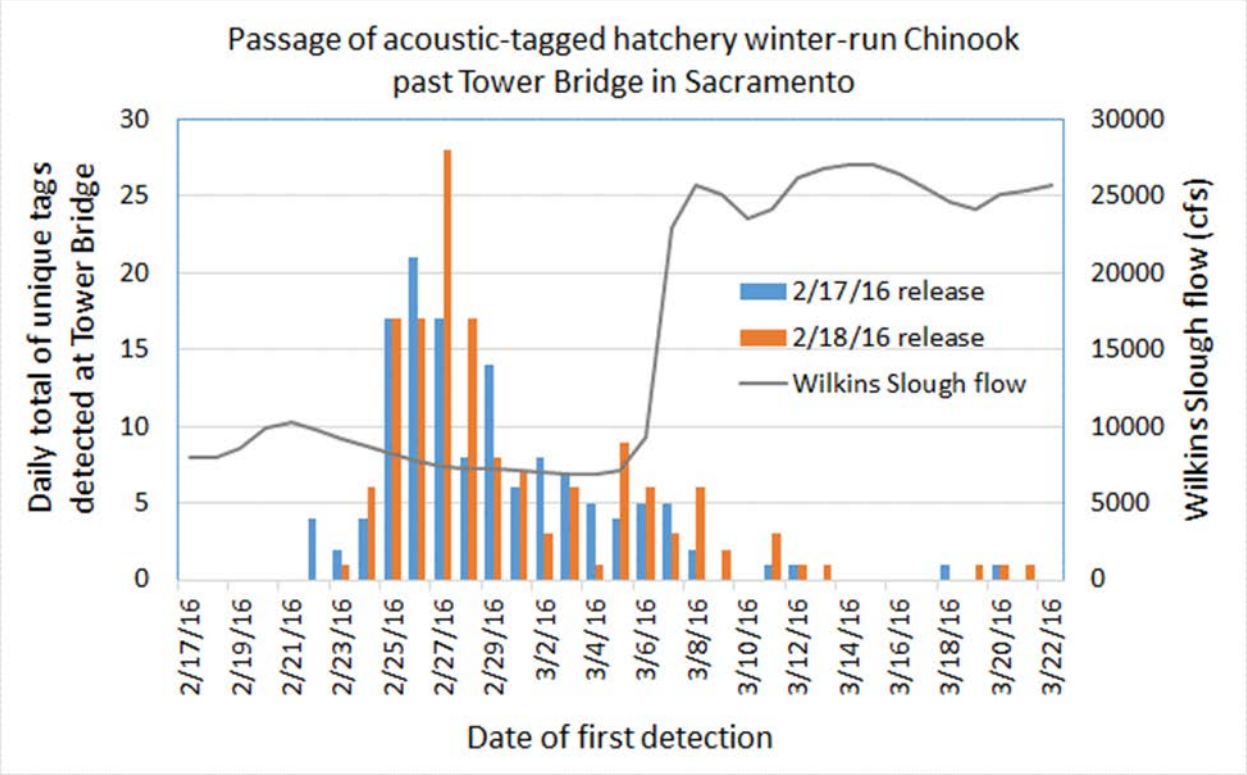

Figure 5-4: Bars represent the daily total of unique acoustic-tags first detected at the Tower Bridge acoustic receiver array, indicating passage of acoustic-tagged hatchery winter-run Chinook. Bars are color-coded by release group. The gray line represents flow (cfs) at Wilkins Slough; data from the WLK station on the California Data Exchange Center (CDEC). The majority of acoustic-tagged fish passed Tower Bridge within the first two weeks after release.

5.5 Monitoring Gaps

5.5.1 Tisdale Data Gaps

Trapping at the Tisdale RSTs did not occur for approximately 50 hours in the month of March due to high debris loads. In addition, the RSTs were pulled on 5/2/16 for the remainder of the water year as a result of a lapse in funding. For the purposes of DOSS, Tisdale is used in conjunction with other sampling sites, both upstream and downstream to track movement of juvenile fish emigration through the Sacramento River. Because Tisdale data are not used as the basis for any alert or trigger in the NMFS BiOp, no RPA implementation was impacted throughout this period.

5.5.2 Knights Landing Data Gaps

Trapping at the Knights Landing RSTs was suspended from 0915 hours 6/6/16 to 1430 hours 6/13/16 due to river water temperatures greater than 72°F that exceeded the safe handling range[16].

[16] The current protocol for monitoring programs at Knights Landing and Tisdale states: "To avoid stress to captured fish, no handling of fish will occur when daily average water temperatures are greater than 72°F. Instantaneous water temperatures will be monitored by staff as well to ensure handling of fish is only conducted when temperatures are 72°F or below. Fish monitoring activities will cease when daily water temperatures average 74°F or greater."

Because Knights Landing data are not used as the basis for any alert or trigger in the NMFS BiOp during June, this shutdown likely did not have an impact on the implementation of Action IV.1.2.

5.5.3 GCID Data Gaps

The GCID RST was not operated for multiple periods from December through May, for a variety of reasons including repairs to gear, high flows, and heavy debris loads. For the purposes of DOSS, GCID is used in conjunction with other sampling sites, both upstream and downstream to track movement of juvenile fish movement through the Sacramento River. While the monitoring gaps at GCID occurred during the outmigration of ESA-listed salmonids, DOSS generally had information from RSTs upstream (from Red Bluff Diversion Dam) or downstream (Tisdale or Knights Landing) during at least part of the GCID shutdowns and so had information to assess distribution of ESA-listed species in the Sacramento River. Because GCID data are not used as the basis for any alert or trigger in the NMFS BiOp, no RPA implementation was impacted throughout this period.

REFERENCES CITED

NMFS. 2009. Final Biological Opinion and Conference Opinion of the Proposed Long-term Operations of the Central Valley Project and State Water Project. U.S. Department of Commerce National Marine Fisheries Service. 4 June 2009. http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/nmfs_biological_and_conference_opinion_on_the_long-term_operations_of_the_cvp_and_swp.pdf

NMFS. 2011. 2009 RPA with 2011 Amendments. U.S. Department of Commerce National Marine Fisheries Service. 7 April 2011. http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

Appendix A—Operations Summary Tables

GUIDE TO THE WY 2016 OPERATIONS TABLE

- The controlling factor in any blank cell is the same as the most recently listed controlling factor; factors are listed only when there is a change
- Controlling factors for DCC operations are listed in regular text, within brackets.
- Controlling factors for Delta exports are listed in regular text.
- Conditions or requirements of note, but not controlling Delta operations (for example, D-1641 or NMFS BiOp requirements that go into effect at the beginning of a month), are listed in italicized text for informative purposes.
- The "Delta WQ" controlling factor generally refers to seasonal salinity management rather than a specific water quality compliance location.

Date	Balance/Excess	Jones PP (cfs)	Clifton Court Inflow (cfs)	DCC Gate Status	USGS Tidally Filtered Mean 5-Day OMR (cfs)	USGS Tidally Filtered Mean 14-Day OMR (cfs)	Mean 5-Day OMR Index Calculation (cfs)	Mean 14-Day OMR Index Calculation (cfs)	Factor(s) Controlling Delta Operations
10/1/2015	B	806	295	O					*D-1641 Delta Outflow (3,000 cfs)*
10/2/2015	B	806	293	O					Delta WQ
10/3/2015	B	806	293	O					
10/4/2015	B	811	294	O					
10/5/2015	B	806	290	O					
10/6/2015	B	805	291	O					
10/7/2015	B	804	289	O					
10/8/2015	B	805	294	O					
10/9/2015	B	803	291	O					
10/10/2015	B	804	297	O					
10/11/2015	B	1603	286	O					
10/12/2015	B	1607	289	O					
10/13/2015	B	1609	293	O					
10/14/2015	B	1612	292	O					
10/15/2015	B	1614	298	O					
10/16/2015	B	1616	297	O					
10/17/2015	B	1619	302	O					
10/18/2015	B	1046	283	O					
10/19/2015	B	805	288	O					
10/20/2015	B	831	291	O					
10/21/2015	B	867	294	O					
10/22/2015	B	911	296	O					
10/23/2015	B	955	299	O					
10/24/2015	B	956	292	O					
10/25/2015	B	956	295	O					
10/26/2015	B	953	298	O					
10/27/2015	B	955	298	O					
10/28/2015	B	955	291	O					
10/29/2015	B	957	289	C					[DCC Gates - Rio Vista (2,500 cfs)]; Delta WQ
10/30/2015	B	953	296	O					[DCC Gates - Rio Vista (2,500 cfs)]; Delta WQ
10/31/2015	B	952	539	O					
11/1/2015	B	993	547	O					*D-1641 Delta Outflow (3,500 cfs)*
11/2/2015	B	951	546	O					
11/3/2015	B	1629	699	O					
11/4/2015	B	1785	694	O					
11/5/2015	B	1895	996	O					
11/6/2015	B	1904	992	O					
11/7/2015	B	1901	992	O					
11/8/2015	B	1907	988	O					
11/9/2015	B	1909	992	O					
11/10/2015	B	1907	990	O					
11/11/2015	B	1900	996	O					
11/12/2015	B	1900	991	C					[DCC Gates - Rio Vista (2,500 cfs)]; Delta WQ
11/13/2015	B	1902	990	O					[DCC Gates - Rio Vista (2,500 cfs)]; Delta WQ
11/14/2015	B	1906	996	O					
11/15/2015	B	1915	997	O					
11/16/2015	B	1908	995	O					
11/17/2015	B	1892	494	O					
11/18/2015	B	1888	491	C					[DCC Gates - Rio Vista (2,500 cfs)]; Delta WQ
11/19/2015	B	1958	490	C					
11/20/2015	B	1916	497	O					[DCC Gates - Rio Vista (2,500 cfs)]; Delta WQ
11/21/2015	B	1921	495	O					
11/22/2015	B	830	289	O					
11/23/2015	B	799	299	O					
11/24/2015	B	807	292	O					
11/25/2015	B	811	287	O					
11/26/2015	B	801	288	O					
11/27/2015	B	800	289	O					
11/28/2015	B	800	284	O					
11/29/2015	B	799	299	O					
11/30/2015	B	798	299	O					
12/1/2015	B	796	140	C	-857	-1427	-1084	-1431	*D-1641 Delta Outflow (3,500 cfs)* ; [DCC Gates - NMFS Action IV.1.2]; Delta WQ
12/2/2015	B	401	142	C	-795	-1334	-990	-1317	
12/3/2015	B	402	147	C	-811	-1263	-877	-1190	
12/4/2015	B	404	199	O	-689	-1104	-793	-1077	[DCC Gates - WQ]; Delta WQ

Date	Balance/Excess	Jones PP (cfs)	Clifton Court Inflow (cfs)	DCC Gate Status	USGS Tidally Filtered Mean 5-Day OMR (cfs)	USGS Tidally Filtered Mean 14-Day OMR (cfs)	Mean 5-Day OMR Index Calculation (cfs)	Mean 14-Day OMR Index Calculation (cfs)	Factor(s) Controlling Delta Operations
12/5/2015	B	401	190	O	-644	-976	-707	-963	
12/6/2015	B	405	190	O	-713	-918	-649	-934	
12/7/2015	B	405	190	O	-742	-852	-661	-904	
12/8/2015	B	404	186	O	-667	-787	-692	-875	
12/9/2015	B	396	190	O	-805	-798	-689	-844	
12/10/2015	B	406	197	O	-984	-844	-693	-817	
12/11/2015	B	406	191	O	-901	-813	-699	-790	
12/12/2015	B	408	190	O	-755	-744	-703	-762	
12/13/2015	B	407	190	O	-710	-714	-705	-732	
12/14/2015	B	459	190	O	-305	-592	-715	-704	
12/15/2015	B	419	195	C	-24	-547	-715	-685	[DCC Gates - NMFS Action IV.1.2]; Delta WQ
12/16/2015	B	436	297	C	-55	-549	-737	-700	
12/17/2015	B	792	500	C	-275	-552	-864	-758	
12/18/2015	B	806	495	C	-513	-651	-993	-803	
12/19/2015	B	797	498	C	-989	-716	-1111	-848	
12/20/2015	B	797	499	C	-1132	-697	-1232	-894	
12/21/2015	B	798	499	C	-1431	-795	-1326	-938	
12/22/2015	B	1365	1995	C	-1989	-1024	-1695	-1116	
12/23/2015	B	1615	2990	C	-2340	-1199	-2287	-1374	
12/24/2015	B	1644	3994	C	-2891	-1397	-3059	-1693	
12/25/2015	B	2590	2994	C	-3485	-1619	-3780	-1994	
12/26/2015	B	2605	2993	C	-3861	-1904	-4501	-2294	
12/27/2015	B	2690	3998	C	-4150	-2253	-5060	-2671	
12/28/2015	B	2751	3893	C	-4687	-2764	-5395	-3046	
12/29/2015	B	2743	3891	C	No Data	No Data	-5555	-3422	
12/30/2015	B	2742	3488	C	No Data	No Data	-5696	-3765	
12/31/2015	B	2731	2998	C	No Data	No Data	-5744	-4037	
1/1/2016	B	2571	1989	C	No Data	No Data	-5358	-4230	*D-1641 Delta Outflow (6,000 cfs);* D-1641 Delta Outflow (monthly target 6,000 cfs; 7-day target 4,800 cfs)
1/2/2016	B	1915	1498	C	No Data	No Data	-4763	-4350	
1/3/2016	B	1069	1485	C	No Data	No Data	-4009	-4414	
1/4/2016	B	806	1495	C	No Data	No Data	-3280	-4463	
1/5/2016	B	802	2995	C	No Data	No Data	-2921	-4475	
1/6/2016	E	1375	4194	C	No Data	No Data	-3101	-4521	NMFS Action IV.2.3 (OMR flow management)
1/7/2016	E	1960	3592	C	-3488	No Data	-3478	-4500	
1/8/2016	E	2598	2990	C	-3615	No Data	-3995	-4491	
1/9/2016	E	2865	3194	C	-3891	No Data	-4604	-4500	
1/10/2016	E	3412	2393	C	-4118	No Data	-4885	-4412	
1/11/2016	E	3628	2289	C	-4206	No Data	-4880	-4337	
1/12/2016	E	3637	2294	C	-4339	No Data	-4894	-4264	
1/13/2016	E	3647	2398	C	-4649	No Data	-4954	-4226	
1/14/2016	E	3618	2197	C	-4653	No Data	-4931	-4209	
1/15/2016	E	2422	1695	C	-4432	No Data	-4663	-4164	Turbidity Management (OMR -3500)
1/16/2016	E	1901	2299	C	-4121	-3915	-4383	-4201	
1/17/2016	E	1903	2196	C	-3852	-3943	-4083	-4290	
1/18/2016	E	1909	2193	C	-3430	-3974	-3756	-4396	
1/19/2016	E	1912	2243	C	-3190	-3964	-3471	-4406	
1/20/2016	E	2338	1993	C	-3065	-3865	-3488	-4302	
1/21/2016	E	2508	1994	C	-3036	-3754	-3393	-4171	
1/22/2016	E	2517	1990	C	-2957	-3708	-3212	-4010	FWS Action 2 (OMR -2500)
1/23/2016	E	2520	1597	C	-2797	-3583	-3016	-3829	
1/24/2016	E	2509	1345	C	-2483	-3380	-2808	-3664	
1/25/2016	E	2494	1297	C	-2301	-3184	-2600	-3488	
1/26/2016	E	2104	1894	C	-2180	-2982	-2492	-3312	
1/27/2016	E	2178	2198	C	-2038	-2776	-2564	-3157	FWS Action 2 (OMR -3000)
1/28/2016	E	2454	2391	C	-2165	-2694	-2749	-3049	FWS Action 2 (OMR -3500)
1/29/2016	E	2454	2331	C	-2571	-2715	-2951	-3052	
1/30/2016	E	2466	2191	C	-2881	-2742	-3151	-3048	
1/31/2016	E	2453	2093	C	-3034	-2690	-3343	-3048	
2/1/2016	E	2448	1990	C	-2907	-2589	-3448	-3046	
2/2/2016	E	1862	1499	C	-2732	-2531	-3262	-2975	Turbidity Management (OMR -2500)
2/3/2016	E	1605	1497	C	-2470	-2503	-3021	-2885	
2/4/2016	E	1614	1495	C	-2263	-2466	-2785	-2831	
2/5/2016	E	1603	1491	C	-2187	-2415	-2550	-2812	
2/6/2016	E	1867	1494	C	-2349	-2429	-2372	-2816	

Date	Balance/Excess	Jones PP (cfs)	Clifton Court Inflow (cfs)	DCC Gate Status	USGS Tidally Filtered Mean 5-Day OMR (cfs)	USGS Tidally Filtered Mean 14-Day OMR (cfs)	Mean 5-Day OMR Index Calculation (cfs)	Mean 14-Day OMR Index Calculation (cfs)	Factor(s) Controlling Delta Operations
2/7/2016	E	1964	1495	C	-2475	-2528	-2408	-2832	
2/8/2016	E	2208	1397	C	-2577	-2601	-2524	-2858	
2/9/2016	E	2445	1798	C	-2755	-2671	-2753	-2925	Turbidity Management (OMR -3500)
2/10/2016	E	2445	2099	C	-3007	-2761	-3034	-2980	FWS Action 2 (OMR -4000)
2/11/2016	E	2680	2588	C	-3296	-2833	-3398	-3048	FWS Action 2 (OMR -5000); NMFS Action IV.2.3 (OMR flow management)
2/12/2016	E	3248	2591	C	-3624	-2904	-3845	-3151	
2/13/2016	E	3420	2500	C	-3984	-2995	-4282	-3262	
2/14/2016	E	3405	2499	C	-4327	-3133	-4600	-3373	
2/15/2016	E	3406	2447	C	-4661	-3387	-4861	-3485	
2/16/2016	E	3423	2439	C	-5086	-3674	-4990	-3665	
2/17/2016	E	3401	2393	C	-5559	-4007	-5002	-3859	
2/18/2016	E	3395	2399	C	-5596	-4185	-4995	-4051	
2/19/2016	E	3406	2397	C	-5511	-4320	-4986	-4244	
2/20/2016	E	3401	2397	C	-5346	-4457	-4980	-4416	
2/21/2016	E	3386	2392	C	-5055	-4595	-4972	-4581	
2/22/2016	E	3392	2391	C	-4669	-4755	-4974	-4734	
2/23/2016	E	3426	2396	C	-4747	-4897	-4982	-4847	
2/24/2016	E	3391	2390	C	-4891	-4993	-4985	-4940	
2/25/2016	E	3435	2362	C	-4991	-5062	-4993	-4986	
2/26/2016	E	3397	2394	C	-5068	-5111	-4995	-4991	
2/27/2016	E	3390	2395	C	-5073	-5144	-4996	-4989	
2/28/2016	E	3403	2385	C	-5043	-5152	-4992	-4987	
2/29/2016	E	3408	2399	C	-5099	-5150	-5002	-4991	
3/1/2016	E	3429	2357	C	-5266	-5127	-5014	-4995	
3/2/2016	E	3410	2199	C	-5375	-5045	-5009	-4994	
3/3/2016	E	3419	2190	C	-5449	-5091	-5002	-4992	
3/4/2016	E	3410	2197	C	-5548	-5165	-4991	-4989	
3/5/2016	E	3411	2224	C	-5587	-5236	-4977	-4989	
3/6/2016	E	3431	2290	C	-5433	-5262	-4968	-4993	
3/7/2016	E	3425	2328	C	-5157	-5219	-4969	-4992	
3/8/2016	E	3414	2390	C	-4887	-5141	-4969	-4987	FWS Action 3 (OMR -5000); NMFS Action IV.2.3 (OMR flow management)
3/9/2016	E	3414	2794	C	-4739	-5111	-4989	-4990	
3/10/2016	E	3431	3098	C	-4673	-5123	-4997	-4991	
3/11/2016	E	3424	3046	C	-4757	-5151	-4995	-4993	
3/12/2016	E	3428	2991	C	-4785	-5116	-5000	-4994	
3/13/2016	E	3080	2999	C	-4900	-5090	-4947	-4971	
3/14/2016	E	3411	3293	C	-4871	-5030	-4964	-4977	
3/15/2016	E	3402	3592	C	-4688	-4916	-4972	-4976	
3/16/2016	E	3433	4540	C	-4588	-4870	-4975	-4981	
3/17/2016	E	3419	4391	C	-4849	-4902	-4952	-4976	
3/18/2016	E	3418	3988	C	-5033	-4906	-5025	-4983	
3/19/2016	E	3417	3681	C	-5076	-4847	-5004	-4986	
3/20/2016	E	3416	3496	C	-5188	-4829	-4999	-4987	
3/21/2016	E	3407	3238	C	-5199	-4885	-4993	-4989	
3/22/2016	E	3413	2989	C	-4887	-4902	-5020	-4994	
3/23/2016	E	2741	2774	C	-4521	-4829	-4888	-4947	Project Reduction for Smelt (OMR -3500)
3/24/2016	E	2465	1929	C	-4261	-4700	-4582	-4838	
3/25/2016	E	2466	1842	C	-3958	-4543	-4273	-4729	
3/26/2016	E	2465	1740	C	-3671	-4487	-3963	-4619	
3/27/2016	E	2466	1164	C	-3481	-4395	-3552	-4496	FWS Action 3 (OMR -2500)
3/28/2016	E	2569	1195	C	-3352	-4286	-3298	-4352	
3/29/2016	E	1950	1693	C	-3347	-4221	-3208	-4208	
3/30/2016	E	1972	1643	C	-3394	-4117	-3121	-4066	
3/31/2016	E	1970	1649	C	-3272	-3924	-3049	-3939	
4/1/2016	E	1009	490	C	-2987	-3664	-2824	-3710	NMFS Action IV.2.1 (I:E ratio) *in effect 4/1-5/31*
4/2/2016	E	997	493	C	-2716	-3443	-2560	-3479	
4/3/2016	E	996	490	C	-2460	-3247	-2319	-3251	
4/4/2016	E	996	492	C	-2103	-3011	-2084	-3028	
4/5/2016	E	994	499	C	-1848	-2838	-1841	-2804	
4/6/2016	E	995	503	C	-1963	-2751	-1851	-2625	
4/7/2016	E	999	519	C	-2275	-2734	-1875	-2512	
4/8/2016	E	1001	520	C	-2293	-2652	-1894	-2401	
4/9/2016	E	1000	521	C	-2273	-2512	-1906	-2293	
4/10/2016	E	1001	521	C	-2189	-2377	-1915	-2220	

Date	Balance/Excess	Jones PP (cfs)	Clifton Court Inflow (cfs)	DCC Gate Status	USGS Tidally Filtered Mean 5-Day OMR (cfs)	USGS Tidally Filtered Mean 14-Day OMR (cfs)	Mean 5-Day OMR Index Calculation (cfs)	Mean 14-Day OMR Index Calculation (cfs)	Factor(s) Controlling Delta Operations
4/11/2016	E	1000	523	C	-1929	-2242	-1918	-2132	
4/12/2016	E	998	490	C	-1539	-2088	-1907	-2048	
4/13/2016	E	997	509	C	-1426	-1949	-1898	-1964	
4/14/2016	E	998	511	C	-1338	-1821	-1890	-1879	*NMFS Action IV.2.1 (I:E ratio) Flex approved by NMFS, not applicable until 4/24/16*
4/15/2016	E	996	517	C	-1200	-1738	-1885	-1884	
4/16/2016	E	993	517	C	-1249	-1718	-1887	-1892	
4/17/2016	E	993	513	C	-1372	-1700	-1897	-1897	
4/18/2016	E	994	510	C	-1420	-1705	-1893	-1896	
4/19/2016	E	996	519	C	-1588	-1728	-1869	-1889	
4/20/2016	E	998	517	C	-1919	-1723	-1846	-1882	
4/21/2016	E	998	520	C	-2112	-1660	-1834	-1878	
4/22/2016	E	1000	548	C	-2142	-1646	-1821	-1871	
4/23/2016	E	998	527	C	-2067	-1632	-1805	-1860	
4/24/2016	E	991	1600	C	-2137	-1710	-2010	-1923	NMFS Action IV.2.1 (I:E ratio) Flex; FWS Action 3 (OMR -2500)
4/25/2016	E	987	1595	C	-2070	-1773	-2204	-1984	
4/26/2016	E	984	1592	C	-2124	-1869	-2389	-2050	
4/27/2016	E	976	1599	C	-2325	-1967	-2584	-2117	
4/28/2016	E	980	1593	C	-2547	-2064	-2789	-2182	
4/29/2016	E	980	1591	C	-2538	-2188	-2785	-2244	
4/30/2016	E	993	1599	C	-2548	-2237	-2794	-2308	
5/1/2016	E	1583	993	C	-2567	-2296	-2802	-2373	
5/2/2016	E	1611	990	C	-2573	-2379	-2801	-2441	
5/3/2016	E	1616	991	C	-2640	-2440	-2812	-2518	NMFS Action IV.2.1 (I:E ratio) Flex
5/4/2016	E	1604	991	C	-2863	-2525	-2827	-2595	
5/5/2016	B	1614	999	C	-3049	-2572	-2840	-2668	
5/6/2016	B	1601	990	C	-3043	-2618	-2844	-2738	
5/7/2016	B	1602	995	C	-2978	-2704	-2854	-2815	
5/8/2016	B	994	1600	C	-2922	-2720	-2855	-2820	
5/9/2016	B	954	1595	C	-2840	-2800	-2852	-2826	
5/10/2016	B	988	1090	C	-2774	-2804	-2766	-2802	D-1641 export limit (100% of Vernalis flow)
5/11/2016	B	987	1293	C	-2769	-2777	-2735	-2792	
5/12/2016	B	987	1591	C	-2782	-2788	-2751	-2802	NMFS Action IV.2.1 (I:E ratio) Flex
5/13/2016	B	986	1592	C	-2766	-2801	-2761	-2812	
5/14/2016	B	985	1586	C	-2576	-2810	-2776	-2819	
5/15/2016	B	1427	998	C	-2574	-2806	-2842	-2816	NMFS Action IV.2.1 (I:E ratio) Flex; D-1641 export limit (100% of Vernalis flow)
5/16/2016	B	1598	991	C	-2582	-2780	-2898	-2827	NMFS Action IV.2.1 (I:E ratio) Flex
5/17/2016	B	817	747	C	-2450	-2720	-2722	-2770	D-1641 Delta Outflow (11,400 cfs)
5/18/2016	B	408	396	C	-2296	-2599	-2414	-2664	
5/19/2016	B	426	399	C	-2297	-2541	-2087	-2550	
5/20/2016	B	413	393	C	-2256	-2525	-1780	-2436	
5/21/2016	B	409	398	C	-2046	-2447	-1437	-2321	
5/22/2016	B	795	1389	C	-2124	-2435	-1536	-2299	
5/23/2016	B	803	1790	C	-2435	-2454	-1850	-2306	NMFS Action IV.2.1 (I:E ratio) Flex
5/24/2016	B	1927	594	C	-2652	-2498	-2174	-2339	
5/25/2016	B	997	491	C	-2645	-2481	-2345	-2297	NMFS Action IV.2.1 (I:E ratio)
5/26/2016	B	986	499	C	-2777	-2445	-2519	-2238	
5/27/2016	B	985	500	O	-2749	-2429	-2434	-2182	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; NMFS Action IV.2.1 (I:E ratio)
5/28/2016	B	802	699	O	-2489	-2423	-2277	-2128	
5/29/2016	B	800	697	O	-2293	-2397	-2132	-2085	
5/30/2016	B	800	694	O	-2236	-2357	-2148	-2029	
5/31/2016	B	800	694	C	-2281	-2385	-2163	-2038	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; NMFS Action IV.2.1 (I:E ratio) *Last day of NMFS Action IV.2.1 (I:E ratio)*
6/1/2016	B	800	2596	C	-2543	-2517	-2476	-2204	D-1641 Delta Outflow (7,100 cfs)
6/2/2016	B	803	1799	C	-2749	-2584	-2645	-2327	
6/3/2016	B	801	1791	O	-2898	-2627	-2817	-2456	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; D-1641 Delta Outflow (7,100 cfs)
6/4/2016	B	802	1189	O	-3188	-2765	-2883	-2546	
6/5/2016	B	804	2498	O	-3533	-2888	-3191	-2629	

Date	Balance/Excess	Jones PP (cfs)	Clifton Court Inflow (cfs)	DCC Gate Status	USGS Tidally Filtered Mean 5-Day OMR (cfs)	USGS Tidally Filtered Mean 14-Day OMR (cfs)	Mean 5-Day OMR Index Calculation (cfs)	Mean 14-Day OMR Index Calculation (cfs)	Factor(s) Controlling Delta Operations
6/6/2016	B	805	3292	C	-3808	-3008	-3348	-2739	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; D-1641 Delta Outflow (7,100 cfs)
6/7/2016	B	805	3598	C	-4247	-3154	-3702	-2873	*NMFS IV.2.3 OMR flow management restrictions lifted based on temperature offramp*
6/8/2016	B	800	3797	C	-4693	-3358	-4096	-3081	
6/9/2016	B	797	3694	C	-4988	-3555	-4584	-3283	Delta WQ
6/10/2016	B	787	3992	O	-5183	-3758	-4887	-3505	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; D-1641 Delta Outflow (7,100 cfs)
6/11/2016	B	787	3990	O	-5258	-3997	-5037	-3725	
6/12/2016	B	813	3797	O	-5393	-4261	-5096	-3932	
6/13/2016	B	794	3398	C	-5211	-4421	-5031	-4111	
6/14/2016	B	747	2296	C	-5010	-4529	-4777	-4217	
6/15/2016	B	804	2393	C	-4875	-4590	-4491	-4225	*[No more DCC restrictions per NMFS BiOp or D-1641]*
6/16/2016	B	802	2592	C	-4672	-4683	-4246	-4297	
6/17/2016	B	803	3398	C	-4461	-4819	-4189	-4422	
6/18/2016	B	805	3088	O	-4588	-4920	-4155	-4565	[DCC Gates - WQ]; D-1641 Delta Outflow (7,100
6/19/2016	B	803	3388	O	-4840	-4996	-4375	-4640	
6/20/2016	B	805	3491	O	-5039	-5030	-4593	-4669	
6/21/2016	B	805	4494	O	No Data	No Data	-4956	-4745	
6/22/2016	B	781	5594	O	No Data	No Data	-5389	-4884	
6/23/2016	B	813	5498	O	No Data	No Data	-5857	-5019	
6/24/2016	B	794	5499	O	No Data	No Data	-6276	-5136	D-1641 35% E/I 3 day average
6/25/2016	B	804	5296	O	No Data	No Data	-6634	-5239	
6/26/2016	B	805	4599	O	No Data	No Data	-6677	-5309	D-1641 Delta Outflow (7,100 cfs)
6/27/2016	B	796	4392	O	No Data	No Data	-6452	-5391	
6/28/2016	B	2609	2295	O	No Data	No Data	-6196	-5526	
6/29/2016	B	3990	0	O	-6130	No Data	-5776	-5595	
6/30/2016	B	4096	996	O	-6011	No Data	-5600	-5723	

Appendix B—2015/2016 Salmonid and Green Sturgeon Incidental Take and Monitoring Report

The Incidental Take and Monitoring Report was not yet available at the time the WY 2016 DOSS Annual Report was finalized. Once available, it will be posted on the DOSS website: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/doss.html

Appendix C— Old and Middle River Flows

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

Dec 2015

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
12/1/2015	-860	-1420	-990	-1090	-1430
12/2/2015	-790	-1330	-640	-990	-1320
12/3/2015	-810	-1260	-650	-910	-1200
12/4/2015	-690	-1100	-720	-830	-1090
12/5/2015	-650	-970	-720	-740	-980
12/6/2015	-710	-920	-700	-690	-950
12/7/2015	-740	-850	-700	-700	-920
12/8/2015	-670	-790	-720	-710	-890
12/9/2015	-810	-800	-700	-710	-860
12/10/2015	-980	-840	-740	-710	-840
12/11/2015	-900	-810	-730	-720	-810
12/12/2015	-750	-740	-720	-720	-780
12/13/2015	-710	-710	-700	-720	-750
12/14/2015	-300	-590	-750	-730	-730
12/15/2015	-20	-550	-720	-720	-710
12/16/2015	-60	-550	-840	-750	-720
12/17/2015	-280	-550	-1350	-870	-770
12/18/2015	-520	-650	-1350	-1000	-820
12/19/2015	-990	-720	-1330	-1120	-860
12/20/2015	-1130	-700	-1330	-1240	-910
12/21/2015	-1440	-800	-1300	-1330	-950
12/22/2015	-2000	-1030	-3190	-1700	-1120
12/23/2015	-2350	-1200	-4300	-2290	-1380
12/24/2015	-2910	-1400	-5200	-3060	-1700
12/25/2015	-3500	-1630	-4940	-3790	-2000
12/26/2015	-3870	-1910	-4910	-4510	-2300
12/27/2015	-4160	-2260	-5990	-5070	-2680
12/28/2015	-4700	-2770	-5990	-5400	-3050
12/29/2015			-5990	-5560	-3430
12/30/2015			-5640	-5700	-3770
12/31/2015			-5160	-5750	-4040

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

Jan 2016

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
1/1/2016			-4060	-5360	-4240
1/2/2016			-3010	-4770	-4360
1/3/2016			-2220	-4010	-4420
1/4/2016			-1990	-3280	-4470
1/5/2016			-3360	-2930	-4490
1/6/2016			-4970	-3110	-4530
1/7/2016	-3490		-4910	-3490	-4510
1/8/2016	-3620		-4830	-4010	-4500
1/9/2016	-3900		-5040	-4620	-4510
1/10/2016	-4120		-4770	-4900	-4420
1/11/2016	-4210		-4930	-4900	-4350
1/12/2016	-4350		-4970	-4910	-4270
1/13/2016	-4650		-5110	-4960	-4240
1/14/2016	-4650		-4920	-4940	-4220
1/15/2016	-4430		-3430	-4670	-4180
1/16/2016	-4110	-3920	-3540	-4390	-4210
1/17/2016	-3840	-3940	-3470	-4090	-4300
1/18/2016	-3420	-3970	-3480	-3770	-4410
1/19/2016	-3180	-3960	-3500	-3480	-4420
1/20/2016	-3060	-3860	-3510	-3500	-4310
1/21/2016	-3040	-3750	-3050	-3400	-4180
1/22/2016	-2960	-3710	-2560	-3220	-4020
1/23/2016	-2790	-3580	-2500	-3030	-3840
1/24/2016	-2480	-3380	-2470	-2820	-3670
1/25/2016	-2300	-3180	-2460	-2610	-3500
1/26/2016	-2180	-2980	-2520	-2500	-3320
1/27/2016	-2040	-2770	-2930	-2570	-3170
1/28/2016	-2170	-2690	-3440	-2760	-3060
1/29/2016	-2580	-2720	-3500	-2970	-3070
1/30/2016	-2890	-2740	-3510	-3180	-3060
1/31/2016	-3030	-2690	-3510	-3370	-3070

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

Feb 2016

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
2/1/2016	-2900	-2590	-3440	-3480	-3060
2/2/2016	-2720	-2530	-2490	-3290	-2990
2/3/2016	-2460	-2500	-2250	-3040	-2900
2/4/2016	-2260	-2460	-2280	-2790	-2850
2/5/2016	-2190	-2410	-2290	-2550	-2830
2/6/2016	-2350	-2430	-2550	-2370	-2830
2/7/2016	-2480	-2530	-2670	-2410	-2840
2/8/2016	-2580	-2600	-2830	-2520	-2870
2/9/2016	-2760	-2670	-3430	-2750	-2940
2/10/2016	-3020	-2760	-3690	-3030	-2990
2/11/2016	-3310	-2840	-4370	-3400	-3060
2/12/2016	-3630	-2910	-4910	-3850	-3160
2/13/2016	-3990	-3000	-5010	-4280	-3260
2/14/2016	-4340	-3140	-5020	-4600	-3370
2/15/2016	-4670	-3390	-4990	-4860	-3480
2/16/2016	-5100	-3680	-5010	-4990	-3660
2/17/2016	-5570	-4010	-4970	-5000	-3860
2/18/2016	-5590	-4190	-4980	-5000	-4050
2/19/2016	-5510	-4330	-4980	-4990	-4240
2/20/2016	-5340	-4460	-4970	-4980	-4420
2/21/2016	-5050	-4600	-4970	-4970	-4580
2/22/2016	-4670	-4760	-4980	-4970	-4730
2/23/2016	-4750	-4900	-5020	-4980	-4850
2/24/2016	-4890	-5000	-4990	-4980	-4940
2/25/2016	-4990	-5060	-5010	-4990	-4990
2/26/2016	-5070	-5110	-4980	-4990	-4990
2/27/2016	-5070	-5140	-4980	-5000	-4990
2/28/2016	-5040	-5150	-5000	-4990	-4990
2/29/2016	-5100	-5150	-5040	-5000	-4990

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

Mar 2016

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
3/1/2016	-5270	-5130	-5080	-5020	-5000
3/2/2016	-5380	-5050	-4960	-5010	-4990
3/3/2016	-5450	-5090	-4950	-5000	-4990
3/4/2016	-5550	-5170	-4950	-5000	-4990
3/5/2016	-5590	-5240	-4980	-4980	-4990
3/6/2016	-5430	-5260	-5020	-4970	-4990
3/7/2016	-5150	-5220	-4980	-4970	-4990
3/8/2016	-4880	-5140	-4940	-4970	-4990
3/9/2016	-4740	-5110	-5040	-4990	-4990
3/10/2016	-4670	-5120	-5020	-5000	-4990
3/11/2016	-4760	-5150	-5010	-5000	-5000
3/12/2016	-4780	-5120	-5000	-5000	-5000
3/13/2016	-4900	-5090	-4690	-4950	-4980
3/14/2016	-4870	-5030	-5120	-4970	-4980
3/15/2016	-4680	-4910	-5060	-4980	-4980
3/16/2016	-4590	-4870	-5040	-4980	-4990
3/17/2016	-4860	-4900	-4870	-4960	-4980
3/18/2016	-5040	-4910	-5050	-5030	-4990
3/19/2016	-5080	-4850	-5020	-5010	-4990
3/20/2016	-5190	-4830	-5040	-5010	-4990
3/21/2016	-5200	-4890	-5010	-5000	-5000
3/22/2016	-4880	-4900	-5010	-5030	-5000
3/23/2016	-4520	-4830	-4400	-4900	-4950
3/24/2016	-4260	-4700	-3490	-4590	-4840
3/25/2016	-3950	-4540	-3490	-4280	-4740
3/26/2016	-3660	-4490	-3450	-3970	-4630
3/27/2016	-3480	-4390	-2970	-3560	-4500
3/28/2016	-3340	-4290	-3110	-3300	-4360
3/29/2016	-3350	-4220	-3040	-3210	-4210
3/30/2016	-3390	-4110	-3060	-3130	-4070
3/31/2016	-3270	-3920	-3100	-3060	-3950

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

Apr 2016

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
4/1/2016	-2980	-3660	-1830	-2830	-3720
4/2/2016	-2710	-3440	-1790	-2560	-3480
4/3/2016	-2460	-3240	-1840	-2330	-3260
4/4/2016	-2100	-3010	-1870	-2090	-3030
4/5/2016	-1850	-2840	-1880	-1840	-2810
4/6/2016	-1970	-2750	-1880	-1850	-2630
4/7/2016	-2280	-2730	-1920	-1880	-2520
4/8/2016	-2290	-2650	-1930	-1900	-2410
4/9/2016	-2270	-2510	-1930	-1910	-2300
4/10/2016	-2180	-2370	-1930	-1920	-2220
4/11/2016	-1920	-2240	-1890	-1920	-2140
4/12/2016	-1530	-2090	-1870	-1910	-2050
4/13/2016	-1420	-1950	-1880	-1900	-1970
4/14/2016	-1330	-1820	-1890	-1890	-1880
4/15/2016	-1200	-1740	-1900	-1890	-1890
4/16/2016	-1250	-1720	-1900	-1890	-1890
4/17/2016	-1370	-1700	-1910	-1900	-1900
4/18/2016	-1420	-1710	-1860	-1890	-1900
4/19/2016	-1600	-1730	-1770	-1870	-1890
4/20/2016	-1930	-1720	-1790	-1850	-1880
4/21/2016	-2120	-1660	-1840	-1830	-1880
4/22/2016	-2140	-1650	-1840	-1820	-1870
4/23/2016	-2070	-1630	-1790	-1810	-1860
4/24/2016	-2140	-1710	-2800	-2010	-1920
4/25/2016	-2070	-1770	-2760	-2210	-1990
4/26/2016	-2130	-1870	-2770	-2390	-2050
4/27/2016	-2330	-1970	-2830	-2590	-2120
4/28/2016	-2550	-2070	-2800	-2790	-2180
4/29/2016	-2540	-2190	-2780	-2790	-2250
4/30/2016	-2550	-2240	-2800	-2800	-2310

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

May 2016

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
5/1/2016	-2570	-2300	-2810	-2800	-2370
5/2/2016	-2570	-2380	-2820	-2800	-2440
5/3/2016	-2640	-2440	-2870	-2820	-2520
5/4/2016	-2870	-2530	-2850	-2830	-2600
5/5/2016	-3050	-2570	-2870	-2840	-2670
5/6/2016	-3040	-2620	-2840	-2850	-2740
5/7/2016	-2980	-2700	-2860	-2860	-2820
5/8/2016	-2920	-2720	-2880	-2860	-2820
5/9/2016	-2840	-2800	-2840	-2860	-2830
5/10/2016	-2770	-2800	-2450	-2770	-2810
5/11/2016	-2770	-2780	-2690	-2740	-2800
5/12/2016	-2790	-2790	-2940	-2760	-2810
5/13/2016	-2760	-2800	-2920	-2770	-2820
5/14/2016	-2580	-2810	-2910	-2780	-2830
5/15/2016	-2580	-2810	-2780	-2850	-2820
5/16/2016	-2580	-2780	-2970	-2910	-2830
5/17/2016	-2450	-2720	-2060	-2730	-2780
5/18/2016	-2300	-2600	-1370	-2420	-2670
5/19/2016	-2300	-2540	-1290	-2090	-2560
5/20/2016	-2250	-2530	-1230	-1780	-2440
5/21/2016	-2040	-2450	-1260	-1440	-2330
5/22/2016	-2130	-2440	-2560	-1540	-2310
5/23/2016	-2440	-2460	-2960	-1860	-2310
5/24/2016	-2650	-2500	-2900	-2180	-2350
5/25/2016	-2640	-2480	-2090	-2350	-2300
5/26/2016	-2780	-2450	-2120	-2530	-2250
5/27/2016	-2740	-2430	-2140	-2440	-2190
5/28/2016	-2480	-2420	-2170	-2290	-2140
5/29/2016	-2290	-2400	-2180	-2140	-2090
5/30/2016	-2240	-2360	-2190	-2160	-2040
5/31/2016	-2280	-2390	-2200	-2170	-2050

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

June 2016

(*** Computed from available USGS Tidally Filtered Data)

Date	USGS Tidally Filtered OMR*** (cfs)		OMR Index Calculation (cfs)		
	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
6/1/2016	-2550	-2520	-3700	-2490	-2210
6/2/2016	-2750	-2580	-3020	-2660	-2340
6/3/2016	-2900	-2630	-3040	-2830	-2470
6/4/2016	-3190	-2770	-2520	-2900	-2560
6/5/2016	-3540	-2890	-3740	-3200	-2640
6/6/2016	-3820	-3010	-4500	-3360	-2750
6/7/2016	-4260	-3160	-4790	-3720	-2890
6/8/2016	-4700	-3360	-5010	-4110	-3090
6/9/2016	-4990	-3560	-4950	-4600	-3300
6/10/2016	-5190	-3760	-5240	-4900	-3520
6/11/2016			-5230	-5040	-3740
6/12/2016			-5090	-5100	-3940

Appendix D— Salmon Loss-Density Table

Chinook Salmon - Daily Summary Table

California Department of Fish and Wildlife - Results Subject to Revision

Prepared by: Geir Aasen **Report Date: 6/27/2016** **Report Time: 11:57 AM**

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT										
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH (FL mm)	RACE*		OLDER JUV LOSS DENSITY
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS		SIZE	CWT	
12/22/2015							1	4	3.52				160	LF		0.59
12/23/2015	1	2	9.16										146	LF		1.00
12/24/2015	4	14	60.60										162 - 180	LF		5.55
12/25/2015	1	2	8.57	3	6	26.90	1	4	3.19				149 - 186	LF	LF	1.03
12/26/2015	2	8	35.89										150 - 198	F,LF		3.27
12/27/2015				1	4	17.75							154	LF	LF	
12/28/2015	8	8	34.66	7	10	44.27							135 - 211	F,LF,W	LF	2.62
12/29/2015				6	20	89.51							130 - 188	LF,W	LF	
12/30/2015				4	16	68.24							140 - 160	LF,W	LF	
12/31/2015				2	6	26.15							175 - 186	LF	LF	
01/01/2016	1	4	18.30	1	4	18.25							142 - 158	LF,W	LF	1.96
01/02/2016	1	4	18.32										193	LF		2.70
01/05/2016	2	2	8.67	3	3	13.00							142 - 200	LF,W	LF	1.26
01/06/2016	2	6	**	4	16	73.57							145 - 548	LF,W,U	LF	
01/07/2016	1	4	**	2	4	18.40							148 - 555	W,U	LF	
01/08/2016				1	4	18.43				1	4	3.19	150	W	LF	
01/09/2016										1	4	3.19	134	W	LF	
01/12/2016							1	4	2.88	1	4	2.88	146 - 155	W	LF	0.24

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT									
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED						
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	LENGTH (FL mm)	RACE* SIZE	RACE* CWT	OLDER JUV LOSS DENSITY
01/13/2016										1	6	4.32	160	W	LF	
01/14/2016				2	8	36.71	1	4	2.88	1	4	2.88	131 - 162	W	LF	0.26
01/16/2016							1	4	3.52				175	W		0.42
01/18/2016										1	4	3.52	180	LF	LF	
01/19/2016										2	8	7.04	152 - 163	W	LF	
01/20/2016				5	14	64.20				2	8	6.37	146 - 193	LF,W	LF	
01/21/2016				2	8	36.72				2	8	6.37	139 - 197	LF,W	LF	
01/22/2016				2	6	27.47				2	8	6.37	178 - 183	W	LF	
01/23/2016				1	2	9.11				3	12	9.54	167 - 203	LF,W	LF	
01/24/2016							2	8	5.53	2	8	6.37	37 - 214	F,LF,W	LF	
01/25/2016							1	4	2.76	3	12	9.56	40 - 204	F,LF,W	LF	
01/26/2016				1	1	4.33	1	4	3.01	1	4	3.52	37 - 183	F,W	LF	
01/27/2016				2	6	27.48	2	8	5.77				35 - 189	F,W	LF	
01/28/2016	1	2	8.59	2	6	27.47							77 - 191	W	LF	0.85
01/29/2016				5	10	45.52				1	4	3.19	159 - 195	LF,W	LF	
01/30/2016				1	2	9.10							197	LF	LF	
01/31/2016				1	4	18.09							175	W	LF	
02/02/2016	1	2	9.05	5	10	45.40							135 - 185	W	LF	1.41
02/05/2016							1	4	3.01				46	F		
02/06/2016							1	4	3.52				188	W		0.53

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT									
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED						OLDER JUV LOSS DENSITY
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	LENGTH (FL mm)	RACE*		
														SIZE	CWT	
02/08/2016							1	4	2.76				44	F		
02/09/2016				1	1	4.33							180	W	LF	
02/11/2016				1	2	9.17	4	16	11.05	2	8	6.37	38 - 190	F,S,W	LF	
02/12/2016				3	8	36.37	1	4	2.54				54 - 184	S,W	LF	
02/19/2016	1	4	16.92										44	F		
02/22/2016							1	4	2.88				112	W		0.25
02/25/2016							1	4	2.54				59	S		
02/26/2016							1	4	2.54				57	F		
02/28/2016							1	4	2.54				65	S		
03/04/2016							1	4	3.55				60	F		
03/06/2016										2	8	5.76	101 - 111	W	W	
03/09/2016										1	4	2.88	105	W	W	
03/11/2016							1	4	**				360	,U		
03/14/2016										1	4	2.54	95	S	W	
03/16/2016							1	4	2.54				81	S		
03/17/2016							4	16	10.15				35 - 87	F,S		
03/18/2016							4	16	10.15				73 - 79	S		
03/20/2016										2	8	5.42	96 - 112	S,W	S	
03/21/2016							3	12	7.96	39	156	99.30	77 - 111	S,W	S	0.22
03/22/2016	1	2	8.61	3	6	25.80	1	4	2.88	18	72	46.70	72 - 168	S,W	S	0.23

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT									
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED						
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	LENGTH (FL mm)	RACE* SIZE	RACE* CWT	OLDER JUV LOSS DENSITY
03/23/2016	3	12	51.39	4	16	68.31	3	12	7.61	32	128	83.35	52 - 106	F,S	S	
03/24/2016	1	2	8.61							25	100	69.09	52 - 98	F,S	S	
03/25/2016										11	44	30.40	72 - 83	S	S	
03/26/2016				1	4	17.17				6	24	16.58	70 - 100	F,S	S	
03/27/2016				1	2	8.61				6	24	16.58	77 - 93	S	S	
03/28/2016	1	4	17.22	2	6	27.15				3	12	8.71	75 - 109	S	S	
03/29/2016				1	4	18.34							171	W	LF	
03/30/2016										4	16	12.03	78	S	S	
03/31/2016										4	16	12.03	81 - 84	S	S	
04/01/2016										1	4	3.27	92	S	S	
04/02/2016										1	4	3.27	82	S	S	
04/05/2016										1	4	3.27	86	S	S	
04/06/2016										1	4	3.27	84	S	S	
04/07/2016										1	4	3.27	88	S	S	
04/11/2016							1	4	3.27				97	S		
04/14/2016							1	4	3.88				104	S		
04/17/2016							1	4	3.27				95	S		
04/18/2016							1	4	3.27				90	S		
04/25/2016							2	8	6.54				86	S		
04/27/2016	6	20	86.95										79 - 109	F,S		

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT								
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED					OLDER JUV LOSS DENSITY
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	LENGTH (FL mm)	RACE* SIZE	RACE* CWT	
04/28/2016	3	10	42.77										83 - 95	F,S		
04/29/2016	3	3	13.00				1	4	3.88				85 - 101	F,S		
05/02/2016	4	7	30.12										94 - 101	S		
05/03/2016	1	1	4.33										110	S		
05/12/2016							5	20	17.57				91 - 110	F,S		
05/13/2016	2	4	16.10				3	12	11.04				92 - 108	F,S		
05/14/2016	4	10	41.76										95 - 99	F,S		
05/15/2016	1	2	8.58										92	F		
05/16/2016	1	2	8.59										98	F		
05/17/2016	1	2	9.23										95	F		
05/19/2016							1	4	3.88				106	S		
Season total		**143.0**	**575.99**		**219.0**	**981.36**		**228.0**	**167.85**		**742.0**	**512.41**				
Weekly total		**0.0**	**0.00**		**0.0**	**0.00**		**0.0**	**0.00**		**0.0**	**0.00**				

The table will only be updated with catch, salvage, loss, length, race, and loss density on dates when salmon were salvaged, although the report and "report date" will be updated each week day to indicate that the information is current.

Non-clipped = adipose fin present; Clipped = adipose fin removed; Race: S = spring run, F = fall run, LF = late fall run, W = winter run.

U = Unknown race; fish was larger than any established race by length of the fish at date criteria (> 300 mm).

*Race of clipped (hatchery) salmon reported in this report is determined by the Delta criteria for length of the fish at date of salvage. Actual race determination will be determined from the coded wire tag data once the tag has been read (if available).

** Loss for sub-adult unknown race salmon is not included in this report.

***Since NON clipped salmon was not released, but kept for a study, a “1” was added to loss.

SIZE = race determined by fish length at date of salvage criteria; CWT = hatchery fish race from coded wired tag information.

Older Juvenile Loss Density = daily combined (SWP+CVP) losses of older non-clipped juveniles /1000AF (SWP+CVP exports)

Appendix E— Steelhead Loss-Density Table

Steelhead - Daily Summary Table

California Department of Fish and Wildlife - Results Subject to Revision

Prepared by: Geir Aasen **Report Date: 6/27/2016** **Report Time: 2:12 PM**

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT							
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH (FL mm)	LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS		DENSITY
01/19/2016										1	4	2.72	258	
01/20/2016							1	4	2.72	1	4	2.72	230 - 295	0.30
01/21/2016				1	2	8.66				1	4	2.72	224 - 260	
01/22/2016				3	8	34.64				3	12	8.16	220 - 274	
01/23/2016				2	6	25.98				1	4	2.72	209 - 244	
01/24/2016				2	8	34.64							198 - 235	
01/25/2016				5	16	69.28				1	4	2.72	209 - 333	
01/26/2016				3	6	25.98							212 - 254	
01/27/2016				2	4	17.32							247 - 253	
01/28/2016				2	8	34.64				1	4	2.72	189 - 256	
01/29/2016				4	12	51.96				1	4	2.72	224 - 249	
01/30/2016				2	6	25.98							214 - 248	
01/31/2016				2	6	25.98							198 - 236	
02/01/2016	1	6	25.98	2	8	34.64				1	4	2.72	227 - 260	2.81
02/02/2016							1	4	2.72				273	0.42
02/03/2016				1	4	17.32				1	4	2.72	230 - 232	
02/04/2016							2	8	5.44				223 - 225	0.89

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT							
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH (FL mm)	LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS		DENSITY
02/05/2016				1	4	17.32				1	4	2.72	231 - 236	
02/07/2016				1	2	8.66				1	4	2.72	216 - 287	
02/08/2016				3	6	25.98				1	4	2.72	205 - 237	
02/09/2016							1	4	2.72				227	0.37
02/10/2016				2	4	17.32							243 - 287	
02/11/2016				2	8	34.64							216 - 254	
02/12/2016				2	8	34.64				3	12	8.16	200 - 259	
02/13/2016				1	2	8.66				1	4	2.72	240 - 270	
02/14/2016				2	8	34.64							225 - 227	
02/15/2016				4	14	60.62							204 - 270	
02/16/2016	1	4	17.32	4	14	60.62							237 - 263	1.49
02/17/2016				1	4	17.32							237	
02/18/2016				11	32	138.56				1	4	2.72	188 - 258	
02/19/2016				2	8	34.64	1	4	2.72	13	52	35.36	210 - 272	0.24
02/20/2016				7	22	95.26	1	4	2.72	11	44	29.92	202 - 250	0.24
02/21/2016				5	18	77.94				6	24	16.32	225 - 246	
02/22/2016				9	22	95.26				10	40	27.20	201 - 262	
02/23/2016				6	12	51.96				7	26.7	18.13	200 - 265	
02/24/2016				3	10	43.30				3	12	8.16	233 - 260	

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT							
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH (FL mm)	LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS		DENSITY
02/25/2016				2	6	25.98				4	16	10.88	220 - 264	
02/26/2016	1	4	17.32	6	14	60.62				1	4	2.72	210 - 278	1.52
02/27/2016				2	8	34.64							223 - 267	
02/28/2016										2	8	5.44	215 - 246	
02/29/2016				1	4	17.32				1	4	2.72	245 - 263	
03/02/2016				1	2	8.66				2	8	5.44	232 - 243	
03/03/2016				1	4	17.32				1	4	2.72	249 - 266	
03/04/2016				1	4	17.32				3	12	8.16	218 - 251	
03/05/2016										5	20	13.60	246 - 275	
03/06/2016										4	16	10.88	250 - 292	
03/07/2016										2	8	5.44	229 - 233	
03/08/2016				1	2	8.66				1	4	2.72	210 - 230	
03/09/2016				1	4	17.32				3	11	7.48	225 - 245	
03/10/2016										1	4	2.72	248	
03/11/2016				4	10	43.30	1	4	2.72				213 - 260	0.21
03/12/2016				4	10	43.30	1	4	2.72				236 - 330	0.22
03/13/2016				4	12	51.96				4	16	10.88	225 - 270	
03/14/2016	1	4	17.32	5	18	77.94				4	16	10.88	196 - 614	1.31
03/15/2016	3	8	34.64	17	64	277.12	2	8	5.44	2	8	5.44	224 - 312	2.85

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT							
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH (FL mm)	LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS		DENSITY
03/16/2016	2	4	17.32	21	52	225.16				1	4	2.72	202 - 331	1.10
03/17/2016				9	30	129.90	1	4	2.72	7	28	19.04	191 - 331	0.17
03/18/2016				4	16	69.28	1	4	2.72	4	16	10.88	215 - 305	0.19
03/19/2016				10	34	147.22				1	4	2.72	227 - 273	
03/20/2016	2	4	17.32	7	24	103.92				7	28	19.04	220 - 345	1.23
03/21/2016				7	24	103.92				2	8	5.44	208 - 282	
03/22/2016				5	20	86.60				3	12	8.16	225 - 290	
03/23/2016				5	20	86.60				3	12	8.16	245 - 280	
03/24/2016				2	8	34.64							229 - 233	
03/25/2016	1	2	8.66	1	2	8.66	1	4	2.72				260 - 276	1.33
03/26/2016	1	2	8.66	1	4	17.32				1	4	2.72	248 - 294	1.06
03/27/2016				2	6	25.98				1	4	2.72	241 - 265	
03/28/2016				1	4	17.32				2	8	5.44	235 - 259	
03/29/2016				1	4	17.32				1	4	2.72	198 - 259	
03/30/2016	1	4	17.32	1	2	8.66				1	4	2.72	257 - 334	2.35
03/31/2016	2	6	25.98										211 - 293	3.72
04/03/2016	1	4	17.32										286	6.02
04/05/2016				1	2	8.66							249	
04/10/2016							1	4	2.72				345	0.89

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT							
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH (FL mm)	LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS		DENSITY
04/11/2016										1	4	2.72	290	
04/12/2016							1	1	0.68	1	4	2.72	266 - 289	0.24
04/13/2016										1	1	0.68	265	
04/14/2016										1	1	0.68	280	
04/15/2016				1	4	17.32							214	
04/16/2016				1	4	17.32							253	
04/17/2016				1	2	8.66							239	
04/21/2016										1	1	0.68	261	
04/25/2016				2	6	25.98				1	1	0.68	249 - 278	
04/26/2016				1	2	8.66							270	
05/01/2016				1	1	4.33							357	
05/02/2016	1	1	4.33										297	0.84
05/04/2016	1	4	17.32	1	2	8.66							261 - 280	3.36
05/14/2016				1	4	17.32							268	
05/16/2016										1	4	2.72	239	
05/23/2016	1	1	4.33										246	2.72
06/03/2016										1	1	0.68	265	
Season total		**58.0**	**251.14**		**731.0**	**3165.23**		**61.0**	**41.48**		**590.7**	**401.65**		
Weekly total		**0.0**	**0.00**		**0.0**	**0.00**		**0.0**	**0.00**		**0.0**	**0.00**		

The table will only be updated with catch, salvage, loss, length, and loss density on dates when steelhead were salvaged, although the report and "report date" will be updated each week day to indicate that the information is current.

Non-clipped = adipose fin present; Clipped = adipose fin removed
State Water Project loss = salvage x 4.33; Central Valley Project loss = salvage x 0.68
Steelhead Loss Density = daily combined (SWP+CVP) losses of non adipose clipped steelhead /1000AF (SWP+CVP exports)

Appendix F—Tracking of Acoustic-Tagged Hatchery Winter-run Chinook salmon

Livingston Stone National Fish Hatchery JSATS acoustic tagged smolt movement as of 3/28/2016 09:00. Redding - Bonnyview = site of release, fish trucked from LSNFH. Bonnyview is 6.8 river miles below the usual Caldwell Park release location.

Table 1. FIRST RELEASE ONLY - Preliminary Data, subject to change

			FASTEST FISH ID: 4AA8			
Location	**rkm of location**	**Total Fish detected**	**First arrival**	**Travel Time (days)**	**Speed (rkm/day)**	**Speed (miles/day)**
Redding	540.4	285	2/17/2016 18:00			
Colusa	314.4	198	2/20/2016 5:40	2.5	90.9	56.5
Tisdale	269.2	176	2/20/2016 20:38	0.6	72.5	45.0
Knights Landing	224.1	161	2/21/2016 11:09	0.6	74.6	46.3
Verona	203.5	108	* went through this area when receivers not operating			
Tower Bridge	172.0	133	2/22/2016 4:22	0.7	72.6	45.1
I80 Bridge	170.8	127	2/22/2016 4:54	0.0	53.9	33.5
Hood	138.9	75				
Middle River	150	0				

rkm of location = distance via mainstem path from Golden Gate Bridge, GG Bridge = 0 rkm.
Travel Time = arrival date to location minus arrival date of location above / distance
Verona receivers not online until 2/22/2016 13:23, went offline on 3/12/2016
Hood receiver online starting 2/26/2016 14:35, went offline on 3/7/2016
I80/50 receivers stopped working on 3/9/16 16:00

Table 2. SECOND RELEASE ONLY - Preliminary Data, subject to change

			FASTEST FISH ID: 4AD2			
Location	**rkm of location**	**Total Fish detected**	**First arrival**	**Travel Time (days)**	**Speed (rkm/day)**	**Speed (miles/day)**
Redding	540.4	285	2/18/2016 18:00			
Colusa	314.4	202	2/21/2016 9:18	2.6	85.7	53.2
Tisdale	269.2	181	2/22/2016 1:20	0.7	67.7	42.1
Knights Landing	224.1	162	2/22/2016 17:55	0.7	65.3	40.6
Verona	203.5	104	2/22/2016 23:30	0.2	88.4	54.9
Tower Bridge	172.0	145	2/23/2016 19:30	0.8	37.8	23.5
I80 Bridge	170.8	130	2/23/2016 20:01	0.0	56.1	34.8
Hood	138.9	75				
Middle River	150	0				

Table 3. Survival estimates by reach for Livingston Stone National Fish Hatchery JSATS acoustic tagged winter-run juveniles for Brood year (BY)2012, BY2013, BY2014. The BY2015 data are only from real time receivers last uploaded on 3/28/2016 9:00. Preliminary data and subject to change.

		Survival Estimates				
Reach	**Reach Length (rkm)**	**BY2012**	**BY2013**	**BY2014 release 1**	**BY2014 release 2**	**BY2015 both releases***
Redding to Colusa	237	0.204	0.419	0.510	0.600	0.726
Colusa to Tisdale	45	0.811	0.983	0.989	0.968	0.871
Tisdale to Knights Landing	45	0.996	0.986	0.916	0.942	0.912
Kights Landing to Verona	21	0.900	1.000	0.973	0.999	0.930
Verona to Tower/I80 Bridge	32	1.000	0.931	0.972	0.962	0.921
I80 to Hood	33	NA	NA	NA	0.961	NA
Redding to Tower/I80 Bridge	379	0.149	0.378	0.441	0.525	0.493

BY = Brood Year, hatchery releases occur in next calander year, example BY2012 were released 2013
Survival estimates from Cormack-Jolly-Seber model with survival and detection probability varying by reach
Release of hatchery fish each year occurred in early February at Redding, Caldwell Park (Bonnyview in BY2015)

Table 4. Average travel time in days from release location to each downriver location for the two release groups of LSNFH winter-run Chinook salmon juveniles.

		Release Date	
Location	**rkm**	**2/17/2016**	**2/18/2016**
Colusa	314	6.4	6.6
Tisdale	269	8.9	8.6
Knights Landing	224	10.6	10.0
Verona*	203	10.8	9.2
Tower Bridge	172	11.9	11.6
I80 Bridge	171	11.5	10.7
Hood	138	12.1	10.8

Verona receivers did not go online until after many fish had already past

Appendix G—DOSS Weekly Estimates

Weekly estimates of the proportion of the annual cohort of ESA-listed salmonids yet to enter the Delta (still upstream of the Delta in the Sacramento basin). Blank cells represent weeks in which DOSS made no quantitative estimate.

		Yet to Enter the Delta		
		(above Knights Landing)		
Month	**Meeting Date**	Winter-run wild (%)	Winter-run hatchery (%)	Spring-run wild (%)
October	10/6			
	10/13			
	10/20			
	10/27			
November	11/10	95		
	11/17	95		
	11/24	95		
December	12/1	95		
	12/8	95		
	12/15	90		
	12/22	90		99
	12/29	80-85		95-99
January	1/5	70-75		85
	1/12	10-25		70
	1/19	15		40-50
	1/26	10		35-45
Febrary	2/2	5-10		35-45
	2/9	5-10		35-45
	2/16	5-10		35-45
	2/23	5-10	95	30-40
March	3/1	5	50	30-40
	3/8	5	5-25	30-40
	3/15	1	5-15	5-20
	3/22	1	5	5-10
	3/29	1	5	5
April	4/5	1	1	5
	4/12	1	1	5
	4/19	1	1	5
	4/26	1	1	5
May	5/3	1	1	5
	5/10	1	1	5
	5/17	1	1	1
	5/24	0	0	1
	5/31	0	0	1
June	6/7	0	0	1

Weekly estimates of the proportion of the annual cohort of ESA-listed salmonids in the Delta. Blank cells represent weeks in which DOSS made no quantitative estimate.

		In Delta		
		(Knights Landing to Chipps Island)		
Month	**WY 2016 Meeting Date**	Winter-run wild (%)	Winter-run hatchery (%)	Spring-run wild (%)
October	10/6			
	10/13			
	10/20			
	10/27			
November	11/10	5		
	11/17	5		
	11/24	5		
December	12/1	5		
	12/8	5		
	12/15	10		
	12/22	10		1
	12/29	15-20		1-5
January	1/5	25-30		15
	1/12	75-90		30
	1/19	85		50-60
	1/26	90		55-65
Febrary	2/2	90-95		55-65
	2/9	90-95		55-65
	2/16	90-95		55-65
	2/23	90-95	0-5	60-70
March	3/1	95	25-50	60-70
	3/8	95	50-80	60-70
	3/15	60-80	35-65	50-75
	3/22	50-70	45-65	55-60
	3/29	35-55	30-50	40-50
April	4/5	25-40	10-20	30-40
	4/12	15-30	10	20-30
	4/19	5-20	5	10-20
	4/26	5-10	5	5-15
May	5/3	5	5	5-10
	5/10	5	5	5
	5/17	5	5	5
	5/24	1	1	1
	5/31	1	1	1
June	6/7	1	1	1

Weekly estimates of the proportion of the annual cohort of ESA-listed salmonids that have exited the Delta past Chipps Island. Blank cells represent weeks in which DOSS made no quantitative estimate.

		Exited the Delta		
		(Exited past Chipps Island)		
Month	WY 2016 Meeting Date	Winter-run wild (%)	Winter-run hatchery (%)	Spring-run wild (%)
October	10/6			
	10/13			
	10/20			
	10/27			
November	11/10	0		
	11/17	0		
	11/24	0		
December	12/1	0		
	12/8	0		
	12/15	0		
	12/22	0		0
	12/29	0		0
January	1/5	0		0
	1/12	0-1		0-1
	1/19	0-5		0-5
	1/26	0-5		0-5
Febrary	2/2	0-5		0-5
	2/9	0-5		0-5
	2/16	0-5		0-5
	2/23	0-5	0	0-5
March	3/1	5	5	0-5
	3/8	5	10-40	0-5
	3/15	20-40	30-50	20-30
	3/22	30-50	30-50	30-40
	3/29	45-65	45-65	45-55
April	4/5	60-75	80-90	55-65
	4/12	70-85	90	65-75
	4/19	80-95	95	75-85
	4/26	90-95	95	80-90
May	5/3	95	95	85-95
	5/10	95	95	90
	5/17	95	95	95
	5/24	99	99	98
	5/31	99	99	98
June	6/7	99	99	98

Appendix H—Spring-run and Winter-run Raw and Adjusted Catch Data

Raw data for spring-run and winter-run catch are provided for all three locations: Knights Landing, in-Delta monitoring sites, and Chipps Island. Large catch numbers were observed at all three locations for spring-run and at Chipps Island for winter-run. These anomalies were adjusted either by adjusting just the high catch numbers or by adjusting the catch numbers within the entire date range which was likely affected by the fall-run hatchery releases. Adjusted numbers (shown in bold in the tables) were derived by averaging the data two weeks before and two weeks after either the high catch numbers or the hatchery release date range.

Spring-run raw and adjusted data at Knights Landing and associated calculation of the percent of spring-run "Yet to Enter the Delta". Adjusted data are indicated in bold, highlighted text.

Knight's Landing (Spring-Run)						
Date of DOSS Notes	Spring-Run Raw Data	Spring-Run Adjusted high values	Spring-Run Adjusted release range	100% minus Raw Cumulative	100% minus Cumulative (adjusted high values)	100% minus Cumulative (adjusted release range)
10/6	0	0	0	100	100	100
10/13	0	0	0	100	100	100
10/20	0	0	0	100	100	100
10/27	0	0	0	100	100	100
11/10	0	0	0	100	100	100
11/17	0	0	0	100	100	100
11/24	0	0	0	100	100	100
12/1	0	0	0	100	100	100
12/8	0	0	0	100	100	100
12/15	4	4	4	99.6	97.9	97.6
12/22	4	4	4	99.1	95.7	95.2
12/29	59	59	59	92.6	64.2	59.5
1/5	1	1	1	92.5	63.6	58.9
1/12	34	34	34	88.8	45.5	38.4
1/19	22	22	22	86.4	33.7	25.1
1/26	6	6	6	85.7	30.5	21.5
2/2	4	4	4	85.3	28.3	19.0
2/9	0	0	0	85.3	28.3	19.0
2/16	0	0	0	85.3	28.3	19.0
2/23	2	2	2	85.0	27.3	17.8
3/1	2	2	2	84.8	26.2	16.6
3/8	2	2	2	84.6	25.1	15.4
3/15	7	7	7	83.8	21.4	11.2
3/22	7	7	**2.5**	83.1	17.6	9.7
3/29	**177**	**5.75**	**2.5**	63.6	14.6	8.2
4/5	**272**	**5.75**	**2.5**	33.7	11.5	6.6
4/12	**123**	**5.75**	**2.5**	20.1	8.4	5.1
4/19	**173**	**5.75**	**2.5**	1.1	**5.3**	3.6
4/26	7	7	**2.5**	0.3	1.6	2.1
5/3	2	2	**2.5**	0.1	0.5	0.6
5/10	0	0	0	0.1	0.5	0.6
5/17	1	1	1	0	0	0
5/24	0	0	0	0	0	0
5/31	0	0	0	0	0	0
6/7	0	0	0	0	0	0

Spring-run raw and adjusted data from beach seine and Sacramento trawl monitoring locations, and associated calculation of the percent of spring-run "In-Delta". Raw and adjusted data cumulative percent minus Chipps Island cumulative percent represents an estimate of the percent of fish present in the Delta each week. Adjusted data are indicated in bold, highlighted text.

Combined Beach Seine and Sacramento Trawl (Spring-Run)						
Date of DOSS Notes	Spring-Run Raw Data	Spring-Run (adjusted high values only)	Spring-Run (adjusted release range)	Combined Beach Seine and Sac Trawl minus Chipps Island (raw data)	Combined Beach Seine and Sac Trawl minus Chipps Island (adjusted high value)	Combined Beach Seine and Sac Trawl minus Chipps Island (adjusted release range)
10/6	0	0	0	0	0	0
10/13	0	0	0	0	0	0
10/20	0	0	0	0	0	0
10/27	0	0	0	0	0	0
11/10	0	0	0	0	0	0
11/17	0	0	0	0	0	0
11/24	0	0	0	0	0	0
12/1	0	0	0	0	0	0
12/8	0	0	0	0	0	0
12/15	0	0	0	0	0	0
12/22	0	0	0	0	0	0
12/29	1	1	1	0.4	0.9	1.0
1/5	5	5	5	2.1	5.5	5.7
1/12	4	4	4	3.5	9.1	9.6
1/19	2	2	2	4.2	10.9	11.5
1/26	3	3	3	5.3	13.7	14.4
2/2	7	7	7	7.7	20.0	21.1
2/9	0	0	0	7.7	20.0	21.1
2/16	2	2	2	8.5	21.9	23.0
2/23	4	4	4	9.9	25.5	26.8
3/1	5	5	5	11.6	30.1	31.6
3/8	11	11	11	15.5	40.1	42.1
3/15	15	15	15	20.5	50.6	53.6
3/22	4	4	**6.5**	21.4	49.5	**51.9**
3/29	**93**	**9.25**	**6.5**	51.4	50.9	50.2
4/5	**35**	**9.25**	**6.5**	42.0	52.2	48.5
4/12	**74**	**9.25**	**6.5**	42.5	53.6	46.8
4/19	13	13	**6.5**	13.9	58.3	45.1
4/26	5	5	**6.5**	4.9	55.8	43.4
5/3	1	1	**6.5**	4.3	45.7	41.7
5/10	0	0	0	3.4	36.2	33.1
5/17	0	0	0	1.3	14.2	12.9
5/24	0	0	0	1.2	12.6	11.5
5/31	0	0	0	0.0	0	0
6/7	0	0	0	0.0	0	0

Spring-run raw and adjusted data at Chipps Island, and associated calculation of the percent of spring-run that have "Exited the Delta". The cumulative percent of total catch represents the percentage of fish that have passed the Chipps Island monitoring station. Adjusted data are indicated in bold, highlighted text.

Chipps Island Trawl (Spring-Run)						
Date of DOSS Notes	Spring-Run Raw Data	Spring-Run (adjusted high values)	Spring-Run (adjusted release range)	Cumulative raw data	Cumulative Spring-Run (adjusted high values)	Cumulative Spring-Run (adjusted release range)
10/6	0	0	0	0	0	0
10/13	0	0	0	0	0	0
10/20	0	0	0	0	0	0
10/27	0	0	0	0	0	0
11/10	0	0	0	0	0	0
11/17	0	0	0	0	0	0
11/24	0	0	0	0	0	0
12/1	0	0	0	0	0	0
12/8	0	0	0	0	0	0
12/15	0	0	0	0	0	0
12/22	0	0	0	0	0	0
12/29	0	0	0	0	0	0
1/5	0	0	0	0	0	0
1/12	0	0	0	0	0	0
1/19	0	0	0	0	0	0
1/26	0	0	0	0	0	0
2/2	0	0	0	0	0	0
2/9	0	0	0	0	0	0
2/16	0	0	0	0	0	0
2/23	0	0	0	0	0	0
3/1	0	0	0	0	0	0
3/8	0	0	0	0	0	0
3/15	2	2	2	0.3	3.1	2.9
3/22	3	3	**5.5**	0.7	7.9	10.8
3/29	**19**	**4.5**	**5.5**	3.5	15.0	18.7
4/5	**148**	**4.5**	**5.5**	25.3	22.0	26.6
4/12	**174**	**4.5**	**5.5**	50.8	29.1	34.5
4/19	**226**	**4.5**	**5.5**	84.0	36.2	42.4
4/26	**73**	**4.5**	**5.5**	94.7	43.3	50.4
5/3	7	7	**5.5**	95.7	54.3	58.3
5/10	6	6	6	96.6	63.8	66.9
5/17	14	14	14	98.7	85.8	87.1
5/24	1	1	1	98.8	87.4	88.5
5/31	8	8	8	100	100	100
6/7	0	0	0	100	100	100

Winter-run raw catch data at Knights Landing and associated calculation of the percent of spring-run "Yet to Enter the Delta". Raw data was converted into percent of total, cumulative percent, and 100% minus cumulative percent to show proportion of total which had passed by the Knights Landing monitoring station. Data was not adjusted for hatchery influence since no high data numbers were observed.

Knight's Landing (Winter-Run)				
Date of DOSS Notes	Winter-Run Raw Data	Winter-Run Percent	Cumulative Percent	100% minus Cumulative raw data
10/6	0	0	0	100
10/13	0	0	0	100
10/20	1	1.9	1.9	98.1
10/27	0	0	1.9	98.1
11/10	0	0	1.9	98.1
11/17	0	0	1.9	98.1
11/24	0	0	1.9	98.1
12/1	0	0	1.9	98.1
12/8	0	0	1.9	98.1
12/15	4	7.7	9.6	90.4
12/22	6	11.5	21.2	78.8
12/29	14	26.9	48.1	51.9
1/5	0	0	48.1	51.9
1/12	9	17.3	65.4	34.6
1/19	12	23.1	88.5	11.5
1/26	3	5.8	94.2	5.8
2/2	1	1.9	96.2	3.8
2/9	0	0	96.2	3.8
2/16	0	0	96.2	3.8
2/23	0	0	96.2	3.8
3/1	1	1.9	98.1	1.9
3/8	1	1.9	100	0
3/15	0	0	100	0
3/22	0	0	100	0
3/29	0	0	100	0
4/5	0	0	100	0
4/12	0	0	100	0
4/19	0	0	100	0
4/26	0	0	100	0
5/3	0	0	100	0
5/10	0	0	100	0
5/17	0	0	100	0
5/24	0	0	100	0
5/31	0	0	100	0
6/7	0	0	100	0

Winter-run raw catch data from beach seine and Sacramento trawl monitoring locations (In-Delta). Raw data was converted into percent of total, cumulative percent, and cumulative percent minus Chipps Island raw data. Data was not adjusted for hatchery influence since no high data numbers were observed.

Combined Beach Seine and Sac Trawl Data (Winter-Run)				
Date of DOSS Notes	Combined Winter-Run Beach Seine and Sac Trawl Raw Data	Winter-Run In-Delta Percent	Winter-Run Cumulative Percent	Winter-Run In-Delta minus Chipps Island
10/6	0	0.0	0.0	0.0
10/13	0	0.0	0.0	0.0
10/20	0	0.0	0.0	0.0
10/27	0	0.0	0.0	0.0
11/10	3	5.5	5.5	5.5
11/17	0	0.0	5.5	5.5
11/24	0	0.0	5.5	5.5
12/1	0	0.0	5.5	5.5
12/8	0	0.0	5.5	5.5
12/15	3	5.5	10.9	10.9
12/22	7	12.7	23.6	23.6
12/29	5	9.1	32.7	32.7
1/5	2	3.6	36.4	36.4
1/12	2	3.6	40.0	40.0
1/19	4	7.3	47.3	47.3
1/26	15	27.3	74.5	72.7
2/2	0	0.0	74.5	68.9
2/9	0	0.0	74.5	68.9
2/16	2	3.6	78.2	72.5
2/23	2	3.6	81.8	74.3
3/1	1	1.8	83.6	76.1
3/8	0	0.0	83.6	76.1
3/15	3	5.5	89.1	79.7
3/22	3	5.5	94.5	85.1
3/29	2	3.6	98.2	85.0
4/5	0	0.0	98.2	56.7
4/12	0	0.0	98.2	2.0
4/19	1	1.8	100.0	1.9
4/26	0	0.0	100.0	0.0
5/3	0	0.0	100.0	0.0
5/10	0	0.0	100.0	0.0
5/17	0	0.0	100.0	0.0
5/24	0	0.0	100.0	0.0
5/31	0	0.0	100.0	0.0
6/7	0	0.0	100.0	0.0

Winter-run raw catch data and adjusted data at Knights Landing (Yet to Enter the Delta). The cumulative percent of total catch represents the percentage of fish that have passed the Chipps Island monitoring station. Data was adjusted due to large numbers likely caused by hatchery fish releases, either by only adjusting the large numbers, or the entire hatchery release range. Adjusted data are indicated in bold, highlighted text.

Chipps Island Trawl (Winter-Run)						
Date of DOSS Notes	Winter-Run Raw Data	Winter-Run Adjusted High Values	Winter-Run Adjusted Release Range	Cumulative Winter-Run Chipps Island Raw Data	Cumulative Winter-Run (adjusted high values)	Cumulative Winter-Run (adjusted release range)
10/6	0	0	0	0.0	0	0
10/13	0	0	0	0.0	0	0
10/20	0	0	0	0.0	0	0
10/27	0	0	0	0.0	0	0
11/10	0	0	0	0.0	0	0
11/17	0	0	0	0.0	0	0
11/24	0	0	0	0.0	0	0
12/1	0	0	0	0.0	0	0
12/8	0	0	0	0.0	0	0
12/15	0	0	0	0.0	0	0
12/22	0	0	0	0.0	0	0
12/29	0	0	0	0.0	0	0
1/5	0	0	0	0.0	0	0
1/12	0	0	0	0.0	0	0
1/19	0	0	0	0.0	0	0
1/26	1	1	1	1.9	9.1	14.8
2/2	2	2	2	5.7	27.3	44.4
2/9	0	0	0	5.7	27.3	44.4
2/16	0	0	0	5.7	27.3	44.4
2/23	1	1	1	7.5	36.4	59.3
3/1	0	0	0	7.5	36.4	59.3
3/8	0	0	0	7.5	36.4	59.3
3/15	1	1	1	9.4	45.5	74.1
3/22	0	0	**0.25**	9.4	45.5	77.8
3/29	2	2	**0.25**	13.2	63.6	81.5
4/5	**15**	**1**	**0.25**	41.5	72.7	85.2
4/12	**29**	**1**	**0.25**	96.2	81.8	88.9
4/19	1	1	**0.25**	98.1	90.9	92.6
4/26	1	1	**0.25**	100.0	100	96.3
5/3	0	0	**0.25**	100.0	100	100
5/10	0	0	0	100.0	100	100
5/17	0	0	0	100.0	100	100
5/24	0	0	0	100.0	100	100
5/31	0	0	0	100.0	100	100
6/7	0	0	0	100.0	100	100

Appendix I— Hatchery Winter-run CWT Catch Data

Table I-1: Raw catch, percent daily passage, and cumulative daily passage of hatchery winter run Chinook from Livingston Stone National Fish Hatchery (LSNFH) for the Sacramento trawl and beach seine sampling, based on coded wire tagged fish. Catch is summarized for the week prior to each weekly DOSS call. Raw catch data are from the "Coded Wire Tag Catches 2012-2016.xlsx" file downloaded from https://www.fws.gov/lodi/juvenile_fish_monitoring_program/jfmp_index.htm

	Sacramento Trawl			Beach Seines		
Date of DOSS notes	**LSNFH WR**	**% LSNFH WR**	**Cumulative % LSNFH WR**	**LSNFH WR**	**% LSNFH WR**	**Cumulative % LSNFH WR**
2/16	0	0.0	0.0	0	0.0	0.0
2/23	0	0.0	0.0	0	0.0	0.0
3/1	0	0.0	0.0	1	33.3	33.3
3/8	6	35.3	35.3	0	0.0	33.3
3/15	7	41.2	76.5	2	66.7	100.0
3/22	3	17.6	94.1	0	0.0	100.0
3/29	0	0.0	94.1	0	0.0	100.0
4/5	1	5.9	100.0	0	0.0	100.0
4/12	0	0.0	100.0	0	0.0	100.0
4/19	0	0.0	100.0	0	0.0	100.0
4/26	0	0.0	100.0	0	0.0	100.0
5/3	0	0.0	100.0	0	0.0	100.0
5/10	0	0.0	100.0	0	0.0	100.0
5/17	0	0.0	100.0	0	0.0	100.0
5/24	0	0.0	100.0	0	0.0	100.0
5/31	0	0.0	100.0	0	0.0	100.0
6/7	0	0.0	100.0	0	0.0	100.0
Total raw catch	17			3		

Table I-2: The columns with green header cells show the raw catch, percent daily passage, and cumulative daily passage of hatchery winter run (WR) Chinook from Livingston Stone National Fish Hatchery (LSNFH) for the Chipps Island trawl sampling, as well as for the combined Sacramento Trawl and beach seines. Catch is summarized for the week prior to each weekly DOSS call. Raw catch data are from the "Coded Wire Tag Catches 2012-2016.xlsx" file downloaded from https://www.fws.gov/lodi/juvenile_fish_monitoring_program/jfmp_index.htm. The three columns on the right (with header cells colored to match the region-specific color coding in Figure 5-3 of the report) show the calculated data-based distribution estimates used to compare to the weekly DOSS estimates. The negative "In the Delta" distribution estimates, and the data used for calculation of those estimates, are highlighted in yellow. The cells showing weekly raw catch of LSNFH winter-run at Chipps Trawl for 3/22/16 and 3/29/16 are highlighted in pink.

	Chipps Trawl			Combined Sacramento Trawl & Beach Seines			Yet to Enter the Delta	In the Delta	Exited the Delta
Date of DOSS notes	**LSNFH WR**	**% LSNFH WR**	**Cumulative % LSNFH WR**	**LSNFH WR**	**% LSNFH WR**	**Cumulative % LSNFH WR**	**100% minus cumulative % Sacramento trawl**	**Combined cumulative Sacramento trawl and beach seines minus cumulative % Chipps Island Trawl**	**Cumulative % Chipps Island trawl**
2/16	0	0.0	0.0	0	0.00	0.00	100.0	0.00	0.0
2/23	0	0.0	0.0	0	0.00	0.00	100.0	0.00	0.0
3/1	22	24.7	24.7	1	5.00	5.00	100.0	-19.72	24.7
3/8	33	37.1	61.8	6	30.00	35.00	64.7	-26.80	61.8
3/15	27	30.3	92.1	9	45.00	80.00	23.5	-12.13	92.1
3/22	2	2.2	94.4	3	15.00	95.00	5.9	0.62	94.4
3/29	2	2.2	96.6	0	0.00	95.00	5.9	-1.63	96.6
4/5	3	3.4	100.0	1	5.00	100.00	0.0	0.00	100.0
4/12	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
4/19	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
4/26	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
5/3	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
5/10	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
5/17	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
5/24	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
5/31	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
6/7	0	0.0	100.0	0	0.00	100.00	0.0	0.00	100.0
Total raw catch	89			20					

Normally, the Chipps Island trawl sampling consists of approximately ten tows, three times per week, for a total of approximately 30 tows per week. Because the Chipps Island trawl sampling was shut down for a week in mid-March (no sampling 3/17-24/16), the 3/22/16 weekly total catch was based on just one day of sampling, and the 3/29/16 weekly total catch was based on just two days of sampling. If coded wire tagged fish would have been caught absent this gap in sampling, the total catch during those weeks would have been higher and the exit-timing distribution at Chipps Island would be shifted a bit later in time, potentially leading to (depending on how many fish would have been caught) less negative "In the Delta" estimates. That said, the acoustic-tag data (for which there was no gap in sampling) show that 91% of the acoustic-tagged hatchery winter-run had passed Chipps Island by 3/15/16, so it's possible that the gap in the Chipps Island trawl sampling did not appreciably bias the pattern of percent passage of winter-run based on the CWT data.