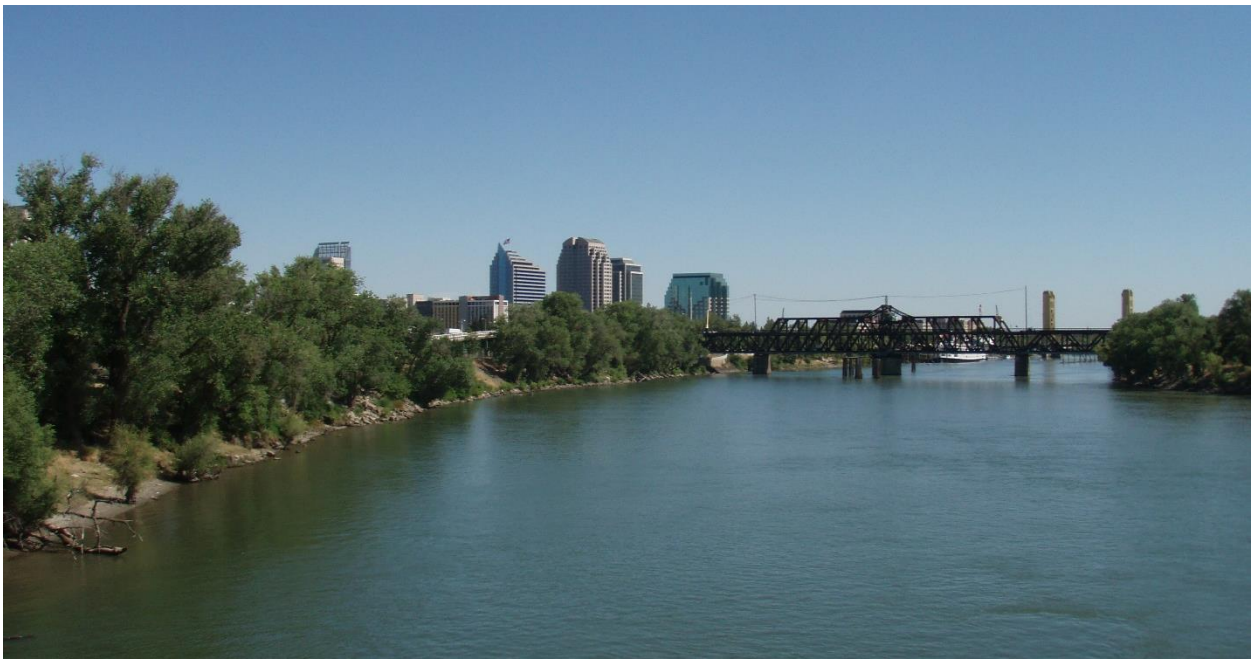
Annual Report of Activities
October 1, 2014, to
September 30, 2015



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

October 2015

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Acronyms and Abbreviations

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
DSM2	Delta Simulation Model
DSP	Delta Science Program
DWR	California Department of Water Resources
EFH	essential fish habitat
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
Reclamation	U.S. Bureau of Reclamation
RKM	River kilometer
RPA	Reasonable and Prudent Alternative
RST	rotary screw trap
RTDOT	Real Time Drought Operations Team
SAR	smolt to adult return rate
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

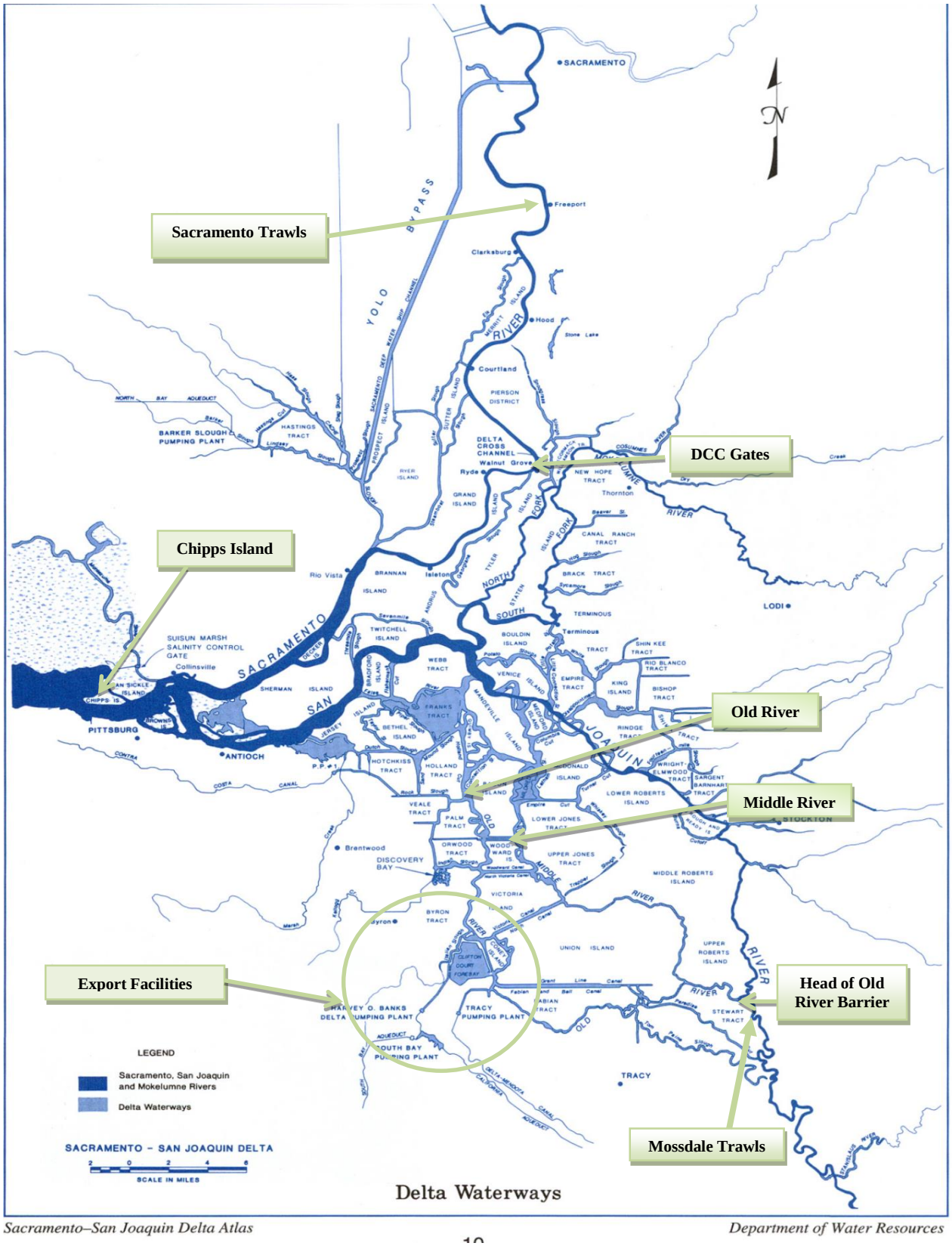

Figure 1.1. DOSS Area of Interest.

Chapter 1 – Background

1.1 Background

On June 4, 2009, the National Oceanic and Atmospheric Association'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 comprises 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), Delta Stewardship Council (DSC), 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/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

DOSS consisted of the following representatives in 2014–2015. Names listed were on the DOSS e-mail distribution list; not all individuals participated actively in the weekly DOSS calls.

U. S. Bureau of Reclamation (Reclamation)
Paul Fujitani
John Hannon
Jason Hassrick
Josh Israel*
Elizabeth Kiteck
Peggy Manza*
Tom Morstein-Marx
Michele Palmer
David van Rijn

U. S. Fish and Wildlife Service (FWS)
Craig Anderson*
Leigh Bartoo*
Pat Brandes
Roger Guinee*

National Marine Fisheries Service (NMFS)
Barb Byrne*
Bruce Oppenheim
Meiling Roddam
Jeff Stuart
Brycen Swart
Garwin Yip

California Department of Fish and Wildlife (DFW)
Russ Bellmer
Chad Dibble
Bob Fujimura*
Ken Kundargi
Duane Linander*
Chris McKibbin
Colin Purdy

Department of Water Resources (DWR)
Andy Chu
Mike Ford
James Gleim
Farida Islam*
Elaine Jeu
Aaron Miller*

Rhiannon Mulligan
Tracy Pettit
Kevin Reece
Harry Spanglet
Dan Yamanaka
Edmund Yu

State Water Resources Control Board (SWRCB)
Chris Carr
Matt Holland*
Scott Ligare
Larry Lindsay
Daniel Worth

U. S. Environmental Protection Agency (EPA)
Valentina Cabrera-Stagno
Erin Foresman*

U.S. Geological Survey (USGS) (Non-participant in 2015)
Jon Burau*

*Designated representative(s) of the agency

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, 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):

Control the net negative flows toward the export pumps in Old and Middle Rivers to reduce the likelihood that fish will be diverted from the San Joaquin River or Sacramento River into the southern or central Delta.

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 Central Valley 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/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)

Conduct annual reviews of the experiment results. 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, steelhead. Based on the findings of the status review, 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 Central Valley 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 –Annual Review Panel Feedback on Actions Relevant to DOSS

2.1 2014 Annual Review Feedback: DCC Trigger Matrix

The report from the independent review panel for the 2014 Long-term Operations Biological Opinions Annual Science Review (Anderson et al. 2014) provided feedback regarding the modified DCC gate opening criteria per Attachment G in the Drought Operations Plan. While noting that there was "a reasonable argument for developing this operating criterion based on [the] current understanding of the science", the panel noted some limitations/uncertainties associated with the catch indices and also offered a suite of suggestions, including:

1) The addition of fish sampling stations downstream of the DCC gates would improve estimates of the efficacy of DCC gate operations for fish protection.
   a) Fish should be sampled south of the entrance to the DCC and within the channel to ensure that episodic events are not missed by the DCC gate closure triggers. In any case, the catch data will be difficult to interpret because of the complex movements of salmon over tidal and diel cycles.
   b) The IRP suggests that a first step in tracking the movements of fish in the vicinity of the DCC would be to expand the acoustic tag sampling with the goal of tracking fish movements between DCC and Georgiana Slough over the relevant temporal cycles.

2) The time delay of approximately two days currently required to close the Delta Cross Channel should be shortened, if possible. Sampling locations that are closer than two-days travel time to the DCC gates would improve the ability to predict fish arrival times at the DCC gates, but would require a more rapid response time for gate closure, which may be impractical.

3) Considerations for studying operations for fish passage effectiveness
   a) Based on the Burau (2014) presentation [during the April 2014 Delta Science Program workshop entitled "Interior Delta Flows and Related Stressors"], the IRP suggests testing the hypotheses that an effective DCC operation is to open the gates on the ebb tides during the day. Further studies of the behavior of acoustically tagged fish in the DCC over diel and tidal cycles may be required to evaluate this hypothesis.

4) Considerations for studying operations for water quality effectiveness
   a) Balancing the needs of water quality and fish protection are important enough to justify further analysis of the water quality benefit that will result from the modified DCC gate operation. A hydrodynamic modeling analysis and associated salinity transport modeling should be done to analyze whether improvements in water quality in the central Delta justifies this operation.

The suggestions relating to gate closure protocols or research investigations in items 2-4, above, are outside of DOSS's scope, which is to guide implementation of the RPA actions in the NMFS BiOp. Reclamation operates the DCC gates under various constraints, including fish protection, water quality needs, and boater safety; DOSS does not have jurisdiction to impose the more rapid response time for gate closure suggested in Item 2. DOSS would certainly be interested in the results of the suggested studies to assess fish passage effectiveness (Item 3) and water quality effectiveness (Item 4) of various DCC operations, but DOSS does not itself conduct research. However, in WY2015 DOSS *was* able to take the first step in implementing some of the sampling suggestions listed under item 1 described above. To implement this recommendation, DOSS suggested receiver placement for tracking of acoustic-tagged hatchery winter-run Chinook salmon. The NMFS Southwest Fisheries Science Center (SWFSC; Arnold Ammann, principal investigator), in coordination with Livingston Stone National Fish Hatchery (LSNFH), conducted a winter-run Chinook salmon migration and survival study in the spring of 2015. Juvenile Salmon Acoustic Telemetry System (JSATS) acoustic tags were used to tag 572 LSNFH winter-run Chinook salmon juveniles, which were released along with the hatchery release (251 on 2/4/15; 321 on 2/6/15) at Caldwell Park in Redding (river kilometer (rkm) 569), and tracked using an array of autonomous (*i.e.*, data not available in real-time; downloaded in late March and late June) receivers (Figure 2.1).

As described in the CVP and SWP Drought Contingency Plan[1] submitted to the State Water Resources Control Board on 1/15/15, real-time acoustic receivers were deployed to help the DOSS technical team determine the likely timing and distribution of the hatchery winter-run in the Sacramento River and Delta. At the 1/20/15 Delta Operations for Salmonids and Sturgeon (DOSS) meeting[2], DOSS discussed potential receiver placements for (a) real-time tracking of hatchery winter-run Chinook salmon, and (b) post-season analysis of potential WY 2015 drought actions . These recommendations were shared with the SWFSC, the UC-Davis Biotelemetry Lab, and LSNFH.

Suggested receiver locations for in-season tracking (Figure 2.2):

- A "Delta entry" location comparable to the Knights Landing rotary screw traps (RSTs)[Real-time receiver at the I-80/Hwy50 bridge in Sacramento (rkm 190) activated prior to the 2/4/15 and 2/6/15 releases of acoustic-tagged winter-run Chinook]
- A "just upstream of DCC" location, perhaps between Clarksburg and the DCC, to track whether fish entering the Delta reach the vicinity of the DCC [Real-time receiver at Hood (rkm 156.5) activated 2/27/15]

[1] See p. 20 of the document, available at:
http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/2015_drought_contingency_plan.pdf

[2] http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocapwy2015.html

- An “interior Delta” location, in Old River or Middle Rivers (north of the export facilities), or at the downstream end of Georgiana Slough, to track movement of fish into the interior and southern Delta. [Real-time receiver at Middle River activated 2/16/15]

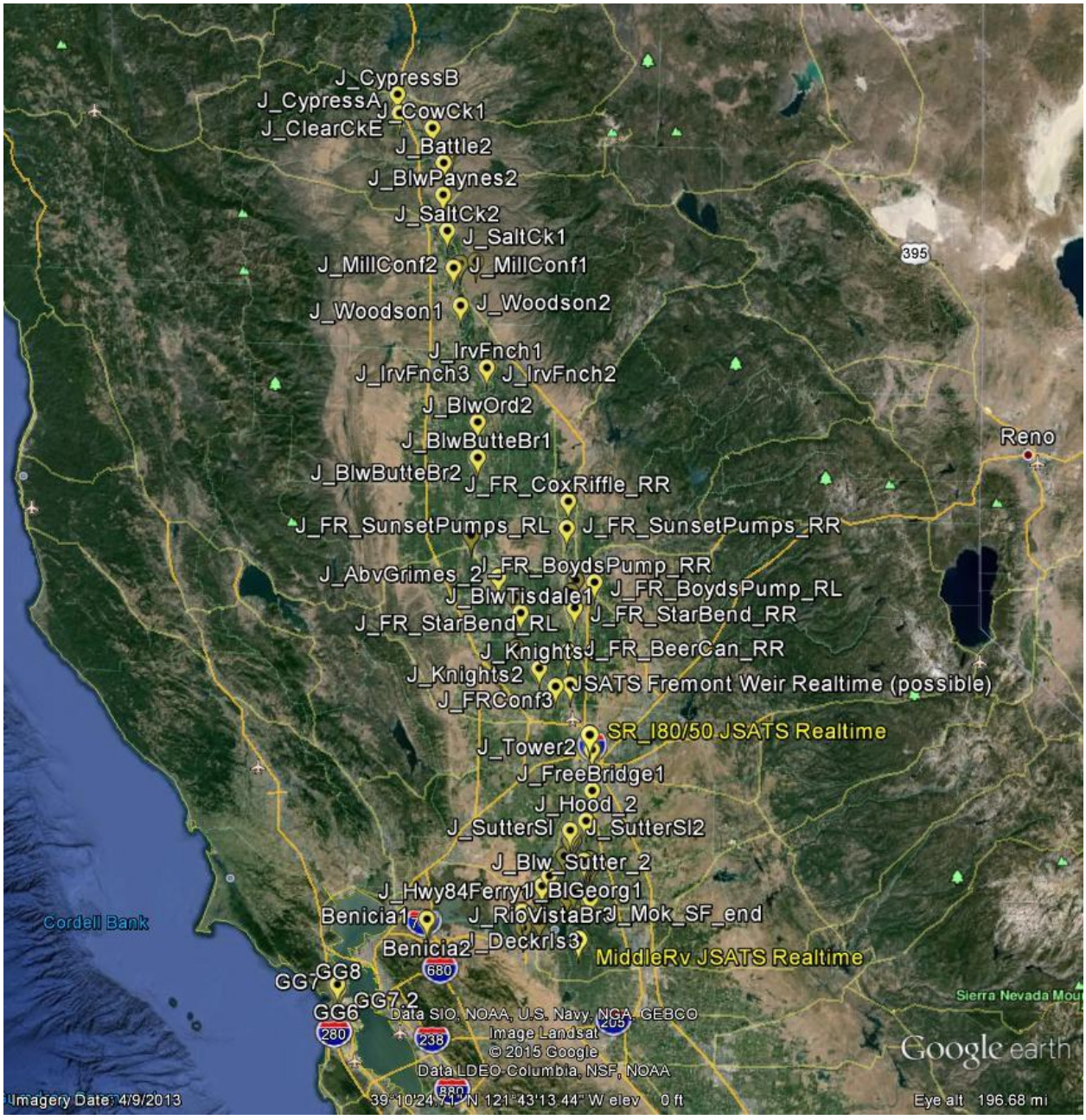

Figure 2.1. Yellow markers show planned locations of autonomous JSATS receivers for 2015 study. (Arnold Ammann, personal communication)

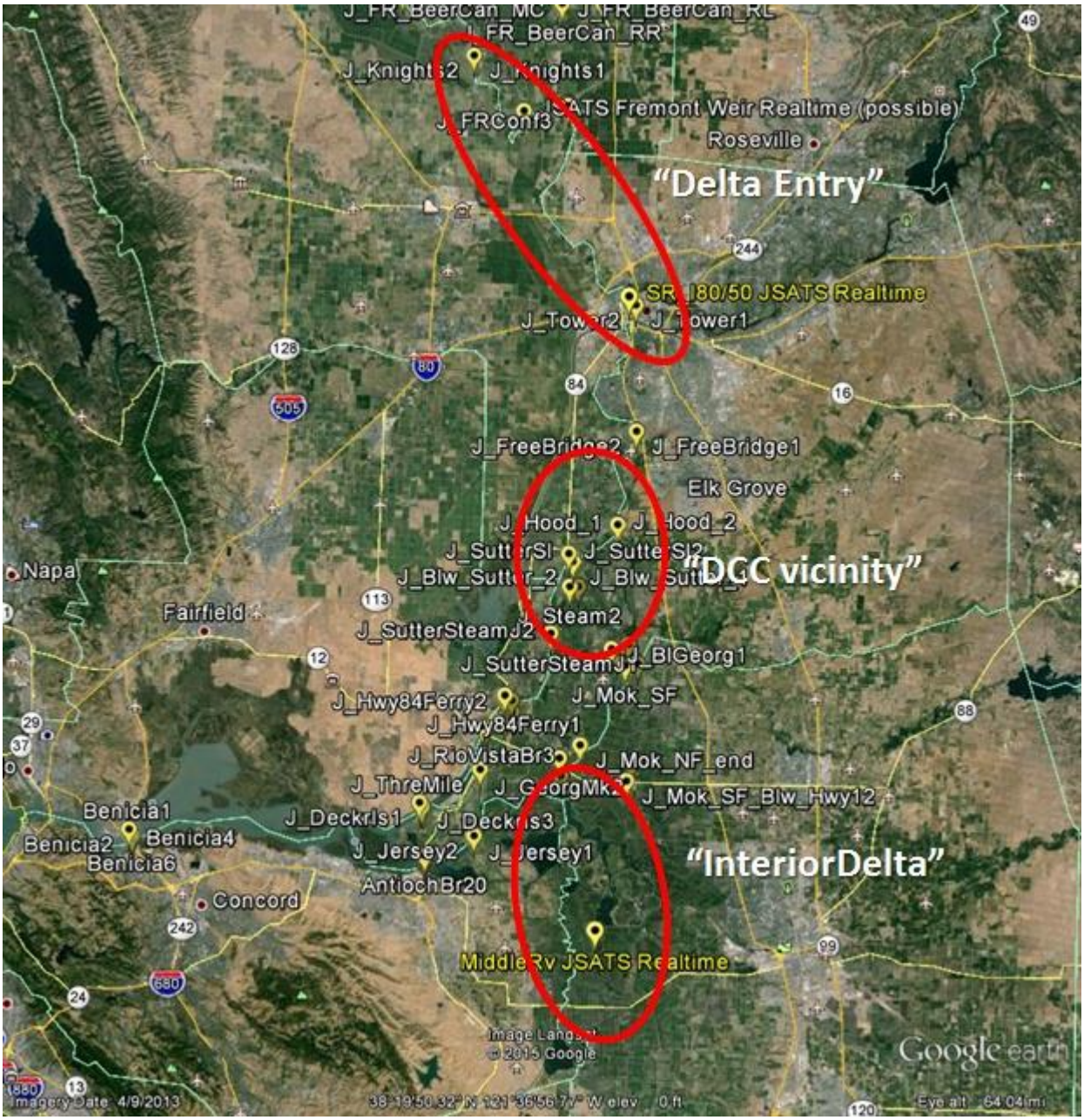

Figure 2.2. Red ovals indicate the suggested general areas for placement of the three available real-time JSATS receivers for tracking of LSNFH winter-run Chinook salmon juveniles during WY 2015. Yellow markers show planned locations of autonomous JSATS receivers for 2015 study.

DOSS also expressed the desire for a "Delta exit" real-time location, but because the western Delta channels are so large, they are quite challenging to set up for real-time monitoring (because multiple receivers are needed to cover the channel, one also needs multiple sets of telemetering equipment). While no real-time information was available for a “Delta exit” location, the SWFSC did, in May 2015, provide DOSS with some preliminary tag detection information from the autonomous receivers

at Benicia.

Suggested receiver locations for post-season data analysis:

- Inside the DCC, to assess passage through DCC if opened as a drought action. It might be possible to download this location "by hand" after any DCC opening to assess effects. [Autonomous receiver in DCC activated 3/19/15; while activation occurred over a month after the release of acoustic-tagged winter-run Chinook, there were no DCC openings between 12/1/14 and 5/13/15].

- Toe drain of the Yolo Bypass, to assess whether, like last year, juvenile salmon hold in the Cache Slough area.[Several autonomous receivers placed in the Yolo Bypass in early March for other studies; after most winter-run Chinook had passed]

Preliminary WY 2015 acoustic tracking results:

Acoustic-tagged LSNFH winter-run Chinook were released in the Sacramento River at Caldwell Park in Redding (rkm 569) on 2/4/15 (251 fish) and 2/6/15 (261 fish). The total hatchery production of ~600,000 winter-run Chinook was released at the same location over three days from 2/4/15 to 2/6/15. The NMFS-SWFSC's Arnold Ammann provided daily updates of tag detections at four real-time receiver locations (the three locations requested by DOSS [I-80/Hwy50 bridge in Sacramento (rkm 190), Hood (rkm 156.5), and Middle River] and one additional receiver [Tisdale (rkm 288)]) during most of February and March, by which point tag detections were becoming rare. The 224 tags detected[3] at the I-80/Hwy50 bridge in Sacramento by the final real-time report on 3/24/15 traveled the 379 km from the release location in Redding in an average of 9.4 days (standard deviation: 6.5; range: 2.9-37.1), which translates to an average speed of 55.7 rkm/day (standard deviation: 27.6; range: 10.2-130.2). While a complete summary of the real-time data is not included in this report, a sample of the real-time data provided to DOSS is in Table 2.1.

From late March to late April, Ammann provided frequent updates of tag detections of acoustic-tagged spring-run Chinook salmon from the Feather River Hatchery (FRH) released in the Feather River on 3/18/2015 at Boyds (rkm 258) and at Gridley (rkm 303). At both locations, 75 acoustic-tagged fish were released with a production release of ~500,000 fish. DOSS considered these data each week when estimating fish distributions.

[3] Includes single tag detections, some of which may be false positives. The estimates of travel time and speed are thus preliminary.

Table 2.1. Sample of real-time acoustic-tag detection data provided to DOSS during WY 2015.

JSATS tagged winter-run Chinook salmon from Livingston Stone National Fish Hatchery

Preliminary Data from realtime JSATS receiver at I80/50 Bridge in Sacramento

last queried 3/15/15 20:10

prepared by Arnold Ammann at NOAA Fisheries

	Release 1	Release 2	All releases	Notes
number released:	251	321	572	
Number of fish with only 1 detection:	28	37	65	* Chance that some of these are false positives, need to look at
Number of fish with 2 or more detections:	55	104	159	data from more receivers to confirm
Total detects of valid IDs:	83	141	224	
Percent detected all detections:	33.1	43.9	39.2	This is the liberal estimate
Percent detected with 2 or more detections:	**21.9**	**32.4**	**27.8**	This the most conservative estimate, final estimate likely to be higher.
Number of fish 2/9/2015	16 (17)	3 (4)	19	2 + detects (includes single detects)
Number of fish 2/10/2015	7 (13)	22 (30)	29	2 + detects (includes single detects)
Number of fish 2/11/2015	4 (6)	10 (15)	14	2 + detects (includes single detects)
Number of fish 2/12/2015	4 (6)	4 (8)	8	2 + detects (includes single detects)
Number of fish 2/13/2015	3 (7)	7 (14)	10	2 + detects (includes single detects)
Number of fish 2/14/2015	8 (12)	7 (15)	15	2 + detects (includes single detects)
Number of fish 2/15/2015	1 (5)	5 (7)	6	2 + detects (includes single detects)
Number of fish 2/16/2015	5 (7)	6 (6)	11	2 + detects (includes single detects)
Number of fish 2/17/2015	2 (2)	4 (4)	6	2 + detects (includes single detects)
Number of fish 2/18/2015	0 (1)	5 (5)	5	2 + detects (includes single detects)
Number of fish 2/19/2015	1 (1)	1 (1)	2	2 + detects (includes single detects)
Number of fish 2/20/2015	0 (0)	6 (7)	6	2 + detects (includes single detects)
Number of fish 2/21/2015	0 (0)	3 (3)	3	2 + detects (includes single detects)
Number of fish 2/22/2015	0 (0)	8 (8)	8	2 + detects (includes single detects)
Number of fish 2/23/2015	0 (0)	1 (1)	1	2 + detects (includes single detects)
Number of fish 2/24/2015	0 (0)	1 (1)	1	2 + detects (includes single detects)
Number of fish 2/25/2015	0 (0)	2 (2)	2	2 + detects (includes single detects)
Number of fish 2/26/2015	0 (0)	1 (1)	1	2 + detects (includes single detects)
Number of fish 2/27/2015	1 (1)	2 (2)	3	2 + detects (includes single detects)
Number of fish 2/28/2015	1 (1)	0 (0)	1	could be stationary, expelled, or shed tag
Number of fish 3/01/2015	1 (1)	0 (0)	1	2 + detects (includes single detects)
Number of fish 3/02/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/03/2015	0 (0)	1 (1)	1	2 + detects (includes single detects)
Number of fish 3/04/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/05/2015	0 (1)	2 (2)	2	2 + detects (includes single detects)
Number of fish 3/06/2015	1 (1)	0 (0)	1	2 + detects (includes single detects)
Number of fish 3/07/2015	0 (1)	1 (1)	1	2 + detects (includes single detects)
Number of fish 3/08/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/09/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/10/2015	0 (0)	2 (2)	2	2 + detects (includes single detects)
Number of fish 3/11/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/12/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/13/2015	0 (0)	1 (1)	1	2 + detects (includes single detects)
Number of fish 3/14/2015	0 (0)	0 (0)	0	2 + detects (includes single detects)
Number of fish 3/15/2015	0 (0)	1 (1)	1	partial 6 hrs, 2 + detects (includes single detects)

Location	RKM	HexID	# detects	Min DateTIme	Max DateTime	Release Group	Release Date	Release RKM	Number in Release Group	Days since release	Speed rkm/day
I80/Bridge Sacramento	190	2B2B	4	2/9/2015 3:32	2/9/2015 3:33	WR_1	2/4/2015 17:30	569	251	4.4	85.8
I80/Bridge Sacramento	190	0670	4	2/9/2015 4:36	2/9/2015 4:37	WR_1	2/4/2015 17:30	569	251	4.5	84.9
I80/Bridge Sacramento	190	0567	1	2/9/2015 4:44	2/9/2015 4:44	WR_1	2/4/2015 17:30	569	251	4.5	84.8
I80/Bridge Sacramento	190	2ACB	2	2/9/2015 5:46	2/9/2015 5:47	WR_1	2/4/2015 17:30	569	251	4.5	84.0
I80/Bridge Sacramento	190	2A29	8	2/9/2015 7:41	2/9/2015 7:43	WR_1	2/4/2015 17:30	569	251	4.6	82.6
I80/Bridge Sacramento	190	2A9B	5	2/9/2015 7:52	2/9/2015 7:53	WR_1	2/4/2015 17:30	569	251	4.6	82.4
I80/Bridge Sacramento	190	2EAB	6	2/9/2015 8:21	2/9/2015 8:22	WR_1	2/4/2015 17:30	569	251	4.6	82.1
I80/Bridge Sacramento	190	2D6B	5	2/9/2015 9:21	2/9/2015 9:22	WR_1	2/4/2015 17:30	569	251	4.7	81.3
I80/Bridge Sacramento	190	0675	4	2/9/2015 9:27	2/9/2015 9:27	WR_1	2/4/2015 17:30	569	251	4.7	81.3
I80/Bridge Sacramento	190	35A9	4	2/9/2015 9:50	2/9/2015 9:52	WR_1	2/4/2015 17:30	569	251	4.7	81.0
I80/Bridge Sacramento	190	2A35	2	2/9/2015 12:31	2/9/2015 12:32	WR_1	2/4/2015 17:30	569	251	4.8	79.1
I80/Bridge Sacramento	190	2AB1	4	2/9/2015 13:39	2/9/2015 13:39	WR_1	2/4/2015 17:30	569	251	4.8	78.3
I80/Bridge Sacramento	190	2A75	6	2/9/2015 13:47	2/9/2015 13:48	WR_1	2/4/2015 17:30	569	251	4.8	78.2
I80/Bridge Sacramento	190	2B49	6	2/9/2015 16:58	2/9/2015 17:00	WR_1	2/4/2015 17:30	569	251	5.0	76.1
I80/Bridge Sacramento	190	0573	4	2/9/2015 17:25	2/9/2015 17:26	WR_1	2/4/2015 17:30	569	251	5.0	75.9
I80/Bridge Sacramento	190	0561	2	2/9/2015 17:27	2/9/2015 17:27	WR_1	2/4/2015 17:30	569	251	5.0	75.8

Chapter 3 — Summary of DOSS Discussions and Advice/Recommendations

3.1 Weekly Discussion Topics

- CVP/SWP operations
- Delta fish monitoring, salvage, loss, and loss densities
- DCC operations
- OMR flow management
- Coordination with other technical teams (e.g., Delta Smelt Working Group)
- Drought operations

3.2 Other Discussion Topics

- Temporary Urgency Change Petitions (TUCPs) submitted to SWRCB response, and project descriptions submitted to NMFS.
- Sampling Effort at Fish Collection Facilities
- Debris management at the fish collection facilities
- Spring run surrogate releases
- Interim winter-run JPE-based fish density triggers
- Protocol for handling >300 mm Chinook at the salvage facilities
- JSATS receivers available for use to track winter-run Chinook salmon movement
- Pilot ePTM scenario development
- CWT recoveries in DJFMP & RST monitoring
- Monitoring Data Discussion

3.3 Summary of WY 2015 RPA Action Implementation

3.3.1 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 Delta Cross Channel 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[4], 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[5]. During October and November of WY 2015, before the DCC was closed in December, the first alert was triggered multiple times:

[4] 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.

[5] Based on the flow data reported for CDEC stations DCV (for Deer Creek) and MLM (for Mill Creek)

- Mill Creek flows >95 cfs: 10/24-28/14
- Mill Creek flows >95 cfs: 10/31-11/5/14
- Deer Creek flows >95 cfs: 11/1/14
- Mill Creek flows >95 cfs: 11/13-16/14
- Mill Creek flows >95 cfs: 11/19-30/14
- Deer Creek flows >95 cfs: 11/20-24/14
- Deer Creek flows >95 cfs: 11/29-30/14

3.3.2 DCC Gate Operations (Action IV.1.2)

RPA Action IV.1.2 modifies the DCC gate operations to reduce the direct and indirect mortality of emigrating juvenile salmonids and green sturgeon. For most of the October 1-June 15 period of DCC gate operations management for listed salmonids and sturgeon (except mid-November until late January, when no drought contingency plan was in effect and the DCC matrix in the NMFS BiOp was implemented), DCC operations were governed by the criteria table in Attachment G of the April 2014 Drought Operations Plan[6]. According to those criteria, when the Knights Landing Catch Index (KLCI) or Sacramento Catch Index (SCI) exceeds a fish trigger, and water quality exceeds the concern level at any of four stations listed in footnote E, the required action response is that "DOSS review[s] monitoring data and makes recommendation to NMFS and WOMT per procedures in Action IV.5". Daily DCC status (open vs. closed) is provided in Appendix A; key DCC operations are summarized below.

Because the KLCI exceeded 5 fish/ trap-day on 10/31/14[7], and water quality exceeded the concern levels at all four stations, DOSS held an emergency meeting at 3pm on 10/31/14 in order to discuss the fish monitoring and water quality data. In addition to the high catch at Knights Landing, over 300 winter-run-sized Chinook were observed on 10/28/14 at the Glenn-Colusa Irrigation District (GCID) rotary screw traps, associated not with a big change in flow, but with a large change in turbidity. There was general agreement that forecasted precipitation might cue additional winter-run to migrate downstream, so the DOSS discussion on DCC operations considered both the observed pulse of fish at Knights Landing, and a potential second pulse of fish responding to the upcoming storm. DOSS members summarized that discussion at the 3:30pm WOMT meeting, and provided some recommendations regarding DCC gate operations.

DOSS recommended that while there was a range of opinion on the urgency of closing the DCC gates in consideration of the balance between fish protection, water quality, and boater safety considerations, there *was* general consensus that closing the DCC gates for at least three days, with

[6] Attachment G begins on p. 132 of the Drought Operations Plan, available at: http://ca.gov/drought/pdf/2014-Operations-Plan.pdf

[7] CDFW reported the morning of 10/31/14 that 40 winter-run-sized Chinook were caught at the Knights Landing rotary screw traps. At the time of the 3pm emergency DOSS call, the trap hours were not available and so the exact KLCI could not be calculated. Because estimates based on recent trap hours put the KLCI estimate at >20 fish/day (well over the 3 and 5 fish/day thresholds in the DCC Trigger Table) DOSS members were comfortable presuming the catch trigger had been exceeded.

closure occurring no later than Sunday evening, 11/2/14, would prevent DCC entrainment risk for most of the winter-run Chinook in the pulse observed at Knights Landing and for any additional winter-run that might move downstream in response to the forecasted precipitation the coming weekend. The gates were closed from 11/2/14 through 11/6/14 in response to this pulse of fish.

The gates were closed from 12/1/14 through 5/13/15.

Based on a review of biological monitoring and evaluation of the DCC gate trigger matrix, the Real Time Drought Operations Team (RTDOT) determined that the DCC gates could be opened briefly during mid-May for water quality improvement. A brief opening of the DCC occurred 5/14/15 through 5/17/15.

During the 5/19/15 DOSS meeting, a DCC gate opening for water quality concerns was discussed. DOSS noted that a DCC opening (planned for weekend of 5/22/15) may increase the risk of entrainment into the interior Delta for fish in the vicinity of the DCC. However, occasional DCC gate opening from 5/21 to 6/15 is allowed per both D-1641 and the NMFS BiOp's RPA Action

IV.1.2, and so this opening did not represent any change in risk to migrating salmonids relative to typical operations. As occurs in most years, the DCC gates were opened over the weekends during the 5/21-6/15 period.

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

The year type for the San Joaquin Basin during implementation of the I:E ratio in April and May 2015 was designated as "Critical", which required implementation of a 1:1 ratio of Vernalis inflow to combined CVP/SWP exports (I:E ratio). The NMFS BiOp provides an exception to meeting the required I:E ratio that allows combined exports of up to 1,500 cfs when Vernalis flows are such that implementation of the I:E ratio would limit exports to less than 1,500 cfs. Implementation of this RPA action was modified under the Drought Operations Plan[8] . Specifically, the Drought Operations Plan allowed for modification of I:E implementation before and after the spring pulse flow period[9] on the San Joaquin during the April-May period. Because the pulse flow occurred late March through late April (initiated earlier than usual because of concerns over rising water temperatures), the flexibility applied in late April through May. Because of low San Joaquin inflows following the pulse flow, the exception allowing combined exports of 1,500 cfs was in effect; other constraints in the Drought Operations Plan independent of the I:E ratio RPA action (e.g. water quality and D-1641 or TUCP Order export limits) also limited exports in late April and May.

[8] See p. 8 of the project description (p. 12 of the PDF) in the document available at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/bureau_of_reclamation_s_march_24__2015__request_for_nmfs_concurrence_on_contingency_plan_for_april_through_september_2015.pdf

[9] D-1641 includes a flow requirement at Vernalis and an export limit (100% of Vernalis flow) during the 31-day spring pulse period. In WY 2015, the spring pulse flow period was 3/25/15-4/25/15 (see p. 8 of the 4/6/15 TUCP Order at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/tucp/2015/tucp_order040615.pdf).

3.3.4 6-Year Acoustic Tag Experiment (Action IV.2.2)

Steelhead release dates and environmental conditions for the 2015 field season of the 6-year acoustic tag experiment are summarized in Table 3.1, below. Receiver data will be converted into the individual tag's detection histories for use at University of Washington's Columbia Basin Research Laboratory to estimate route entrainment and survival along the San Joaquin River and south-Delta migration corridors.

Table 3.1: Tagging and release dates and average hydrologic and operation conditions during 2014 steelhead releases for the six-year study.

				14-Day average					
2015 Tagging Dates	**2015 Release Dates**	**Release Group size**	**Head of Old River Barrier**	**Vernalis Temp (F)**	**Vernalis (cfs)**	**Total Exports**	**I:E**	**Old River @ Head (CFS)**	**OMR (cfs)**
March 3-5	March 4-6	480	Construction started March 16	63.5	525	3725	.14: 1	506	-3699
March 24-26	March 25-27	480		61.9	868	1446	.60: 1	477	-1430
April 21-23	April 22-24	480	Closed April 3	70.7	487	1292	.47: 1	147	-1700

3.3.5 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 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 2015, temperatures at Mossdale ("MSD" station data reported on CDEC) exceeded 72°F for the first seven days of June. Effective 6/8/15, the OMR flow restrictions were lifted.

Based on a 2/3/15 older juvenile loss density of 2.56 fish/TAF, the first stage action response of a -3,500 OMR limit went into effect for 5 days beginning on 2/4/15.

On 2/9/15, the Projects requested flexibility in OMR implementation during the remainder of February. On 2/10/15, NMFS provided its determination, granting the flexibility with some conditions. See details of both letters, available under "Biological Opinion Actions" at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/.

From mid-February through early March, OMR targets (for both salmonid and smelt concerns) were based on daily assessment of conditions and a decision by the Directors. A summary of catch, salvage, loss at the CVP and SWP, and combined loss density during WY 2015 is provided in Appendix E (for Chinook salmon) and Appendix F (for California Central Valley steelhead).

3.3.6 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, steelhead, and green sturgeon by reducing CVP/SWP 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 2015, no loss or loss-density triggers were tripped that required action under RPA IV.3. A summary of catch, salvage, loss at the CVP and SWP, and combined loss density during WY 2015 is provided in Appendix E (for Chinook salmon) and Appendix F (for Central Valley steelhead).

3.4 Other Topics

3.4.1 Juvenile Production Estimate for Winter-run Chinook Salmon

NMFS issued the juvenile production estimate for brood-year 2014 winter-run Chinook salmon (JPE) on 1/16/15[10]. The JPE for juvenile winter-run estimated to enter the Delta in 2014/2015 (juveniles from brood year 2014) was 124,521 natural origin fish, and 188,500 juveniles from LSNFH; the incidental take limit at the CVP/SWP pumps was 2,490 natural origin fish (2%), and 1,885 hatchery-produced fish (1%). Action IV.2.3 (OMR management) includes a loss-density trigger based on the JPE. The two levels of the JPE-based OMR trigger for WY 2015 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 January 1 and prior to NMFS' formal determination on the brood-year 2014 JPE.

3.4.2 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 released in the upper

[10] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/2015.01.16_jpe_letter.pdf

Sacramento River based on turbidity and flow events that mimic natural storm events in spring-run Chinook salmon natal streams.

Table 3.2: Summary of DOSS input to CNFH on spring-run surrogate releases.

Release Type	DOSS Input	Date Released	Number of Fish Released
Production Release	Early December, with first significant rainfall event	12/1/14	853,000
First Surrogate Release	Mid-December, ideally at least a week apart from the production release and coincident with a rainfall event	12/4/14	77,000
Second Surrogate Release	2-3 weeks after the 1st release, ideally coincident with a rainfall event (early January, if 1st release occurs mid-December)	12/18/14	78,000
Third Surrogate Release	2-3 weeks after the 2nd release, ideally coincident with a rainfall event (late January, if 2nd release occurs early January)	2/5/15	83,100

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 2015, loss of 0.045%, 0.058%, and 0% was observed for the first, second, and third spring-run Chinook salmon surrogate release groups (see also p. 8 in Appendix B). Therefore, the SWP/CVP did not exceed the take limit for the spring-run Chinook salmon surrogates and no action response based on spring-run surrogate catch was taken in the RPA actions for export reductions or OMR flow management in water year 2015.

3.4.3 Salvage Facility Operations

3.4.3.1 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. Because drought may lower the overall abundance of salmonids in the Delta, salvage and loss of salmonids may be also be more rare during drought

conditions. NMFS asked DOSS to "consider and make a recommendation on whether fish salvage counts at the Tracy Fish Collection Facility and Skinner Fish Facility should be increased to a minimum 60 minutes for every 2 hours of operational time during drought years."

DOSS offered no specific recommendation, but did identify some advantages, disadvantages, and concerns regarding the potential increase in salvage sampling as a means to reduce uncertainty in the estimates of daily loss density. The full NMFS request, and DOSS feedback, is provided in Appendix C.

3.4.3.2 Debris management at the fish collection facilities

Debris (primarily from aquatic weeds) caused operational challenges, particularly at the CVP's Tracy Fish Collection Facility, throughout much of WY 2015. Specific examples of the consequences of the heavy debris loading at the CVP facility include:

- reduction in the fraction of time salvage sampling could occur (*e.g.*, from 30 minutes to 10 minutes for every two hours),
- occasional closures of one or more bypasses along the primary louvers, and
- buildup of debris in front of and within the facility that may have affected facility efficiency

3.4.4 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 4 — Drought Operations

Because of extremely dry conditions, SWP and CVP project operations during WY 2015 were managed under a series of drought contingency plans and associated orders issued by the State Water Resources Control Board (SWRCB) beginning 10/15/14. 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 4.1 provides a brief overview of the Delta actions in the NMFS BiOp that were implemented in modified fashion during 2015.

Table 4.1. Delta RPA actions that were implemented in modified fashion during 2015 per the drought contingency plans. Links to most documents referenced in the "2015 implementation" column are available in the chronological summary on the SWRCB's website: **http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/tucp.shtml.**

RPA Action	Usual Implementation	2015 Implementation
IV.1.2 (DCC operations)	Mandatory gate closure from February 1 to May 20	DCC gate opening was conditionally allowed per the guidelines in the "DCC Trigger Matrix" provided in Attachment G of the April 2014 Drought Operations Plan, which was developed by an interagency technical team. The DCC gates were opened on 5/14/2015 and closed on 5/18/2015 under this drought flexibility. *See (a) 1/27/2015 documents from Reclamation, (b) 1/29/2015 letter from NMFS (which includes Attachment G of the 4/8/14 Drought Operations Plan as an enclosure), and (c) 2/3/2015 SWRCB Revised Order,*

RPA Action	Usual Implementation	2015 Implementation
IV.2.1 (I:E ratio)	In a critical year, the projects shall operate to an I:E ratio (inflow at Vernalis: combined CVP/SWP exports) of not less than 1:1 from April 1 to May 31, or 1,500 cfs combined exports if Vernalis <1,500 cfs.	Before and after the spring pulse flow period at Vernalis (3/25/15-4/25/15), the projects were not required to operate to the I:E ratio of 1:1 if there was natural flow in the Delta. Because of low inflows to the Delta in late April and May, this flexibility was not used. *See (a) 3/24/15 project description from Reclamation and (b) 3/27/15 letter from NMFS*
IV.2.3 (OMR flow management)	The 14-day average of the OMR index shall not be more negative than -5,000 cfs anytime from January 1 to June 15.	The 14-day running average of OMR was allowed to be up to -5,500 cfs for up to a 7 day period toward the end of the month of February 2015 provided OMR is not targeted to be more negative than -5,000 cfs for more than 5 days for the remainder of the month. *For full details and conditions, see (a) the 2/9/2015 request from Reclamation and (b) the2/10/2015 NMFS response*[11].
	Note: No modifications were proposed in WY 2015 to the OMR flow management action responses associated with the first stage and second stage loss or less-density triggers in this action.	

The SWRCB has compiled a comprehensive chronological summary[12] of the drought actions and associated documentation during WY 2015; readers are referred to that summary for full details on drought actions. The listing below includes just the drought contingency plan proposals and NMFS responses through mid-June, since those documents are most relevant to the NMFS BiOp RPA actions tracked by DOSS.

- September 29, 2014 – Announcement of Reclamation's request for modification of Water Rights Decision 1641, Vernalis flow objective during October of this year.
- October 3, 2014 – NMFS concurrence email.
- October 7, 2014 – Water Right Order modifying Reclamation's Water Right requirement to meet the D1641 Vernalis flow objective during October of this year.
- October 15, 2014 – CVP and SWP Drought Contingency Plan October 15, 2014 through January 15, 2015

[11] These documents are available at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/; not on the SWRCB drought actions website.
[12] http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/tucp.shtml

- January 15, 2015 – CVP and SWP Drought Contingency Plan January 15, 2015 through September 30, 2015
- January 23, 2015 – Temporary Urgency Change Petition
- January 27, 2015 – Letter from Reclamation to NMFS regarding interim contingency plan for February and March pursuant to Reasonable and Prudent Alternative (RPA) Action I.2.3.C of the 2009 Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP) Biological Opinion (2009 BiOp)
    - Attachment – Project Description for February – March 2015 drought response actions to support Endangered Species Act consultations
    - Attachment – Salmonid and green sturgeon supporting information for Endangered Species Act compliance for Temporary Urgency Change Petition regarding delta water quality January 27, 2015
- January 29, 2015 – Letter from NMFS to Reclamation and DWR regarding interim contingency plan for February and March pursuant to Reasonable and Prudent Alternative Action I.2.3.C of the 2009 BiOp
- February 3, 2015 – Announcement and State Water Board order regarding Temporary Urgency Change Petition
- February 9, 2015 –Reclamation's request for NMFS concurrence on OMR flexibilities
- February 10, 2015 – NMFS determination on OMR flexibilities
- March 5, 2015 – Announcement and State Water Board revised order regarding Temporary Urgency Change Petition
- March 24, 2015 – Email from executive director to Reclamation regarding request for concurrence to modify the timing of the San Joaquin River pulse flow and associated export level and emails from the fisheries agencies and DWR
- March 24, 2015 – Letter from Reclamation to NMFS regarding contingency plan for water year (WY) 2015 pursuant to Reasonable and Prudent Alternative (RPA) Action I.2.3.C of the 2009 BiOp
    - Attachment – Project Description for April – September 2015 drought response actions to support Endangered Species Act consultations
    - Attachment – Biological review for Endangered Species Act compliance with the WY 2015 Drought Contingency Plan April through September Project Description
- March 24, 2015 – Petitioners' Request to modify March 5, 2015 Revised Order regarding Temporary Urgency Change for the State and Federal water project
- March 27, 2015 – Letter from NMFS to Reclamation and DWR regarding contingency plan for Water Year 2015 pursuant to Reasonable and Prudent Alternative Action I.2.3.C of the 2009 BiOp
- April 6, 2015 – State Water Board Revised Order regarding Temporary Urgency Change Petition
- April 15, 2015 – NMFS evaluation of alternatives for Sacramento River water temperature compliance for winter-run chinook salmon
- May 21, 2015 – Temporary Urgency Change Petition – June 30 through November 30, 2015
- June 8, 2015 – Notice of Temporary Urgency Change Petition – objections due by June 17, 2015

West False River emergency drought barrier:

On April 1, 2015, Governor Brown issued Executive Order B-29-15 which directs DWR to plan and, if necessary, implement Emergency Drought Salinity Barriers at locations within the Delta in coordination and consultation with the State Water Board and DFW (http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/docs/2015_24_emergency_drought_Barriers/db_wqc_050415.pdf). Construction began 5/7/2015 and was completed 5/28/2015. The barrier is planned on being completely removed November 15th, 2015. It is located on West False River about 0.4 miles east of the San Joaquin River confluence, between Jersey and Bradford Islands in Contra Costa County. The purpose of the installation of the barrier is to prevent intrusion of salt water into parts of the Delta along the San Joaquin River potentially conserving water for use later in the year by preserving water quality.

Chapter 5 — Operations Summary

5.1 Water Year 2015

The hydrologic year type in both the Sacramento and San Joaquin river basins were classified as Critical. A summary of WY 2015 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 Figures 5.1, 5.2, 5.3, and 5.4.

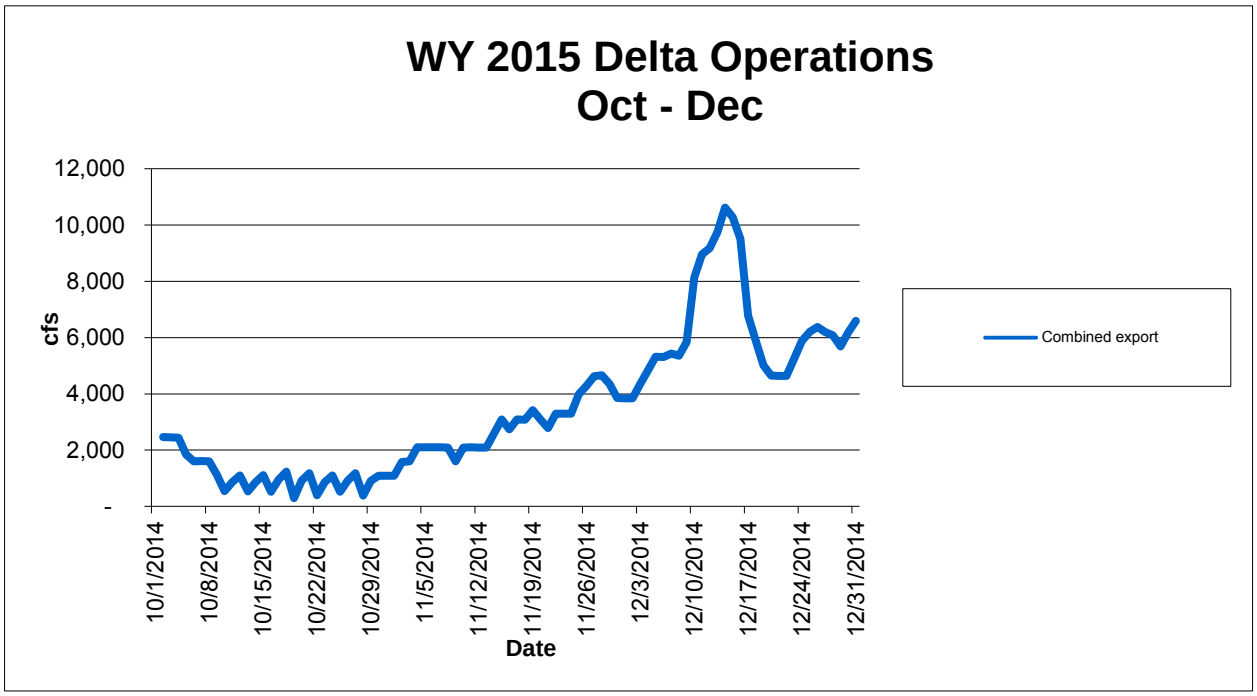

Figure 5.1: Combined exports at the CVP and SWP (in cubic feet per second) from October through December 2014.

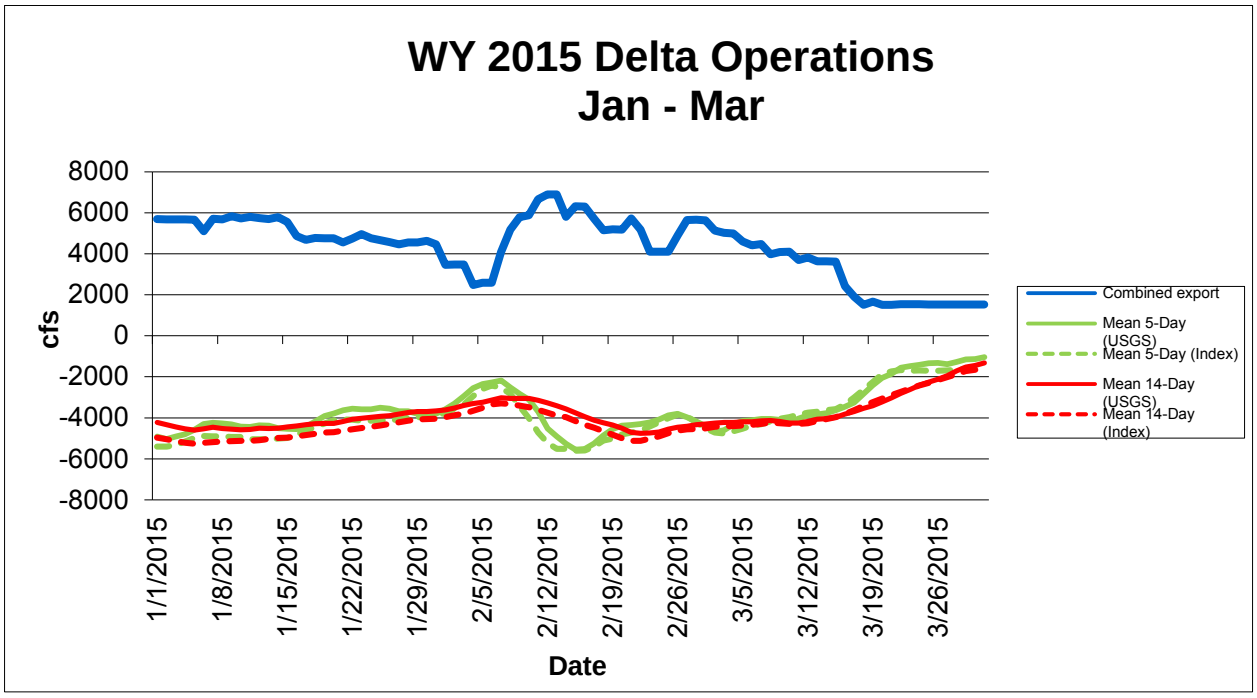

Figure 5.2: Combined exports at the CVP and SWP (blue, in cubic feet per second) and Old and Middle river flows (red and green, in cubic feet per second) from January through March 2015.

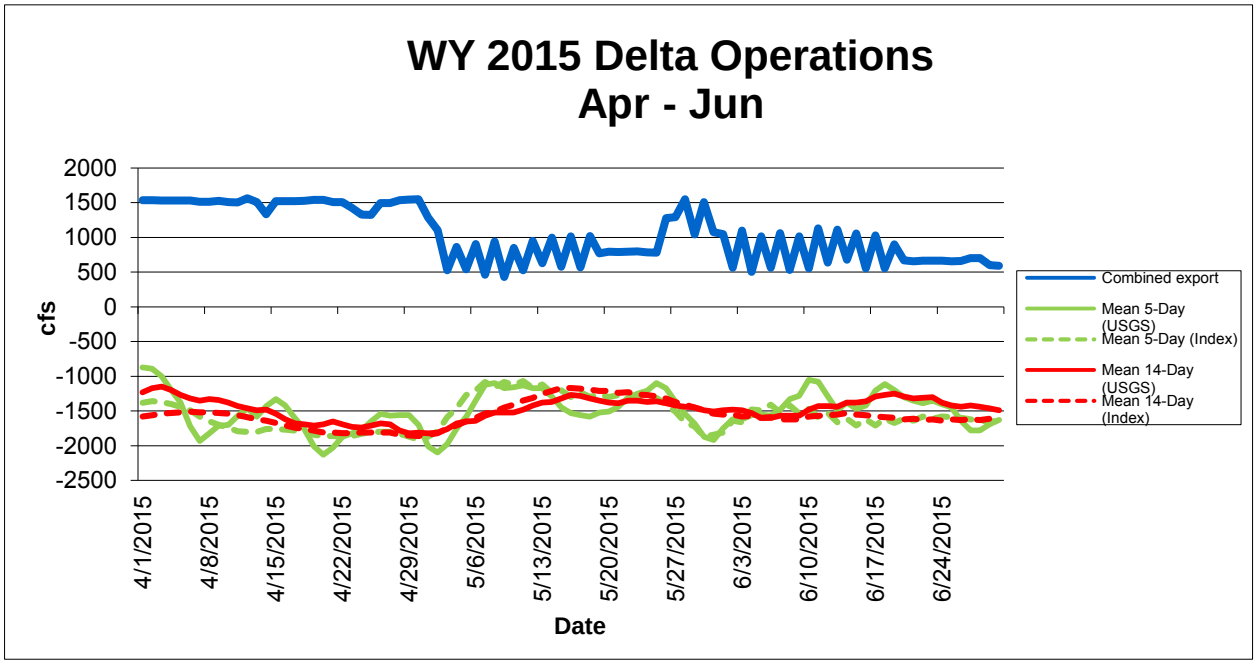

Figure 5.3: Combined exports at the CVP and SWP (blue, in cubic feet per second) and Old and Middle river flows (red and green, in cubic feet per second) from April through June 2015.

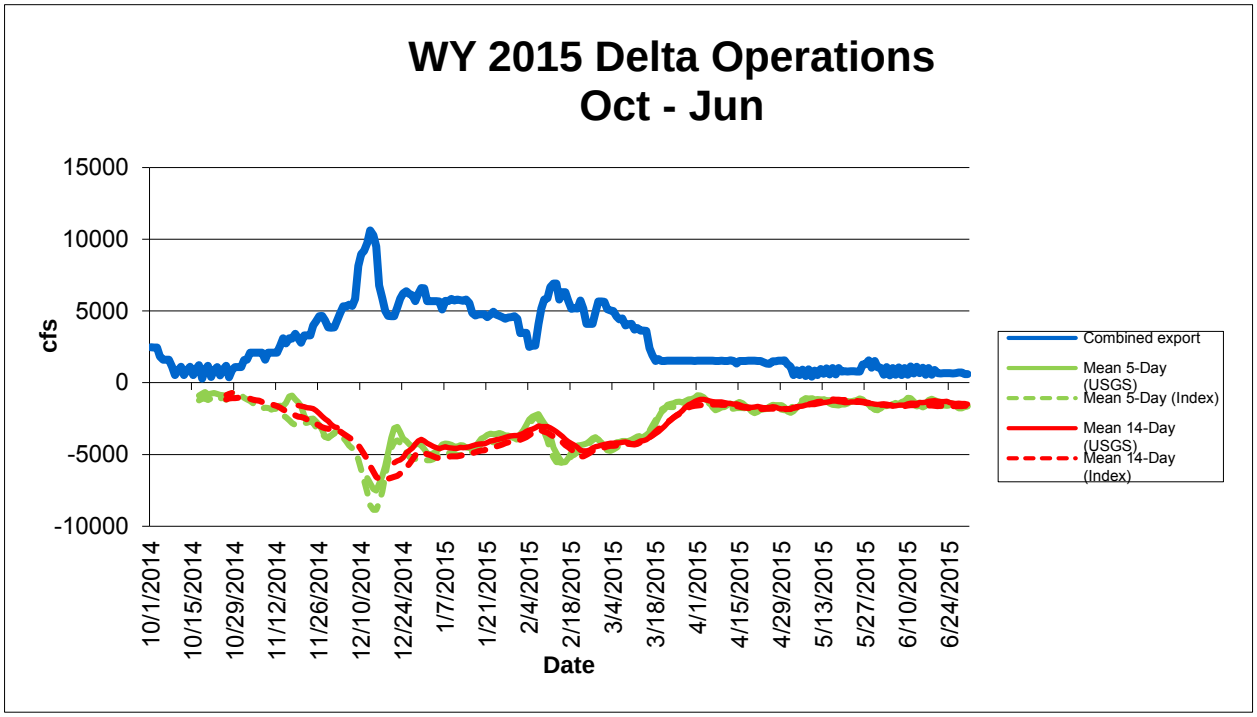

Figure 5.4: Combined exports at the CVP and SWP (blue, in cubic feet per second) and Old and Middle river flows (red and green, in cubic feet per second) from October 2014 through June 2015.

Chapter 6— Monitoring Activities

6.1 WY 2015 Monitoring summary (see also Appendix B)

The Annual Incidental Take Report, included as Appendix B, is a document prepared by DWR and Reclamation that provides a detailed summary of WY 2015 monitoring activities.

6.2 Review of DOSS's weekly distribution estimates

First started in WY 2014, DOSS again in WY 2015 made weekly estimates of the distribution of ESA-listed salmonids throughout the Central Valley based on review of the weekly fish monitoring data and other related data (hydrology, weather forecast, hatchery release). These estimates are intended to give managers and stakeholders[13] an overview of the fisheries conditions for consideration in drought-related operations. The assessment of salmonid distribution was categorized in three following geographic "bins" that add up to 100%: *Yet to enter Delta, In Delta, and Exited Delta past Chipps Island.* As the water year progressed, members discussed the various factors influencing fish migration and reviewed monitoring data to estimate the percentage for each category.

Tables 6.1, 6.2, and 6.3 summarize the DOSS estimates for the proportion of salmonids in each of the three geographic bins, as the year progressed. Details about each week's estimates can be found in the associated DOSS notes[14].

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

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

Table 6.1: Weekly estimates of the proportion of the annual cohort of ESA-listed salmonids yet to enter the Delta (still upstream of the Delta in either the Sacramento or San Joaquin basins).

		Yet to enter Delta						
		(above Knights Landing for Sac fish; above Mossdale for San Joaquin fish)						
Month	**WY2015 Mtg Date**	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Oct	10/7							
Oct	10/14							
Oct	10/21							
Oct	10/28							
Nov	11/4							
Nov	11/12	~75% (last week: same)			Some fraction may have moved during the turbidity event in late October.*			
Nov	11/18	~75%			Same as last week			
Nov	11/25	~75%			Same as last week			
Dec	12/2	~70-75%			Same as last week			
Dec	12/9	~25-50%			Same as last week			
Dec	12/16	<10%		85-90%	<25%			
Dec	12/23	< 10%		50-60%	<10%			
Dec	12/30	<5%		~50%	<5%			

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Jan	1/6	<5%		50-75%	<5%			
Jan	1/13	<5%		50-75%	<5%	>95% *		
Jan	1/20	<5%		50-75%	<5%	90-95% *		
Jan	1/27	<5%		50-75%	<5%	85-95% *		
Feb	2/3	<5%		50-75%	<5%	40-60% *		
Feb	2/10	Few stragglers only	95%	<25%	Few stragglers only	10-20% **	Limited catch data	~80%
Feb	2/17	Few stragglers only	~75%	5-20%	Few stragglers only	10-20% ***	Limited catch data	~80%
Feb	2/24	Few stragglers only	35-55%	5-20%	Few stragglers only	~10% ***	Limited catch data	~80%
Mar	3/3	Few stragglers only	30-50%	5-20%	Few stragglers only	~10% ***	Limited catch data	~80%
Mar	3/10	Few stragglers only	25-35%	5-20%	Few stragglers only	~10% ***	Limited catch data	~80%
Mar	3/17	Few stragglers only	5-15%	5-20%	Few stragglers only	~10% ***	Limited catch data	~35%
Mar	3/24	Few stragglers only	0-5%	5-20%	Few stragglers only	~10% ***	Limited catch data	30%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Mar	3/31	Few stragglers only	Few stragglers only	5-15%	Few stragglers only	~10% ***	Limited catch data	15%
Apr	4/7	Few stragglers only	Few stragglers only	~5%	Few stragglers only	5% ***	Limited catch data	10%
Apr	4/14	Few stragglers only	Few stragglers only	Few stragglers only to 5%	Few stragglers only	5% ***	Limited catch data	5-10%
Apr	4/21	Few stragglers only	Few stragglers only	Few stragglers only to 5%	Generally done migrating with the exception of a few stragglers	<5% ***	Limited catch data	5%
Apr	4/28	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Few stragglers only to 5%	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	<5%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
May	5/5	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	<5%
May	5/12	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	<5%
May	5/19	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	Few stragglers

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
May	5/26	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	Generally done migrating with the exception of a few stragglers
Jun	6/9	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	Generally done migrating with the exception of a few stragglers

*Coleman only

**CNFH and Feather River Hatchery fish only

*** All hatchery fish

Table 6.2: Weekly estimates of the proportion of the annual cohort of ESA-listed salmonids in the Delta

		In Delta						
		(Knights Landing to Chipps for Sac fish; Mossdale to Chipps for SJ fish)						
Month	**WY2015 Mtg Date**	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Oct	10/7							
Oct	10/14							
Oct	10/21							
Oct	10/28							
Nov	11/4							
Nov	11/12	~25% (last week: same)			Some fraction may have moved during the turbidity event in late October.*			
Nov	11/18	~25%			Same as last week			
Nov	11/25	~25%			Same as last week			
Dec	12/2	~25-30%			Same as last week			
Dec	12/9	~50-75%			Same as last week			
Dec	12/16	>90%		<10-15%	>75%			
Dec	12/23	>90%		40-50%	>75%			
Dec	12/30	>95%		~50%	80-90%			
Jan	1/6	>95%		25-50%	80-90%			

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Jan	1/13	>95%		25-50%	80-90%	<5% *		
Jan	1/20	>95%		25-50%	80-90%	5-10% *		
Jan	1/27	>95%		25-50%	80-90%	5-15% *		
Feb	2/3	>95%		25-50%	80-90%	40-60% *		
Feb	2/10	>95%	5%	>75%	75-85%	80-90% ***	Limited catch data	~20%
Feb	2/17	>95%	~25%	80-95%	75%85%	80-90% ***	Limited catch data	~20%
Feb	2/24	>95%	40-60%	80-95%	~75%	~80% ***	Limited catch data	~20%
Mar	3/3	>95%	45-65%	80-95%	70%	75% ***	Limited catch data	~20%
Mar	3/10	>95%	65-75%	80-95%	60-70%	60% ***	Limited catch data	~20%
Mar	3/17	85%	70-85%	80-95%	~50%	40% ***	Limited catch data	~65%
Mar	3/24	75%	70-85%	80-90%	~40%	30% ***	Limited catch data	60%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Mar	3/31	50%	50%	70-80%	10-30%	25% ***	Limited catch data	60%
Apr	4/7	40%	40%	60%	10%	15% ***	Limited catch data	50%
Apr	4/14	20%	20%	50%	5%	5% ***	Limited catch data	40%
Apr	4/21	10%	10%	40%	Generally done migrating with the exception of a few stragglers	<5%	Limited catch data	25%
Apr	4/28	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	20-30%	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	10-15%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
May	5/5	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	20%	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	10%
May	5/12	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	15%	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	10%
May	5/19	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	5%	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	5%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
May	5/26	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	Generally done migrating with the exception of a few stragglers
Jun	6/9	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers	Generally done migrating with the exception of a few stragglers ***	Limited catch data	Generally done migrating with the exception of a few stragglers

*Coleman only

**CNFH and Feather River Hatchery fish only

*** All hatchery fish

Table 6.3: Weekly estimates of the proportion of the annual cohort of ESA-listed salmonids that have exited the Delta past Chipps Island.

		Exited Delta past Chipps Island						
		Chipps Island for all fish						
Month	**WY2015 Mtg Date**	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Oct	10/7							
Oct	10/14							
Oct	10/21							
Oct	10/28							
Nov	11/4							
Nov	11/12	0% (last week: same)			Some fraction may have moved during the turbidity event in late October.*			
Nov	11/18	0%			Same as last week			
Nov	11/25	0%			Same as last week			
Dec	12/2	0%			Same as last week			
Dec	12/9	0%			Same as last week			
Dec	12/16	0%		0%	0%			
Dec	12/23	<5%		<5%	10%			
Dec	12/30	<5%		<5%	<15%			
Jan	1/6	<5%		<5%	<15%			

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Jan	1/13	<5%		<5%	<15%	0% *		
Jan	1/20	<5%		<5%	<15%	0% *		
Jan	1/27	<5%		<5%	<15%	0% *		
Feb	2/3	<5%		<5%	<15%	~5% *		
Feb	2/10	<5%	0%	<5%	15-25%	Few to <5% ***	Limited catch data	0%
Feb	2/17	<5%	0%	<5%	15-25%	Few to <5% ***	Limited catch data	0%
Feb	2/24	<5%	~5%	<5%	~25%	10% ***	Limited catch data	0%
Mar	3/3	<5%	~5%	<5%	30%	15% ***	Limited catch data	0%
Mar	3/10	<5%	~5%	<5%	30-40%	30% ***	Limited catch data	0%
Mar	3/17	<15%	<15%	<5%	~50%	50% ***	Limited catch data	0%
Mar	3/24	25%	25%	10%	~60%	60% ***	Limited catch data	10-15%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
Mar	3/31	50%	50%	20-25%	70-90%	65% ***	Limited catch data	25-30%
Apr	4/7	60%	60%	40%	90%	85% ***	Limited catch data	35-40%
Apr	4/14	80%	80%	50%	95%	90% ***	Limited catch data	45-50%
Apr	4/21	90%	90%	60%	>95%	>95% ***	Limited catch data	70%
Apr	4/28	>95%	>95%	70-80%	>95%	>95% ***	Limited catch data	80-85%
May	5/5	>99%	>99%	80%	>99%	>95% ***	Limited catch data	85-90%

Month	WY2015 Mtg Date	WR unmarked	WR marked	SR unmarked	SR Yearling	O. mykiss marked	O. mykiss SacR unmarked	O. mykiss SJ River unmarked
May	5/12	>99%	>99%	85%	>99%	>95% ***	Limited catch data	90%
May	5/19	>99%	>99%	95%	>99%	>99% ***	Limited catch data	95%
May	5/26	>99%	>99%	>99%	>99%	>99% ***	Limited catch data	>95%
Jun	6/9	>99%	>99%	>99%	>99%	>99% ***	Limited catch data	>99%

*Coleman only

**CNFH and Feather River Hatchery fish only

*** All hatchery fish

6.3 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 2015. This information was used by DOSS as an "early warning" system for assessing risk of entrainment into the south Delta or the export facilities.

Before or during opening of the Delta Cross Channel when operating under the DCC Trigger Matrix, the monitoring frequency of the Sacramento beach seines and Sacramento trawl increased to daily in order to support calculation of the daily Sacramento Seine Catch Index and the Sacramento Trawl Catch Index. Because the Knights Landing rotary screw trap runs continuously and is usually checked once or more per day (except under special circumstances, for example during very high flows that can cause safety issues to field crews), information to calculate the Knights Landing Catch Index is generally available on a daily basis throughout the sampling season.

6.4 In-Season Acoustic tag-tracking (Winter-run & Spring-run)

See a brief discussion of the acoustic tagging information available to DOSS during WY 2015 in Section 2.1 of this report.

6.5 Monitoring Gaps

6.5.1 Knight's Landing Temporary shutdown

Concerns about winter run take at the Knights Landing RSTs sampling site resulted in the temporary shutdown at 1615 on 2/10/2015. NMFS and DFW resolved concerns quickly and trapping resumed at 0730 on 2/11/2015. During this time period, the Knights Landing Catch Index is a component of a third alert for Action IV.3 from November 1st to April 30th, and is one of the triggers in the matrix governing DCC operations under IV.1.2. Due to the short amount of time the Knights Landing RSTs were shutdown, it likely did not have an impact on the implementation of Action IV.3 or IV.1.2.

6.5.2 GCID Temporary shutdown

Concerns of spring run take at the GCID RST sampling site resulted in the temporary shutdown on 4/24/2015 due to an increase in debris and spring run mortalities. NMFS and GCID resolved concerns fairly quickly and trapping resumed 5/3/2015. Data were not interpolated for this missing period. For the purposes of DOSS, GCID is used in conjunction with other sampling sites, both upstream and downstream to track movement of juvenile fish emigration through 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

Anderson, J.J., J.A. Gore, R.T. Kneib, N.E. Monsen, J.M. Nestler, and J. Van Sickle. 2014. Independent Review Panel (IRP) Report for the 2014 Long-term Operations Biological Opinions (LOBO) Annual Science Review. Prepared for the Delta Science Program. December 2014.

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 Perry, R. W. and J. R. Skalski. 2008. Migration and survival of juvenile Chinook salmon through the Sacramento-San Joaquin River Delta during the winter of 2006-2007. U.S. Fish and Wildlife Service Report. 26 pages.

Appendix A
Operations Summary Tables

Guide to the WY 2015 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, 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
10/1/2014	B	1678	789	O					*D-1641 Delta Outflow (3,000 cfs)*
10/2/2014	B	1667	789	O					
10/3/2014	B	1653	787	O					
10/4/2014	B	1049	785	O					Delta WQ
10/5/2014	B	808	793	O					
10/6/2014	B	809	799	O					
10/7/2014	B	811	790	O					
10/8/2014	B	822	296	O					
10/9/2014	B	254	287	O					
10/10/2014	B	576	288	O					
10/11/2014	B	814	291	O					
10/12/2014	B	236	289	O					
10/13/2014	B	571	292	O					
10/14/2014	B	812	295	O					
10/15/2014	B	239	285	O					
10/16/2014	B	660	294	O					
10/17/2014	B	940	295	O					
10/18/2014	B	0	294	O					
10/19/2014	B	622	291	O					
10/20/2014	B	884	291	O					
10/21/2014	B	96	297	O					
10/22/2014	B	571	287	O					
10/23/2014	B	811	286	O					
10/24/2014	B	236	284	O					
10/25/2014	B	629	290	O					
10/26/2014	B	890	295	O					
10/27/2014	B	82	298	O					
10/28/2014	B	607	295	C					[DCC Gates - Rio Vista (2,000 cfs)]; Delta WQ
10/29/2014	B	806	287	C					
10/30/2014	B	808	283	O					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
10/31/2014	B	808	281	O					
11/1/2014	B	807	776	O					*D-1641 Delta Outflow (3,500 cfs)*
11/2/2014	B	840	761	C					[DCC Gates – NMFS Action IV.1.2]; Delta WQ
11/3/2014	B	805	1294	C					
11/4/2014	B	805	1292	C					
11/5/2014	B	806	1295	C					
11/6/2014	B	805	1292	C					
11/7/2014	B	806	1287	O					Delta WQ
11/8/2014	B	807	795	O					
11/9/2014	B	806	1286	O					
11/10/2014	B	808	1296	O					
11/11/2014	B	810	1281	O					
11/12/2014	B	806	1287	O					
11/13/2014	B	805	1787	O					
11/14/2014	B	803	2290	O					
11/15/2014	B	467	2274	O					
11/16/2014	B	800	2296	O					
11/17/2014	B	798	2286	O					
11/18/2014	B	1137	2284	O					
11/19/2014	B	804	2288	O					
11/20/2014	B	805	1985	O					
11/21/2014	B	806	2493	O					
11/22/2014	B	805	2495	O					
11/23/2014	B	804	2491	O					
11/24/2014	B	801	3191	O					
11/25/2014	B	799	3490	O					
11/26/2014	B	838	3794	O					
11/27/2014	B	861	3798	O					
11/28/2014	B	861	3492	O					
11/29/2014	B	861	2992	O					
11/30/2014	B	859	2987	O					
12/1/2014	B	859	2989	C	-3480	-3070	-3550	-3250	*D-1641 Delta Outflow (3,500 cfs);* [DCC Gates: NMFS Action IV.1.2]; Delta WQ
12/2/2014	B	861	3491	C	-3340	-3120	-3500	-3300	
12/3/2014	B	847	3983	C	--	--	-3580	-3390	
12/4/2014	B	835	4488	C	--	--	-3840	-3550	
12/5/2014	B	836	4482	C	--	--	-4090	-3680	
12/6/2014	B	944	4495	C	--	--	-4380	-3820	
12/7/2014	B	869	4495	C	--	--	-4570	-3960	
12/8/2014	B	869	4984	C	--	--	-4770	-4090	

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
12/9/2014	E	1670	6477	C	--	--	-5350	-4360	
12/10/2014	E	2290	6675	C	--	--	-6070	-4660	
12/11/2014	E	2511	6669	C	--	--	-6810	-4970	
12/12/2014	E	3076	6674	C	-6640	--	-7650	-5340	
12/13/2014	E	3957	6667	C	-7000	--	-8540	-5800	
12/14/2014	E	4111	6175	C	-7400	--	-8850	-6200	
12/15/2014	E	3514	5995	C	-7520	--	-8860	-6560	During the second half of December, specific daily OMR targets were set by the Directors[1]. OMR decisions were primarily driven by turbidity management goals intended to control smelt distribution.
12/16/2014	E	2693	4095	C	-7040	--	-8360	-6710	
12/17/2014	E	2698	3191	C	-6500	--	-7580	-6770	
12/18/2014	E	2324	2695	C	-5790	--	-6480	-6740	
12/19/2014	E	1953	2697	C	-4880	--	-5430	-6680	
12/20/2014	E	1953	2692	C	-3830	--	-4540	-6620	
12/21/2014	E	1950	2692	C	-3160	-5580	-4140	-6560	
12/22/2014	E	2258	2996	C	-3080	-5440	-4020	-6500	
12/23/2014	E	2678	3198	C	-3460	-5370	-4190	-6330	
12/24/2014	E	2817	3395	C	-3900	-5230	-4500	-6120	
12/25/2014	E	2490	3888	C	-4050	-4890	-4840	-5920	
12/26/2014	E	2815	3386	C	-4280	-4730	-5150	-5660	
12/27/2014	E	2802	3289	C	-4470	-4540	-5320	-5350	
12/28/2014	E	2796	2891	C	-4330	-4280	-5310	-5060	
12/29/2014	E	2798	3385	C	-4220	-4050	-5330	-4860	
12/30/2014	E	2804	3792	C	-4390	-3950	-5380	-4850	
12/31/2014	E	2787	3787	C	-4610	-4060	-5460	-4910	
1/1/2015	E	2793	2898	C	-4910	-4220	-5400	-4970	*D-1641 Delta Outflow (6,000 cfs)*; NMFS Action IV.2.3 (OMR flow management[2])
1/2/2015	E	2794	2888	C	-5040	-4330	-5400	-5050	
1/3/2015	E	2795	2894	C	-4910	-4440	-5320	-5140	
1/4/2015	E	2793	2886	C	-4800	-4530	-5160	-5220	
1/5/2015	E	2474	3189	C	-4580	-4600	-4990	-5260	
1/6/2015	E	1852	3247	C	-4310	-4530	-4890	-5220	
1/7/2015	E	1826	3886	C	-4240	-4460	-4900	-5190	
1/8/2015	E	1091	4594	C	-4270	-4520	-4900	-5160	

[1] Directors from: Reclamation, DWR, NMFS, DFW, USFWS

[2] OMR calendar-based action response of -5,000 cfs in effect; for details on implementation and compliance measures, see (a) pages 74-79 in Enclosure 2 of the 2011 Amendments to the 2009 RPA document (http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf) and (b) the 2/27/14 NMFS letter regarding the OMR index calculation (http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/nmfs_response_to_reclamation_s_omr_index_demonstration_project_-_february_27__2014.pdf)

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
1/9/2015	E	955	4886	C	-4320	-4550	-4930	-5140	
1/10/2015	E	839	4890	C	-4430	-4580	-4930	-5120	
1/11/2015	E	912	4891	C	-4450	-4570	-5050	-5120	
1/12/2015	E	873	4879	C	-4360	-4500	-5050	-5090	
1/13/2015	E	836	4868	C	-4380	-4520	-5040	-5030	
1/14/2015	E	907	4885	C	-4510	-4510	-5020	-4980	
1/15/2015	B	873	4691	C	-4540	-4450	-4990	-4970	D-1641 Delta Outflow (monthly target 6,000 cfs; 7-day target 4,800 cfs)
1/16/2015	B	875	3997	C	-4550	-4400	-4820	-4910	
1/17/2015	B	877	3798	C	-4430	-4330	-4620	-4840	
1/18/2015	B	878	3895	C	-4180	-4290	-4450	-4780	
1/19/2015	B	877	3888	C	-3910	-4270	-4280	-4720	
1/20/2015	B	877	3889	C	-3790	-4270	-4130	-4700	
1/21/2015	B	877	3685	C	-3630	-4180	-4080	-4620	
1/22/2015	B	874	3878	C	-3550	-4070	-4100	-4560	
1/23/2015	B	873	4087	C	-3590	-4030	-4140	-4500	
1/24/2015	B	874	3880	C	-3580	-3970	-4140	-4440	
1/25/2015	B	874	3794	C	-3500	-3930	-4130	-4370	
1/26/2015	B	875	3690	C	-3560	-3890	-4130	-4300	
1/27/2015	B	871	3595	C	-3680	-3820	-4080	-4220	
1/28/2015	B	875	3684	C	-3680	-3740	-4000	-4140	
1/29/2015	B	877	3686	C	-3800	-3700	-3970	-4080	
1/30/2015	B	950	3690	C	-3880	-3690	-3960	-4060	
1/31/2015	B	977	3492	C	-3800	-3670	-3940	-4050	
2/1/2015	B	976	2485	C	-3590	-3610	-3750	-3970	Delta WQ
2/2/2015	B	989	2489	C	-3310	-3520	-3550	-3880	
2/3/2015	B	990	2489	C	-2940	-3400	-3340	-3790	
2/4/2015	B	991	1497	C	-2560	-3300	-2940	-3650	*NMFS Action IV.2.3 (OMR flow management -- first stage action response in effect 2/4-2/9; controlling only on 2/8-2/9)*; D-1641 Delta Outflow
2/5/2015	B	995	1598	C	-2360	-3240	-2590	-3510	
2/6/2015	B	998	1598	C	-2270	-3140	-2420	-3350	
2/7/2015	E	992	3092	C	-2180	-3020	-2530	-3300	NMFS Action IV.2.3 (OMR flow management -- first stage action response)[3]
2/8/2015	E	987	4199	C	-2520	-3050	-2830	-3330	

[3] OMR first stage action response of -3,500 cfs in effect; for details on implementation and compliance measures, see documents referenced in footnote 2.

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
2/9/2015	E	996	4795	C	-2840	-3050	-3430	-3410	NMFS Action IV.2.3 (OMR flow management)[4]
2/10/2015	E	895	4993	C	-3120	-3050	-4010	-3490	
2/11/2015	E	815	5850	C	-3710	-3150	-4720	-3610	NMFS Action IV.2.3 (OMR flow management per drought flexibility)[5]; Delta operations and specific daily OMR targets (for smelt and salmonid protection) were set by the Directors on some days.
2/12/2015	E	814	6090	C	-4520	-3280	-5220	-3750	
2/13/2015	E	819	6090	C	-4910	-3420	-5520	-3890	
2/14/2015	E	820	4988	C	-5270	-3570	-5520	-3970	
2/15/2015	E	827	5495	C	-5550	-3750	-5610	-4150	
2/16/2015	E	824	5490	C	-5520	-3940	-5590	-4340	
2/17/2015	E	827	4890	C	-5260	-4110	-5400	-4480	
2/18/2015	E	816	4335	C	-4860	-4240	-5100	-4660	
2/19/2015	E	1524	3674	C	-4550	-4350	-5010	-4830	
2/20/2015	E	1843	3333	C	-4380	-4500	-4810	-5000	
2/21/2015	E	1834	3889	C	-4350	-4710	-4710	-5120	
2/22/2015	E	1295	3891	C	-4310	-4750	-4620	-5120	
2/23/2015	E	863	3244	C	-4230	-4740	-4420	-5020	
2/24/2015	E	858	3240	C	-4090	-4700	-4220	-4910	
2/25/2015	E	857	3249	C	-3880	-4560	-4010	-4750	
2/26/2015	E	858	4048	C	-3800	-4460	-3850	-4630	
2/27/2015	E	860	4796	C	-3980	-4420	-3940	-4560	NMFS Action IV.2.3 (OMR flow management)[6]
2/28/2015	E	860	4799	C	-4180	-4340	-4220	-4550	
3/1/2015	E	858	4783	C	-4410	-4300	-4510	-4510	
3/2/2015	E	1547	3589	C	-4680	-4260	-4710	-4440	35% E/I 14 day average
3/3/2015	E	1828	3203	C	-4600	-4220	-4760	-4400	
3/4/2015	E	1828	3163	C	-4320	-4220	-4660	-4400	
3/5/2015	E	1823	2786	C	-4150	-4200	-4530	-4380	
3/6/2015	E	2430	1985	C	-4120	-4200	-4370	-4350	
3/7/2015	E	2692	1791	C	-4050	-4150	-4310	-4300	
3/8/2015	E	2587	1398	C	-4050	-4130	-4170	-4240	
3/9/2015	E	2698	1389	C	-4100	-4180	-4050	-4270	
3/10/2015	E	2702	1398	C	-4220	-4250	-3970	-4290	
3/11/2015	E	2710	992	C	-4040	-4260	-3850	-4300	
3/12/2015	E	3187	631	C	-3880	-4180	-3750	-4260	

[4] OMR calendar-based action response of -5,000 cfs in effect; for details on implementation and compliance measures, see documents referenced in footnote 2.

[5] Details of 2/9/15 OMR drought flexibility request and 2/10/15 NMFS response available at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/

[6] OMR calendar-based action response of -5,000 cfs in effect; for details on implementation and compliance measures, see documents referenced in footnote 2.

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
3/13/2015	B	3342	297	C	-3830	-4070	-3700	-4150	
3/14/2015	B	3337	299	C	-3780	-4040	-3630	-4060	
3/15/2015	B	3334	284	C	-3630	-3970	-3570	-3960	
3/16/2015	B	934	1484	C	-3460	-3820	-3340	-3810	TUCP Order export limit (1,500 cfs + additional amount for health & safety)
3/17/2015	B	977	932	C	-3260	-3700	-3000	-3630	
3/18/2015	B	975	535	C	-2840	-3540	-2620	-3420	TUCP Order export limit (1,500 cfs)
3/19/2015	B	977	683	C	-2410	-3410	-2250	-3240	TUCP Order export limit (1,500 cfs + additional amount for health & safety)
3/20/2015	B	974	536	C	-2050	-3230	-1880	-3070	TUCP Order export limit (1,500 cfs)
3/21/2015	B	980	525	C	-1850	-3030	-1730	-2890	
3/22/2015	B	994	549	C	-1550	-2810	-1680	-2740	
3/23/2015	B	994	541	C	-1480	-2610	-1700	-2580	
3/24/2015	B	993	544	C	-1420	-2410	-1690	-2430	
3/25/2015	B	982	549	C	-1330	-2260	-1700	-2300	*San Joaquin pulse period and associated D-1641 export limit (100% of Vernalis flow) in effect 3/25-4/25*; TUCP Order export limit (1,500 cfs); D-1641 export limit (100% of Vernalis flow)
3/26/2015	B	992	539	C	-1320	-2120	-1710	-2160	
3/27/2015	B	993	541	C	-1380	-1940	-1690	-2020	
3/28/2015	B	992	541	C	-1270	-1710	-1650	-1870	
3/29/2015	B	993	533	C	-1150	-1530	-1590	-1720	
3/30/2015	B	993	535	C	-1140	-1440	-1520	-1650	
3/31/2015	B	995	531	C	-1040	-1320	-1450	-1600	
4/1/2015	B	990	547	C	-870	-1230	-1380	-1580	*NMFS Action IV.2.1 (I:E ratio) in effect 4/1-5/31;*TUCP Order export limit (1,500 cfs); D-1641 export limit (100% of Vernalis flow); NMFS Action IV.2.1 (1:1 I:E ratio)[7]
4/2/2015	B	989	544	C	-890	-1170	-1360	-1560	
4/3/2015	B	988	543	C	-1000	-1150	-1370	-1540	
4/4/2015	B	988	542	C	-1200	-1200	-1400	-1530	
4/5/2015	B	989	544	C	-1380	-1270	-1440	-1520	
4/6/2015	B	988	541	C	-1720	-1320	-1490	-1510	

[7] Neither NMFS Action IV.2.1 nor the D-1641 export limit require combined exports of less than 1,500 cfs, even if Vernalis flows are less than 1,500 cfs.

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
4/7/2015	B	991	523	C	-1930	-1350	-1580	-1520	
4/8/2015	B	989	524	C	-1820	-1330	-1650	-1520	
4/9/2015	B	987	540	C	-1710	-1340	-1700	-1530	NMFS Action IV.2.1 (1:1 I:E ratio); D-1641 export limit (100% of Vernalis flow)
4/10/2015	B	988	520	C	-1700	-1380	-1740	-1540	
4/11/2015	B	988	516	C	-1570	-1430	-1790	-1560	
4/12/2015	B	989	515	C	-1460	-1460	-1800	-1590	
4/13/2015	B	989	519	C	-1580	-1490	-1800	-1620	
4/14/2015	B	989	345	C	-1430	-1480	-1760	-1640	NMFS Action IV.2.1 (1:1 I:E ratio); D-1641 export limit (100% of Vernalis flow); TUCP Order export limit (1,500 cfs)
4/15/2015	B	986	537	C	-1330	-1540	-1760	-1670	
4/16/2015	B	986	538	C	-1420	-1620	-1770	-1710	
4/17/2015	B	987	536	C	-1600	-1680	-1780	-1740	
4/18/2015	B	989	538	C	-1760	-1690	-1790	-1760	
4/19/2015	B	992	548	C	-2010	-1710	-1840	-1780	
4/20/2015	B	993	549	C	-2130	-1690	-1860	-1810	
4/21/2015	B	992	519	C	-2030	-1650	-1860	-1810	
4/22/2015	B	992	518	C	-1870	-1690	-1870	-1820	
4/23/2015	B	902	524	C	-1820	-1730	-1860	-1820	
4/24/2015	B	808	521	C	-1780	-1740	-1830	-1810	
4/25/2015	B	808	516	C	-1650	-1710	-1800	-1810	*Last day of San Joaquin pulse period and associated D-1641 export limit (100% of Vernalis flow)*
4/26/2015	B	804	692	C	-1540	-1680	-1800	-1810	NMFS Action IV.2.1 (1:1 I:E ratio);TUCP Order export limit (1,500 cfs)
4/27/2015	B	802	695	C	-1570	-1690	-1800	-1810	
4/28/2015	B	803	734	C	-1560	-1780	-1830	-1840	
4/29/2015	B	803	742	C	-1560	-1820	-1870	-1850	
4/30/2015	B	804	745	C	-1700	-1810	-1910	-1860	
5/1/2015	B	805	482	C	-2010	-1820	-1870	-1840	Delta WQ
5/2/2015	B	810	293	C	-2100	-1810	-1790	-1820	
5/3/2015	B	240	286	C	-1980	-1760	-1590	-1750	
5/4/2015	B	571	294	C	-1750	-1680	-1460	-1710	
5/5/2015	B	240	298	C	-1580	-1650	-1270	-1650	
5/6/2015	B	618	287	C	-1350	-1640	-1200	-1600	
5/7/2015	B	183	278	C	-1120	-1570	-1080	-1540	
5/8/2015	B	649	290	C	-1100	-1520	-1160	-1510	
5/9/2015	B	150	278	C	-1170	-1520	-1080	-1450	

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
5/10/2015	B	567	282	C	-1160	-1520	-1130	-1410	
5/11/2015	B	241	285	C	-1130	-1480	-1070	-1350	
5/12/2015	B	566	385	C	-1170	-1420	-1170	-1310	
5/13/2015	B	241	389	C	-1170	-1380	-1120	-1250	
5/14/2015	B	619	378	O	-1290	-1370	-1240	-1210	[DCC gates open for Delta WQ per DCC drought flexibility][8]; Delta WQ
5/15/2015	B	189	389	O	-1450	-1320	-1200	-1170	
5/16/2015	B	622	393	O	-1530	-1270	-1300	-1170	
5/17/2015	B	178	389	O	-1560	-1280	-1230	-1180	
5/18/2015	B	624	398	C	-1580	-1320	-1300	-1190	
5/19/2015	B	177	594	C	-1520	-1350	-1260	-1210	
5/20/2015	B	0	794	C	-1510	-1380	-1300	-1210	
5/21/2015	B	0	790	C	-1440	-1390	-1270	-1240	
5/22/2015	B	0	794	O	-1310	-1350	-1320	-1230	[DCC Gate Operations per D-1641 & NMFS BiOp Action IV.1.2][9]; Delta WQ
5/23/2015	B	0	799	O	-1250	-1350	-1290	-1260	
5/24/2015	B	0	784	O	-1210	-1370	-1300	-1270	
5/25/2015	B	0	781	O	-1100	-1360	-1310	-1290	
5/26/2015	B	0	1279	C	-1170	-1390	-1410	-1320	
5/27/2015	B	0	1295	C	-1370	-1420	-1510	-1370	
5/28/2015	B	655	895	C	-1540	-1440	-1660	-1410	
5/29/2015	B	150	893	O	-1680	-1450	-1720	-1450	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; Delta WQ
5/30/2015	B	619	891	O	-1870	-1490	-1870	-1490	
5/31/2015	B	181	892	O	-1920	-1510	-1840	-1540	*Last day of NMFS Action IV.2.1 (1:1 I:E ratio)*
6/1/2015	B	655	392	C	-1750	-1490	-1810	-1550	*D-1641 Delta Outflow (4,000 cfs);* Delta WQ
6/2/2015	B	171	392	C	-1620	-1480	-1640	-1550	
6/3/2015	B	708	392	C	-1620	-1490	-1660	-1580	
6/4/2015	B	114	392	C	-1560	-1530	-1480	-1570	
6/5/2015	B	622	392	O	-1550	-1600	-1490	-1600	[DCC Gate Operations per D-1641 and NMFS BiOp IV.2.1]; Delta WQ
6/6/2015	B	178	385	O	-1570	-1600	-1410	-1590	
6/7/2015	B	662	398	O	-1480	-1570	-1520	-1620	

[8] This DCC opening allowed under DCC drought flexibility and trigger matrix in the Drought Operations Plan.

[9] Per NMFS BiOp and D-1641, from 5/21-6/15, the DCC gates must be closed for 14 days. Openings from this point onward were for 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
6/8/2015	B	138	395	**C**	-1330	-1570	-1420	-1620	*NMFS IV.2.3 OMR flow management restrictions lifted based on temperature offramp*
6/9/2015	B	626	390	**C**	-1280	-1570	-1540	-1620	
6/10/2015	B	174	382	**C**	-1050	-1480	-1470	-1580	
6/11/2015	B	651	478	**C**	-1080	-1430	-1590	-1570	
6/12/2015	B	150	487	**C**	-1290	-1430	-1530	-1560	
6/13/2015	B	622	490	**O**	-1490	-1440	-1660	-1550	[DCC Gate Operations per D-1641 & NMFS BiOp]; Delta WQ
6/14/2015	B	178	499	**O**	-1380	-1380	-1610	-1530	
6/15/2015	B	660	394	**C**	-1470	-1380	-1710	-1550	
6/16/2015	B	156	399	**O**	-1420	-1360	-1620	-1560	*[No more DCC restrictions per NMFS BiOp or D-1641];* Delta WQ
6/17/2015	B	630	399	**O**	-1210	-1290	-1710	-1580	
6/18/2015	B	163	392	**O**	-1110	-1270	-1610	-1590	
6/19/2015	B	504	395	**O**	-1200	-1250	-1670	-1600	
6/20/2015	B	275	393	**O**	-1300	-1290	-1610	-1620	
6/21/2015	B	270	385	**O**	-1350	-1320	-1640	-1610	
6/22/2015	B	272	392	**O**	-1390	-1310	-1580	-1630	
6/23/2015	B	268	365	**C**	-1350	-1300	-1610	-1620	
6/24/2015	B	268	396	**C**	-1400	-1380	-1580	-1640	
6/25/2015	B	267	389	**C**	-1450	-1420	-1590	-1620	
6/26/2015	B	267	394	**O**	-1640	-1440	-1600	-1630	
6/27/2015	B	306	396	**O**	-1780	-1420	-1620	-1620	
6/28/2015	B	304	398	**O**	-1780	-1440	-1640	-1630	
6/29/2015	B	310	290	**O**	-1690	-1460	-1650	-1610	
6/30/2015	B	304	290	**O**	-1490	-1650	-1630		

Appendix B
2014/2015 Salmonid and Green Sturgeon Incidental Take and Monitoring Report

2014/2015
SALMONID AND GREEN STURGEON
INCIDENTAL TAKE AND MONITORING REPORT

October 1, 2015

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2014/2015 SALMONID AND GREEN STURGEON INCIDENTAL TAKE AND MONITORING REPORT

This annual report is required under the terms and conditions of the 2009 National Marine Fisheries Service (NMFS) Biological Opinion and Conference Opinion on the Proposed Long-Term Operations of the Central Valley Project and State Water Project (2009 NMFS Biological Opinion). This report summarizes the incidental take of winter-run Chinook salmon (*Oncorhynchus tshawytscha*), spring-run Chinook salmon (*O. tshawytscha*) surrogates, Central Valley steelhead (*O. mykiss*), and green sturgeon (*Acipenser medirostris*) at the State Water Project's (SWP) John E. Skinner Delta Fish Protective Facility and the Central Valley Project's (CVP) Tracy Fish Collection Facility (Delta fish facilities) for 2014/2015. This report also includes data from a wide geographic area including the salmonid monitoring program for the lower Sacramento River and the Delta (Figure 1), and the hydrologic conditions in the Delta.

In addition to this annual report, the California Department of Water Resources (DWR) and the United States Bureau of Reclamation (Reclamation) also prepared preliminary weekly data reports for the Data Assessment Team (DAT) and the Delta Operations for Salmonids and Sturgeon technical working group (DOSS) during the 2014/2015 incidental take season. Preliminary analysis of the weekly data reports can be found in the weekly meeting notes that are posted on the DAT and DOSS websites:

DAT:
http://www.water.ca.gov/swp/operationscontrol/calfed/calfeddat.cfm
DOSS:
http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/doss.html

Data Acquisition

DWR and Reclamation acquired data from the California Department of Fish and Wildlife (DFW), the United States Fish and Wildlife Service (USFWS), and other internal DWR and Reclamation divisions. At the time of the data acquisition, many of the agencies were still in the process of finalizing their data, therefore, the data presented in this report are preliminary and subject to revision. DWR and Reclamation will add an addendum to this report if analysis of the finalized data leads to substantial changes to the results.

Methods for Measuring Incidental Take

Current Method

For this report, DWR and Reclamation quantified incidental take for the listed species to the nearest whole fish at each facility using the current methods that are described in the 2009 NMFS Biological Opinion. DWR and Reclamation estimated the incidental take of steelhead and green sturgeon based on salvage, and estimated the incidental take of Chinook salmon based on loss using the procedures in DFW (2013). For implementation of NMFS Reasonable and Prudent Alternative (RPA) Action IV.2.3, DWR and Reclamation also estimated daily steelhead loss using the interim DOSS (2011) method, which expands for steelhead loss from salvage using Chinook salmon expansion factors.

Alternative Methods

As presented in the 2013/2014 report, there is still a high degree of uncertainty and poor documentation associated with the current methods used to estimate loss or incidental take of Chinook salmon, steelhead, and green sturgeon. Reclamation is required to improve the quantification of loss by developing an alternative technique to quantify incidental take of listed anadromous species at the Delta fish facilities in compliance with Term and Condition 2a of the 2009 NMFS Biological Opinion. In the summer of 2013, Reclamation and DWR, with guidance from the interagency Term and Condition 2a (T&C 2a) Technical Work Team (technical team), drafted Anonymous (2013) to describe the proposed modifications to the current methods for estimating loss. Anonymous (2013) was drafted for independent review and consideration at the 2013 Long-Term Operations Biological Opinions (LOBO) Annual Review, and was based on various documents drafted for the T&C 2a process. These documents include:

1) Jahn (2011), which describes an alternative technique for estimating point and confidence interval estimates of loss;
2) CFS (2013), which describes the most important terms in the modified Jahn (2011) loss equation for estimating loss and the contribution each term makes to the overall variance of loss; and
3) a two year comparison of the Jahn (2011) method with the current methods for estimating incidental take, which is documented in the 2011/2012 and 2012/2013 incidental take and monitoring reports (see DWR and Reclamation 2012; DWR and Reclamation 2013).

However, the Independent Review Panel (IRP) for the 2013 LOBO review expressed concerns in their final report on the Jahn (2011) model for calculating point and confidence interval estimates of loss, which would also apply to the Anonymous (2013) approach and to the current methods (see Anderson et al. 2013 for concerns). The IRP's concerns include using fixed survival values in the equation, not accounting for probable losses from zero salvage, and using the error propagation method for characterizing uncertainty (Anderson et al. 2013). To address these concerns, the IRP provided recommendations on how to improve the loss and uncertainty estimates, including using a Bayesian method to account for probable losses from zero salvage and using a Monte Carlo simulation for estimating loss and its uncertainty (see Anderson et al. 2013 for recommendations).

To move forward with some of these approaches from the IRP, T&C 2a technical team members have agreed to consider the IRP's suggestion to develop a different framework for calculating loss, which incorporates essential terms as random variables. Team members have also reviewed the various conceptual models for the SWP and CVP fish collection facilities that were presented by different agencies with technical expertise. Per the guidance of the technical team, DWR has initiated a task order for the Contractor to complete various tasks that will help DWR and Reclamation to move forward with the 2013 recommendations from the IRP on T&C 2a. The task order consists of 5 major tasks. The tasks are listed below with a brief progress status:

Task 1: Complete Second Opinion Report on IRP Recommendations
The final copy of the second opinion report was received from the consultants on August 11, 2015 and was accepted by the technical team members

Task2: Provide Monte Carlo Script(s) from Teply and Ceder (2013) and Prepare Associated Report on Script(s).
No work has been done on Task 2 yet as the technical team members have agreed to proceed with Task 3 instead.

Task3: Develop New Loss Method and Tool with Report.
Contractors have conducted the first workshop with technical team to review what the technical team needs for the new method and tool for estimating loss. The second workshop is scheduled on October 8, 2015.

Task 4: Complete Study Design Recommendation Report.
Contractors have recommended some additional studies during the first workshop and are expected to provide more as Task 3 progresses.

Task 5: Project Management.
Contractor will provide general project management, including coordination of staff, administrative support, and contract administration throughout the execution of the Task Order.

According to the task order, this project should be completed by June 2016. DWR expects to receive all final deliverables by April 2016. An update on the project status will be provided in the 2015/2016 Annual Incidental Report.

Observed Chinook Salmon Salvage

Figure 2 on page 15 describes the observed Chinook salmon salvage at the Delta fish facilities in 2014/2015 from normal salvage counts, special studies, and secondary flushes. However, Figure 2 does not depict any Chinook salmon that cannot be classified using the Delta model length-at-date criteria. This includes Chinook salmon that are larger than the length-at-date criteria considered in the model, and any Chinook salmon that were not measured for length. In 2014/2015, forklengths were obtained for all Chinook salmon salvaged at the Delta fish facilities. However, 3 sub-adult of an undetermined run of Chinook Salmon were salvaged at the SWP that fell outside of the length-at-criteria (all greater than 500 mm fork length) and therefore no loss was calculated for those fish.

Based on recent clarifications in DOSS (2013), DWR and Reclamation defined naturally produced older juvenile Chinook salmon as all non-adipose fin clipped (non-clipped) Chinook salmon greater than or equal to the minimum winter-run length-at-date criteria using the Delta Model and less than the maximum length-at-date criteria considered in the Delta Model. The Delta Model categorizes two different brood years of winter-run Chinook salmon in July. For this month, DWR and Reclamation used the minimum winter-run length-at-date criteria for the older brood year.

Overall, the number of observed non-clipped older juvenile Chinook salmon was significantly lower than in 2013/2014. In 2014/2015, all of the observed non-clipped older juvenile Chinook salmon salvaged occurred in April and May 2014 (Figure 2). There was no noticeable trend between the number of non-clipped older juvenile salvage and the export. In comparison, young-of-the-year (YOY) Chinook salmon were first observed at the Delta fish facilities around mid-December which coincided with increased Sacramento and San Joaquin River flows and were salvaged until mid- May.

Overall, the number of observed hatchery Chinook salmon at the Delta fish facilities was substantially higher in 2014/2015 than in 2013/2014. The Coleman Hatchery late fall-run brood year 2014 releases had the highest salvage out of all the hatchery fish observed in salvage.

Observed Chinook Salmon Genetic Run Assignment

Of the 10 non-clipped juvenile Chinook Salmon, classified as “older juveniles,” that were collected during routine salvage operations and predator removals, 9 underwent race confirmation by genetic analysis. One fish, collected at the CVP on January 4, 2015 with a measured forklength of 120mm, was not sampled for genetics and therefore its run assignment could not be confirmed nor denied. The resulting salvage number associated with this fish was 12.0, with a corresponding calculated loss of 9.56. All other “older juvenile” Chinook were genetically identified as Spring, Fall, and Late-Fall runs, no true Winter-run were identified in 2014/2015 at the South Delta Salvage Facilities.

Winter-Run Chinook Salmon

Winter-Run Chinook Salmon Incidental Take

In 2014, DFW estimated a total adult escapement of 3,015 winter-run spawners to the upper Sacramento River, which is 47% lower than the estimated adult escapement of 6,404 spawners in 2013. It was even lower than the 16-year average of 6,139 adults. The methodology (Cormack-Jolly-Seber Model) used in 2014 to calculate the annual winter-run escapement was the same as in 2012 and 2013. This Cormack-Jolly-Seber model allowed for an estimation of a 90% confidence interval, which ranged from 2,741 to 3,290 fish. Based on the point estimate of escapement, NMFS calculated the juvenile production estimate (JPE) of natural (non-clipped) winter-run Chinook salmon entering the Delta in 2014/2015. However, NMFS made significant changes to the survival terms in calculating this year’s JPE taking into consideration from the Independent Review Panel 2014 review, recommendation from the Winter-Run Project Work Team (WRPWT) technical review, and internal recommendations from NMFS-Southwest Fisheries Science Center.

In previous years, the JPE included the survival rate of eggs-to-fry calculated from an average over the last 15 years of the adult escapement and passage estimates at RBDD. In the 2014 JPE, NMFS included the egg-to-fry survival term of 0.05, which was based on the high mortality rate (95%), observed at an early life-stage due to extreme hydrologic conditions throughout the year. It was supported by the JPI estimates developed by the California Department of Fish and Wildlife (DFW).

The survival of juvenile winter-run to the Delta was also changed to 0.42 from 0.16 in the 2014 JPE calculation, which was based on one of the recommendation made by the WRPWT. The WRPWT advised an in-river survival rate of 0.42, which was the survival of acoustically tagged winter-run smolts between Salt Creek and Tower Bridge in Sacramento during 2014. The value of 0.16 used in 2013 JPE was calculated using 5 years of acoustically tagged data from late-fall run Chinook and one year of data from

winter-run acoustic tags. In 2014, two years of winter-run acoustic tagged data were available during the calculation. Both NMFS and WRPWT members have agreed that the new JPE calculation will be a better representation of a shorter rearing periods of winter-run juveniles prior to entering the Delta in Water Year 2015 based on the fish behavior and hydraulic condition during their migration period.

Using the modified survival terms and based on the best available information, NMFS estimated that 124,521 natural origin juvenile winter-run Chinook salmon would enter the Delta. Based on this JPE, the incidental take level from October 1, 2013, through June 30, 2014, for the Delta fish facilities was 2,490 non-clipped winter-run Chinook salmon, which is equal to 2% of the natural winter-run production entering the Delta. For tracking incidental take, winter-run Chinook salmon are classified by length according to the Delta Model length-at-date criteria and the measurement of winter-run Chinook salmon incidental take is based on loss using the current loss equation from DFW (2013).

More detailed information on rationales provided by NMFS for this year's JPE estimation can be found on http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/20150116_nmfs_winter-run_juvenile_production_estimate_nr.pdf

Loss of winter-run Chinook salmon, based on the Delta Model, occurred at both Delta fish facilities for an expanded loss of approximately 101 at the SWP and approximately 31 at the CVP. The combined expanded loss of winter-run sized Chinook salmon was 132 for the season; about 5.3% of the incidental take permitted. Overall, the combined annual winter-run sized Chinook salmon loss was higher than the previous water year even though the total loss was lowest on record when compared to the past nine water years (Figure 5, pg. 18) due to the low number of the authorized level of incidental take by NMFS in 2014. DWR and Reclamation were below the incidental take limit in 2014/2015.

In 2014/2015, there was a single occurrence when the combined older juvenile Chinook salmon loss density trigger was exceeded (NMFS RPA Action IV.2.3) but there was no need for export reductions or for more restrictive Old and Middle River flow levels for the protection of non-clipped winter-run Chinook salmon as the projects were already operating within the first stage action response of Action IV.2.3 (Figure 4, pg. 17).

Hatchery Winter-Run Chinook Salmon Incidental Take

On February 4-6, 2015, an estimated 612,056 winter-run smolts from Livingston Stone National Fish Hatchery (LSNFH) were released in the Sacramento River at Caldwell Park near Redding, California. According to the Hatchery data, the release group was 100% adipose fin clipped with a CWT. The hatchery production group was significantly

increased in 2014 to compensate for the loss in natural production due to extreme drought conditions. Based on preliminary release information and an updated survival term, NMFS estimated that 185,600 hatchery fish would enter the Delta. NMFS set the incidental take level at 1% of the total hatchery production entering the Delta, or 1,885 hatchery winter-run Chinook salmon from October 1, 2014, through June 30, 2015. There was a confirmed loss of 8.40 estimated for hatchery winter-run Chinook salmon at the Delta fish facilities, which was only 0.00004% of the authorized take level (Table 1 pg. 28). Therefore, DWR and Reclamation were below the incidental take level.

One hatchery (adipose fin clipped) Chinook salmon was caught on February 23, 2015, at the SWP fish facility, but was released due to staff error. Therefore, no CWT data could be retrieved from that fish (Table 1, pg. 28). The fork length of this Chinook salmon was recorded as 162mm, which is a late fall-run length for February 23 using the Delta Model length-at-date criteria. The loss was estimated as 18.01 and reported under the Unknown CWT Loss as the tag was lost with the erroneously released fish (Table 2, pg. 28). On February 24, 2015 one acoustically tagged fish was salvaged which was measured 161 mm, also a late fall-run according to the Delta Model length-at-date criteria. An acoustic tag loss of 17.00 was estimated for the salvage (Table 2, pg. 28). Between November and December of 2015, there were incidents at the CVP related to tag reading and retrieving which resulted in an estimation of 26.62 Unknown CWT Loss at CVP for the season (Table 2, pg. 28).

Spring-Run Chinook Salmon

Under the 2009 NMFS Biological Opinion, NMFS uses hatchery reared subyearling late fall-run Chinook salmon as surrogates for yearling spring-run Chinook salmon emigrating from the upper Sacramento River and tributaries into the Delta. Late fall-run Chinook salmon are used as a surrogate because spring-run Chinook salmon cannot be easily distinguished from the other races of salmon based upon their size in the lower Sacramento River and Delta. The Coleman National Fish Hatchery (CNFH) releases a percentage of the total CNFH late fall-run Chinook salmon production into surrogate release groups.

In water year 2014, CNFH released three groups of late fall-run Chinook salmon uniquely marked as spring-run Chinook salmon surrogates into Battle Creek: 1) 77,000 on 12/04/15, 2) 78,000 on 12/18/14, and 3) 83,100 on 2/05/15. In addition to these surrogate releases, CNFH also released 853,000 late fall-run Chinook salmon into Battle Creek on 12/1/14 as part of its production release. Prior to these releases, DOSS provided input to the CNFH on the release schedule of the spring-run Chinook salmon surrogates based on the information that the production release would occur during the first significant precipitation event in December. However, DOSS also noted that a potential benefit of not releasing the surrogates with a rainfall event would give the fish time to mingle with naturally produced spring-runs before a major flow event lead both

natural and surrogate fish to migrate downstream causing greater mortality. DOSS members have also discussed the release timing for the late fall-run production release. DOSS provided the guidance to release the production group early December based on the thought that releasing the Production group prior to the surrogate release might better represent natural spring run survival. A summary of more specific inputs provided from DOSS to CNFH is described in DOSS (2015).

Measuring Incidental Take

The incidental take level for the combined operation of the Delta pumping plants is equal to 1% of any individual CNFH late-fall Chinook salmon surrogate release group. Measurement of incidental take for each surrogate release group is based on loss using the current loss equation from DFW (2013). However, there are occasions when the hatchery of origin for the CWT Chinook salmon could not be confirmed due to lost, missing, damaged tags, or due to released fish. For this reason, the actual loss could be higher than what is confirmed in Table 1. As noted earlier, one hatchery (adipose fin clipped) Chinook salmon was caught on February 23, 2015, at the SWP fish facility, but was released due to staff error. Therefore, no CWT data could be retrieved from that fish (Table 2, pg. 29). The fork length of this Chinook salmon was recorded as 162 mm, which is a late fall-run length on February 23 using the Delta Model length-at-date criteria. The loss was estimated as 18.01 and reported under the Unknown CWT Loss as the tag was lost with the erroneously released fish (Table 2, pg. 29).

First Surrogate Release Group and Incidental Take

The first spring-run Chinook salmon surrogate hatchery group of approximately 77,000 CNFH late fall-run Chinook salmon was released on December 4, 2014. A total of 34.98 confirmed loss was estimated from this group from the fish salvaged at Delta fish facilities (Table 1, pg.28). The percent loss was calculated to be 0.045%, which was below the exceedance level according to NMFS BiOp.

Second Surrogate Release Group and Incidental Take

On December 18, 2014, CNFH released the second spring-run Chinook salmon surrogate hatchery group of approximately 78,000 late fall-run Chinook salmon into Battle Creek. A total of 45.52 confirmed loss was estimated from this group from the fish salvaged at Delta fish facilities (Table 1, pg. 28). The percent loss was calculated to be 0.058%, which was below the exceedance level according to NMFS Biop.

Third Surrogate Release Group and Incidental Take

On February 2, 2015, CNFH released the third spring-run Chinook salmon surrogate

hatchery group of approximately 83,100 late fall-run Chinook salmon into Battle Creek (Table 1, pg. 28). There were no spring surrogates salvaged at Delta fish facilities this year from this group.

Fry/Smolt Chinook Salmon Loss

The combined expanded loss of fry/smolt Chinook salmon salvaged between October 2014 and July 2015 was approximately 96 (Figure 6, pg. 19). Using the Delta Model length-at-date criteria, DWR and Reclamation defined fry/smolts as all non-clipped Chinook salmon smaller than the minimum winter-run length-at-date criteria. The Delta Model categorizes two different brood years of winter-run Chinook salmon in July. For this month, DWR and Reclamation used the minimum winter-run length-at-date criteria for the older brood year.

Similar to 2012/2013, most of the fry/smolt Chinook loss occurred during mid-April. However, unlike previous years, fry/smolt Chinook salmon were salvaged earlier in the season starting mid-February. The annual loss in 2014/2015 was still notably low when compared to the last nine water years (Figure 7, pg. 20), particularly to 2010/2011, where the annual loss was at 86,781 from October to July. Interestingly, the annual loss increased during 2012/2013 from 2011/2012, but substantially decreased in 2013/2014 from 2012/2013 when the loss was about 11,147 and continued to substantially decrease in the year 2014/2015.

Chinook Salmon Monitoring in the Sacramento River and the Delta

The Delta Juvenile Fish Monitoring Program (DJFMP) conducted by USFWS operates under the auspices of the Interagency Ecological Program (IEP). The DJFMP has been conducting juvenile salmon monitoring in the Delta since the early 1970s with the goals of gaining information on potential management actions that could improve the survival of juvenile salmon rearing and migrating through the Delta. The second goal is to document non-salmonid temporal and spatial distributions. For the USFWS Sacramento River and Delta surveys, DWR and Reclamation separated non-clipped older juvenile Chinook salmon from fry/smolts using the Frank Fisher Model. The Frank Fisher Model categorizes two different brood years of winter-run Chinook salmon in July and August. DWR and Reclamation used the minimum length of the dominant brood year of a reporting period for categorizing older juveniles and fry/smolts.

Spring-Run Chinook Salmon Surrogate Monitoring

The USFWS conducted a midwater and Kodiak trawl survey on the Sacramento River

at Sherwood Harbor to gauge the relative abundance and timing of juvenile Chinook salmon entering the Delta. USFWS recovered 7 surrogates from the first surrogate release, 0 surrogates from the second release group, and 1 surrogate from the third release group (Figure 7, pg. 20). The number of recovered surrogates was higher than the previous year. The surrogate catch occurred during mid-December of 2014, which coincided with the catch of older juvenile Chinook salmon at the Sacramento trawl.

In addition, a midwater trawl survey was conducted at Chipps Island, which is the most downstream trawl survey location in the legal Delta. USFWS recovered surrogates at Chipps Island for a catch of 6 surrogates from the first surrogate release, a total of 17 from the second surrogate release in February, and 9 surrogates for the third surrogate release. The timing of recoveries at Chipps Island for all three surrogate releases was consistent with the timing of older juvenile Chinook salmon catch at Chipps Island. The number of recovered surrogates was significantly higher at Chipps Island than the previous year.

Hatchery Winter-Run Chinook Salmon Monitoring

Recoveries of hatchery winter-run Chinook salmon from LSNFH in the Delta monitoring trawls and Chipps Island were higher than 2013/2014. Between early February and April of 2015, the USFWS recovered 84 hatchery winter-run Chinook salmon from LSNFH in the Sacramento trawl and 40 of those were recovered on February 9, 2015. A total of 80 hatchery winter-run Chinook salmon from LSNFH were recovered in the Chipps Island midwater trawl (Figure 8, pg. 21).

Overall recoveries were significantly higher than previous water years where USFWS caught 13 hatchery winter-run Chinook salmon in the Sacramento Trawls and 17 hatchery winter run from LSNFH at Chipps Island trawls. Unlike previous years, there was not a noteworthy coincidence between the timing of recovery for LSNFH, which coincided with older juvenile Chinook salmon collected at that location.

Central Valley Steelhead

Steelhead Incidental Take

Between October 2014 and July 2015, greater than 81% of the non-clipped steelhead salvage occurred at the SWP. This differs from 2013/2014 where greater than 79% of the non-clipped steelhead salvage occurred at the CVP. For non-clipped steelhead, the CVP salvaged a total of 8 and the SWP salvaged a total of 35, with the most salvage occurring in April and May at the CVP and in February and April at the SWP (Figure 13, pg. 24). However, DWR and Reclamation did not exceed any steelhead loss triggers

from January to June 2015 for more restrictive Old and Middle River flow limits (Figure 9). The daily steelhead loss triggers were calculated by multiplying combined exports in TAF on a given day by either 8 fish/TAF or 12 fish/TAF. The overall seasonal salvage for hatchery steelhead was extremely low compared to the data from the past nine water years (Figure 14, pg. 23).

The SWP and CVP total expanded salvage of non-clipped steelhead was approximately 43 and remained well below the incidental take level of 3,000 fish for the water year (Figure 9, pg. 22). The annual salvage of non-clipped steelhead for 2014/2015 significantly decreased from 2013/2014, which was 185 (Figure 9, pg. 22). A similar trend was observed in the previous year when compared to 2012/2013 non-clipped salvage data for steelhead.

The SWP and CVP Salvage of hatchery (adipose fin clipped) steelhead increased in 2013/2014 compared to the previous year. From October 2014 to July 2015, the CVP salvaged a total of 116 and the SWP salvaged a total of 407 for a combined total annual salvage of 523 steelhead (Figure 10, pg. 22). Overall Salvage of hatchery steelhead was higher than the 2013/2014 total of 230 steelhead. However, hatchery steelhead salvage at CVP has decreased in 2014/2015 and increased by greater than 80% at SWP compared to 2013/2014. The overall seasonal salvage for hatchery steelhead was higher compared to the data from the past nine water years (Figure 12, pg. 23).

Green Sturgeon Incidental Take

The incidental take level for green sturgeon is set at 74 fish for the water year and is based on historical salvage. Similar to 2012/2013 and 2013/2014, no green sturgeon was salvaged at the Delta fish facilities between October and July in 2014/2015. The last salvage of green sturgeon was observed in 2010/2011 (Figure 14).

Accidental Mortality

On February 10, 2015, a dead juvenile green sturgeon was spotted in one of the holding tanks at the SWP. It is not considered salvage as it was not recovered in a count. It was measured 670mm fl. DWR reported the incident to DOSS and asked for guidance. Per the guidance from NMFS via DOSS, the carcass was frozen and taken to the onsite laboratory for tissue sampling and further inspection.

Delta Hydrology

Water Year 2015 marked the fourth consecutive year of California's drought. The California Department of Water Resources measured Sierra snowpack at 5% of average for April 1, 2015. Followed by record heat for the month of June, however, Californians still managed to reduce their water usage by 27.3% exceeding the 25%

reduction in water use mandate implemented on April of 2015 (Figure 15, pg. 26)

More information on drought can be found on http://ca.gov/drought/.

Overall, average exports for Sacramento River and San Joaquin River were both less in 2014/2015 than they were for 2012/2013. For water year 2015, the Sacramento Valley was classified as a “critical” water year type and the San Joaquin Valley was classified as a “critical” water year type as well. Table 3 on page 30 is a monthly average summary of SWP and CVP exports, Sacramento and San Joaquin River flows, and Delta outflow.

In addition, modeled volumetric water fingerprints derived from the Delta Simulation Model 2 (DSM2) at Clifton Court Forebay (SWP) and at the Jones Pumping Plant (CVP) are presented in Figure 16 and 17. Overall, these fingerprints show that the majority of the water from the SWP typically came from the Sacramento River. Last year the water at CVP was evenly split between Sacramento and the San Joaquin River, but this year slightly more water was from the Sacramento River.

References

Anderson, J.J., J.A. Gore, R.T. Kneib, M.S. Lorang, J.M. Nestler, and J. Van Sickle. 2013. Report of the 2013 Independent Review Panel on the Long-term Operations Biological Opinions (LOBO) Annual Review. Prepared for the Delta Science Program.

[DFW] California Department of Fish and Wildlife. 2013. Chinook Salmon Loss Estimation for Skinner Delta Fish Protective Facility and Tracy Fish Collection Facility. Protocol. Stockton, California.

[DWR and Reclamation] California Department of Water Resources and U.S. Bureau of Reclamation. 2012. 2011/2012 Salmonid and Green Sturgeon Incidental Take and Monitoring Report. West Sacramento, California.

[DWR and Reclamation] California Department of Water Resources and U.S. Bureau of Reclamation. 2013. 2012/2013 Salmonid and Green Sturgeon Incidental Take and Monitoring Report. West Sacramento, California.

[DWR and Reclamation] California Department of Water Resources and U.S. Bureau of Reclamation. 2013. 2013/2014 Salmonid and Green Sturgeon Incidental Take and Monitoring Report. West Sacramento, California.

[CFS] Cramer Fish Sciences. 2013. Alternative Loss Calculation: Sensitivity Analysis. Lacey, Washington.

Dekar, M., P. Brandes, J. Kirsch, L. Smith, J. Speegle, P. Cadrett, and M. Marshall. 2013. Background Report Prepared for Review by the IEP Science Advisory Group, June 2013. U.S. Fish and Wildlife Service. Lodi, California.

[DOSS] Delta Operations for Salmonids and Sturgeon Technical Working Group. 2011. Annual Report of Activities October 1, 2010, to September 30, 2011.

[DOSS] Delta Operations for Salmonids and Sturgeon Technical Working Group. 2013. Annual Report of Activities October 1, 2010, to September 30, 2013.

[DOSS] Delta Operations for Salmonids and Sturgeon Technical Working Group. 2014. Annual Report of Activities October 1, 2013, to September 30, 2014.

[DOSS] Delta Operations for Salmonids and Sturgeon Technical Working Group. 2014. Annual Report of Activities October 1, 2013, to September 30, 2015.

Hassrick, J., and S. Hayes. Unpublished Data. Survival of Migratory Patterns of Juvenile Winter-run Chinook Salmon in the Sacramento River, Delta, and San Francisco Bay. Results of the first year acoustic tag study.

Jahn, A., and P. Smith. 1987. Effects of sample size and contagion on estimating fish egg abundance. CalCOFI Reports 28:171-177.

Jahn, A. 2011. An Alternative Technique to Quantify the Incidental Take of Listed Anadromous Fishes at the Federal and State Water Export Facilities in the San Francisco Bay-Delta Estuary. Ukiah, California.

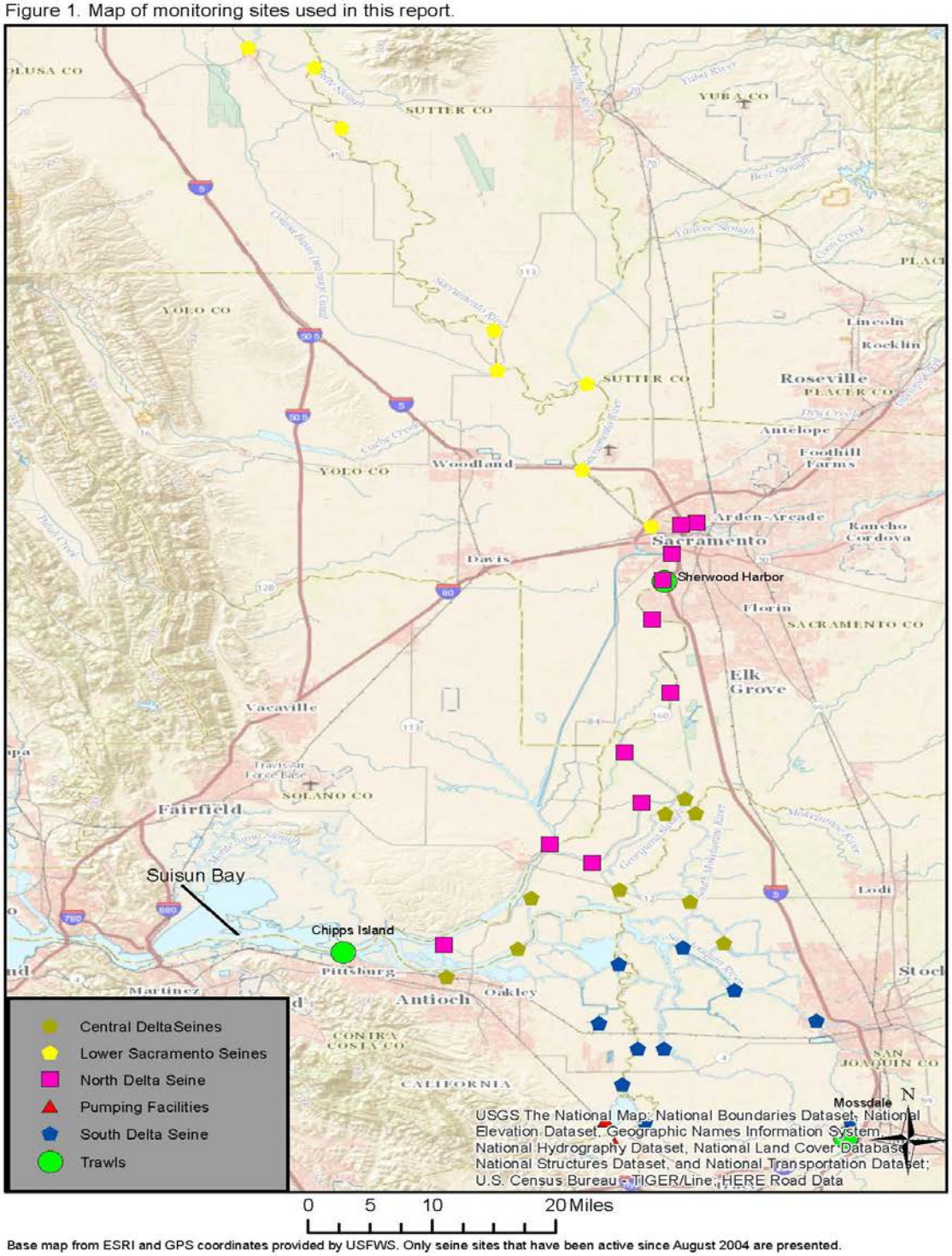
Michel, C.J., A.J. Ammann, S.T. Lindley, P.T. Sandstrom, E.D. Chapman, H.E. Fish, M.J. Thomas, G.P. Singer, P. Klimley, and B. MacFarlane. Unpublished Draft. Chinook Salmon (*Oncorhynchus tshawytscha)* Outmigration Survival between Wet and Dry Years in California's Sacramento River.

[NMFS] National Marine Fisheries Service. 2009. Biological Opinion and Conference Opinion on the Proposed Long-term Operations of the Central Valley Project and State Water Project. Long Beach, California.

Rea, M. 2015. Letter to Mr. Ron Milligan of the Bureau of Reclamation on the juvenile winter-run Chinook salmon production estimate during water year 2015.January 16, 2015. National Marine Fisheries Service. Sacramento, California.

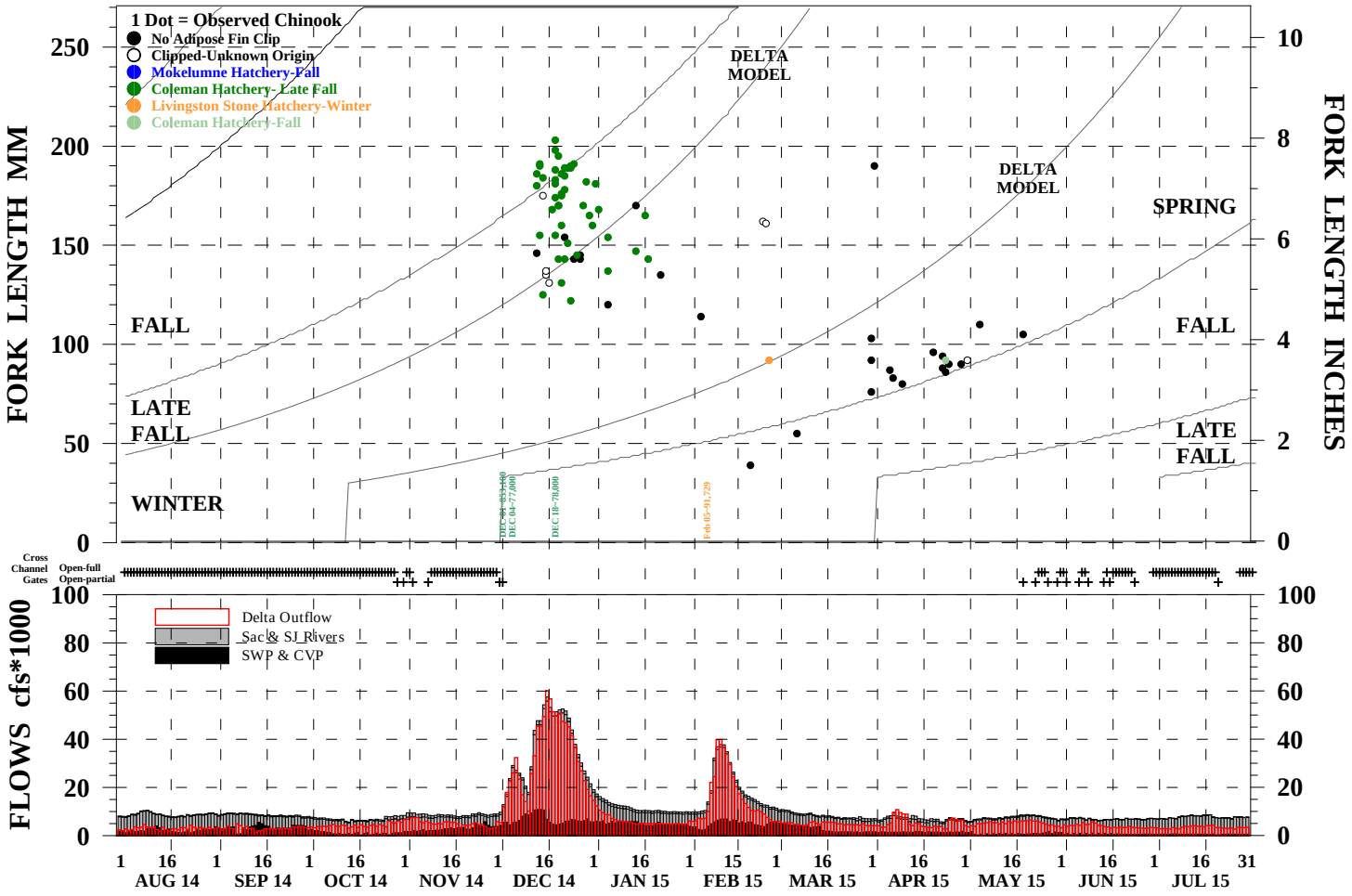
List of Figures

Figure 1. Map of monitoring sites used in this report.



Base map from ESRI and GPS coordinates provided by USFWS. Only seine sites that have been active since August 2004 are presented.

Figure 2. Observed Chinook salvage at the Delta fish facilities, with Delta hydrology August 1, 2014, through July 31, 2015. Race designation based on Delta model and CWT's



Chinook not measured for length and Chinook outside of the length-at-date criteria (Delta model) are not reported.

Figure 3. Daily loss and loss density of non-clipped winter-run length and older juvenile Chinook salmon at the Delta fish facilities using the current loss equation (DFW 2013), October 1, 2014, through June 30, 2015.

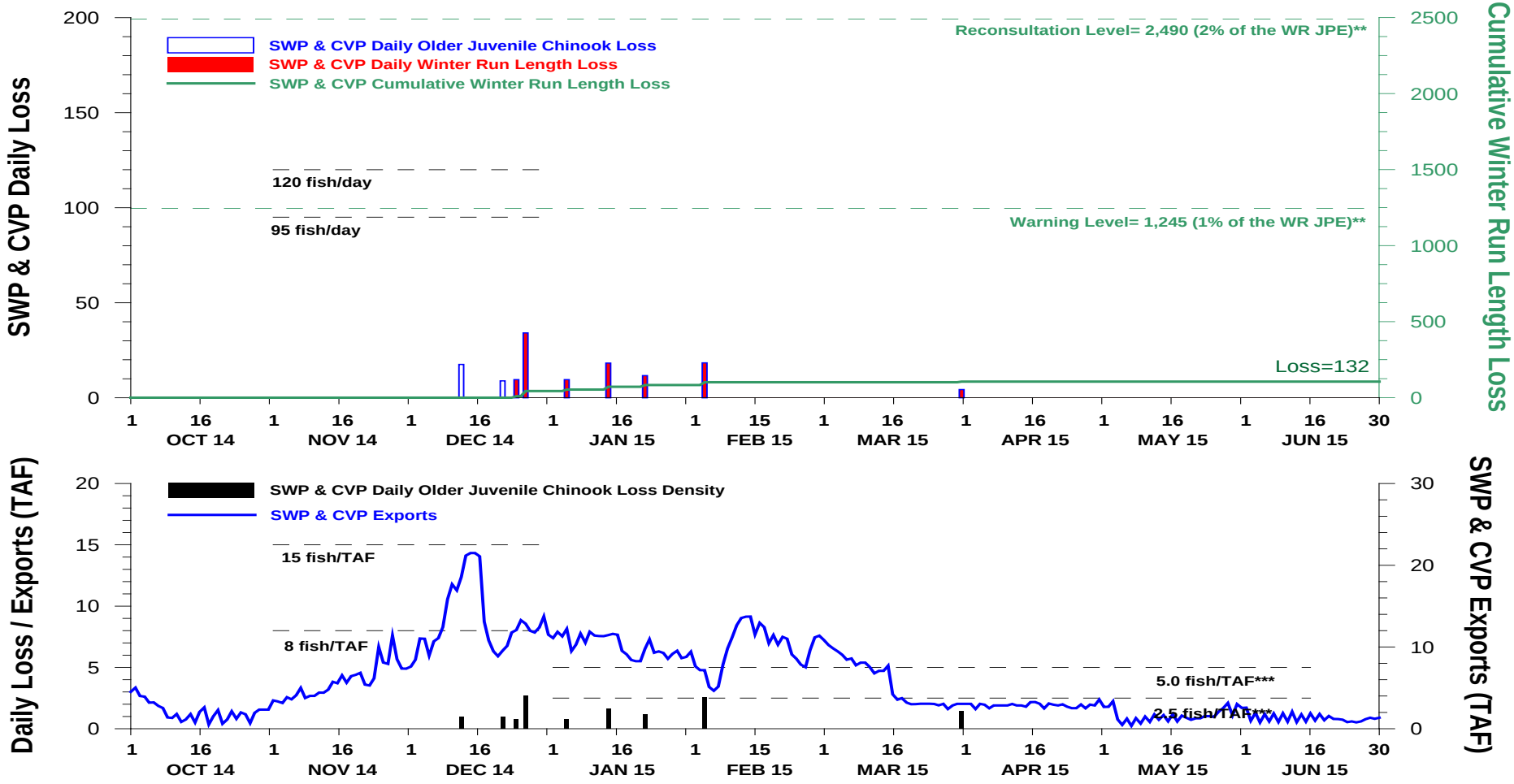


Figure 4. Non-clipped winter-run length Chinook salmon loss at the Delta fish facilities from October to June using the current loss equation (DFW 2013), water years 2006 through 2015.

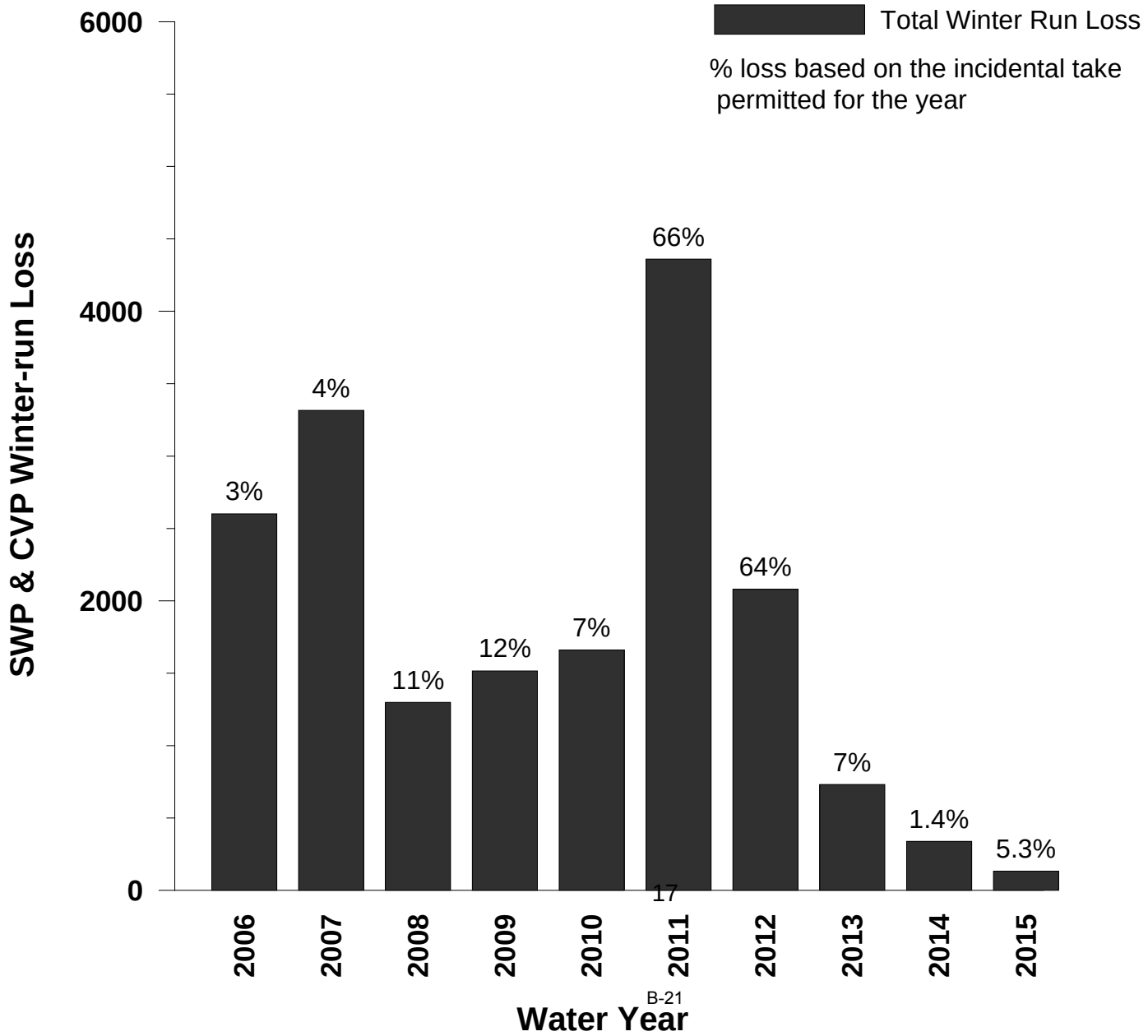


Figure 5. Daily loss and loss density of non-clipped fry/smolt Chinook salmon at the Delta fish facilities using the current loss equation (DFW 2013), October 1, 2014, through July 31, 2015.

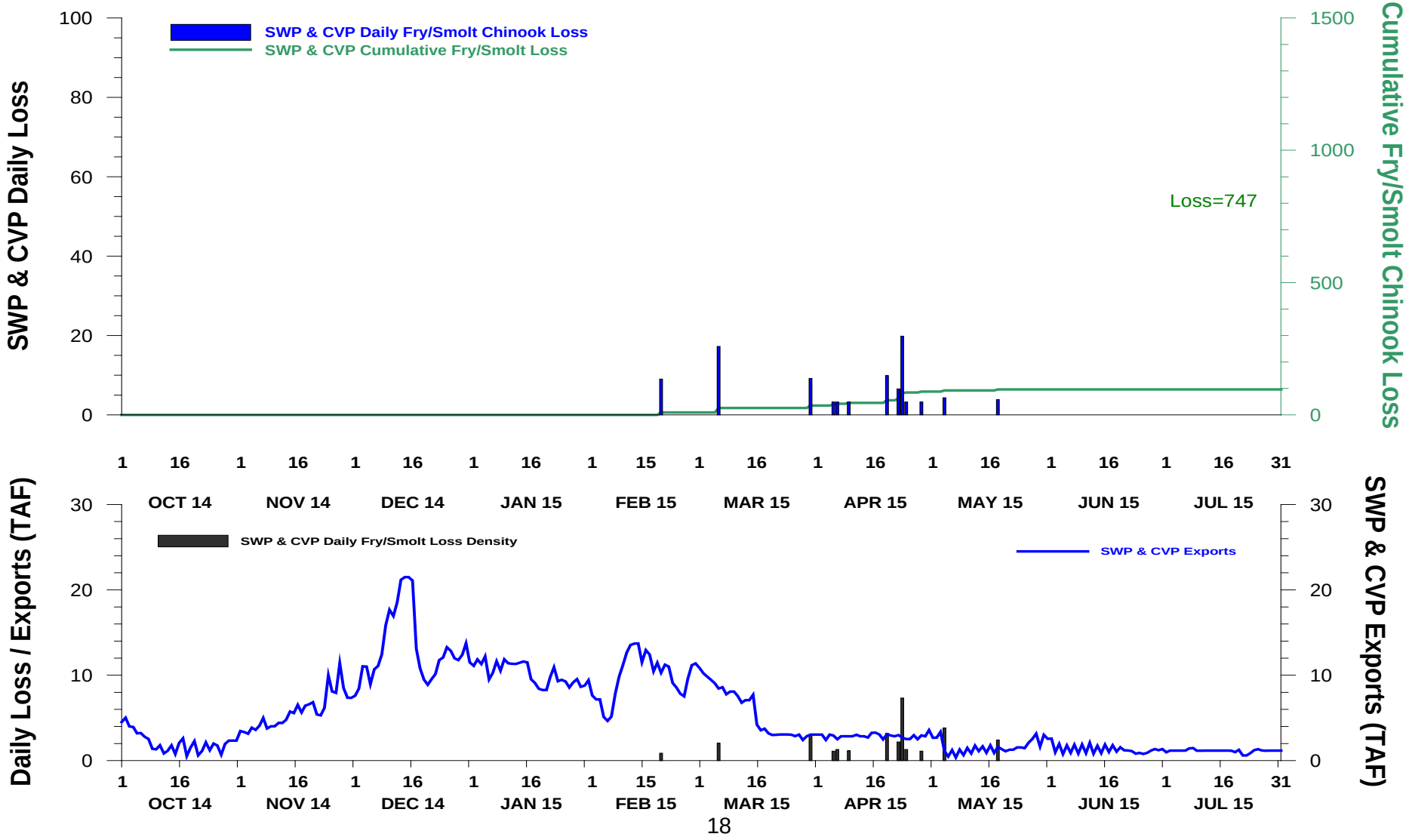


Figure 6. Non-clipped fry/smolt Chinook salmon loss at the Delta fish facilities from October to July using the current loss equation (DFW 2013), water years 2005 through 2015.

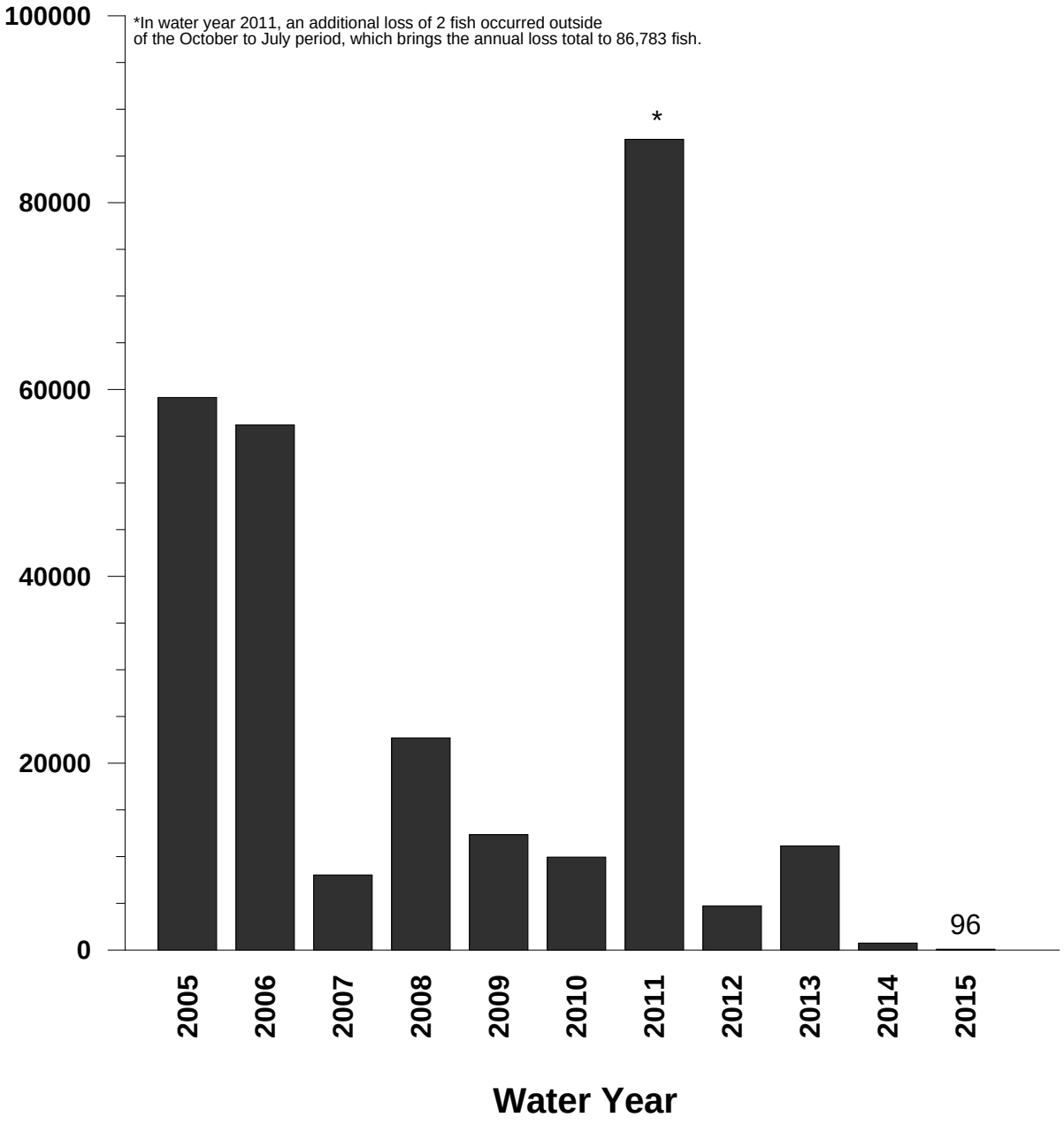


Figure 7. Older juvenile Chinook salmon and LSNFH winter-run Chinook salmon recoveries from the Delta monitoring program and loss at the Delta fish facilities, October 1, 2014, through June 30, 2015.

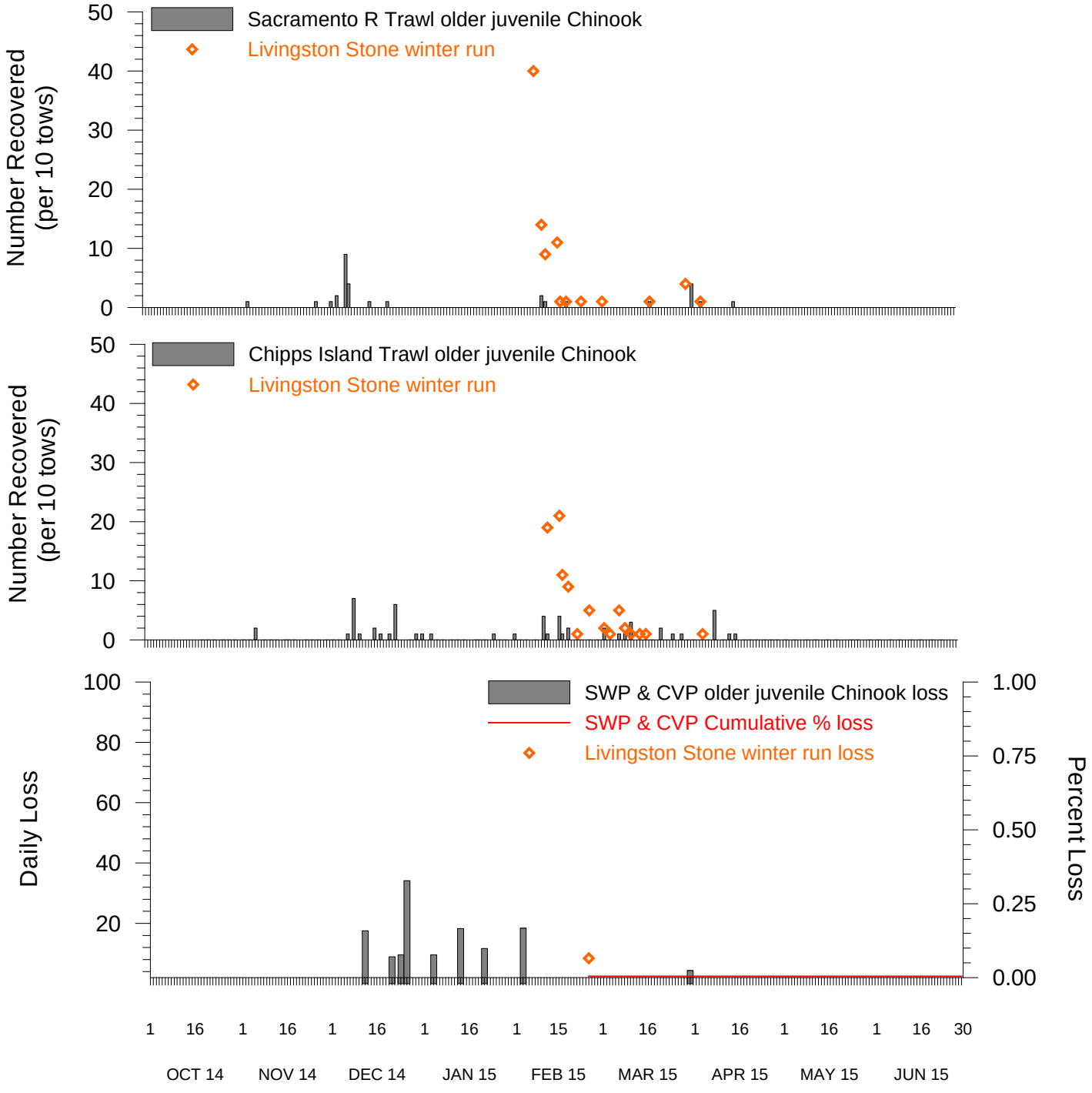


Figure 8. Older juvenile Chinook salmon and CNFH late-fall Chinook salmon (spring-run surrogate) recoveries from the Delta monitoring program and loss at the Delta fish facilities, October 1, 2014, through June 30, 2015.

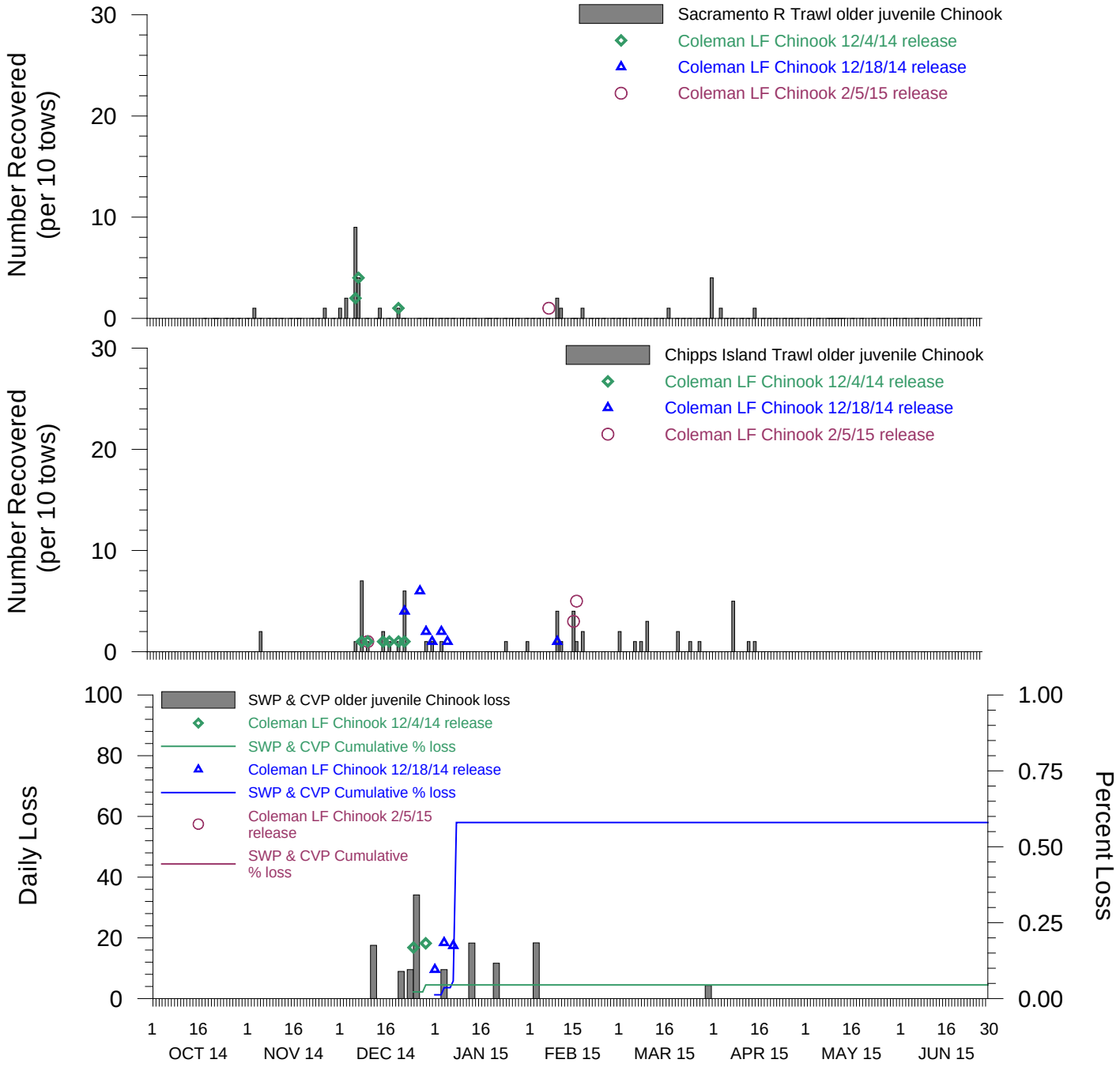


Figure 9. Non-clipped steelhead salvage at the Delta fish facilities, October 2014 through July 2015.

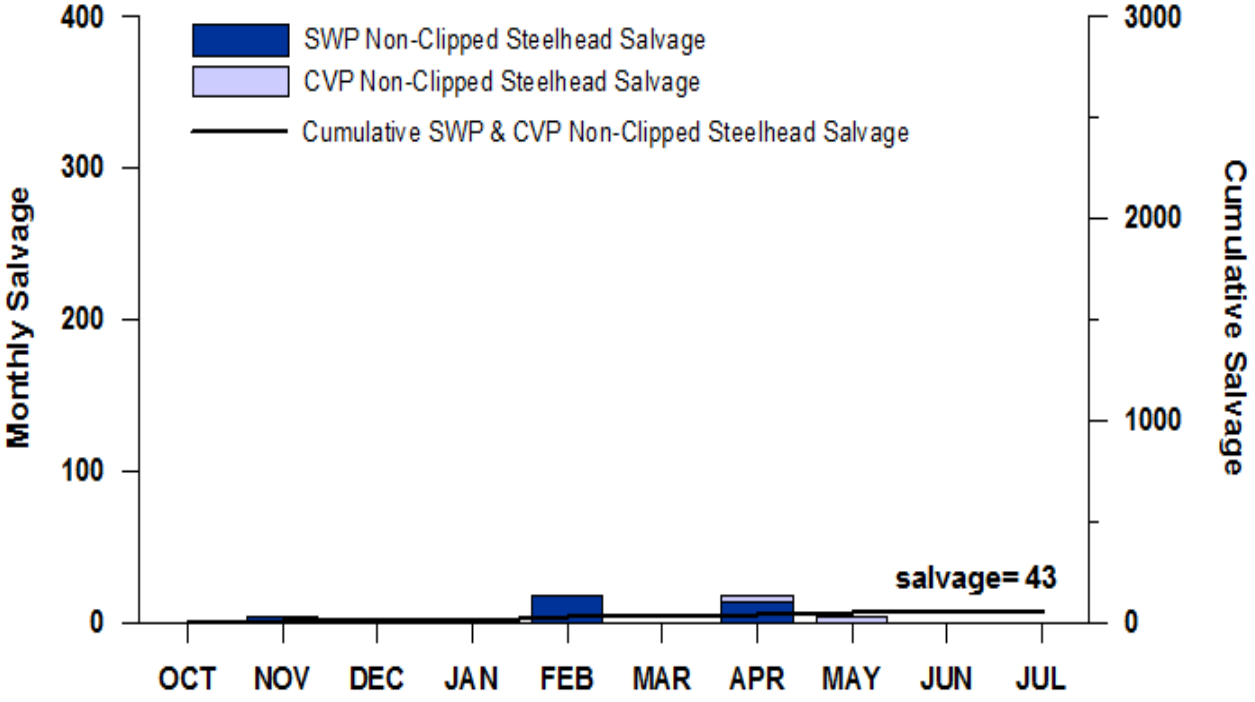


Figure 10. Hatchery (adipose fin clipped) steelhead salvage at the Delta fish facilities, October 2014 through July 2015.

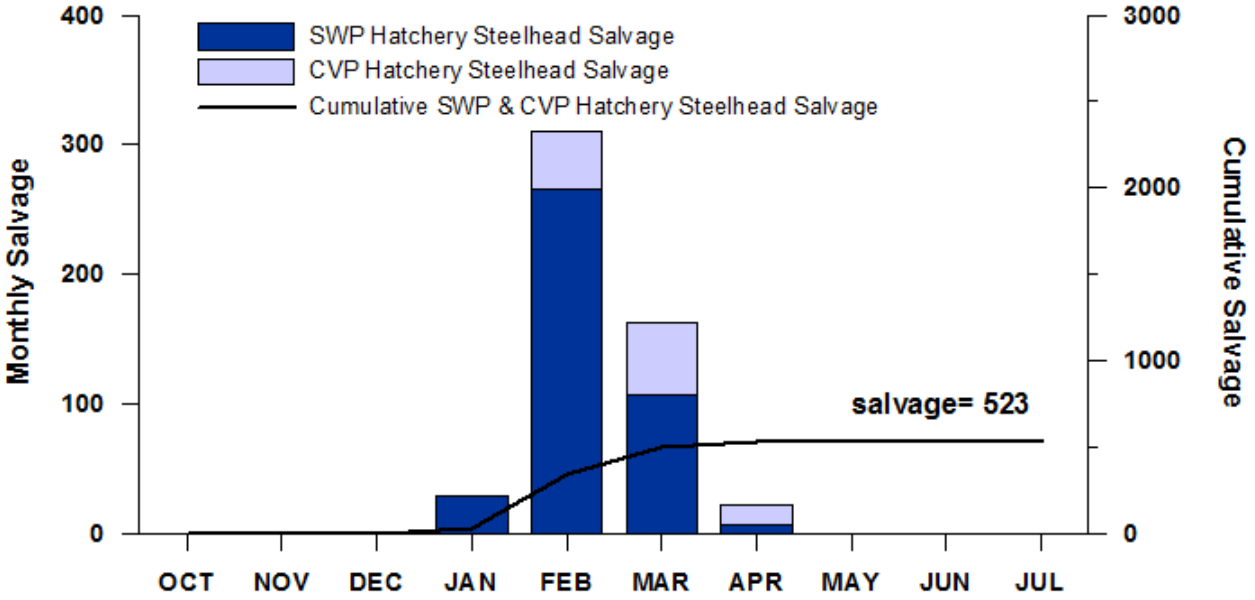


Figure 11. Non-clipped steelhead salvage at the Delta fish facilities from October to July, water years 2006 through 2015.

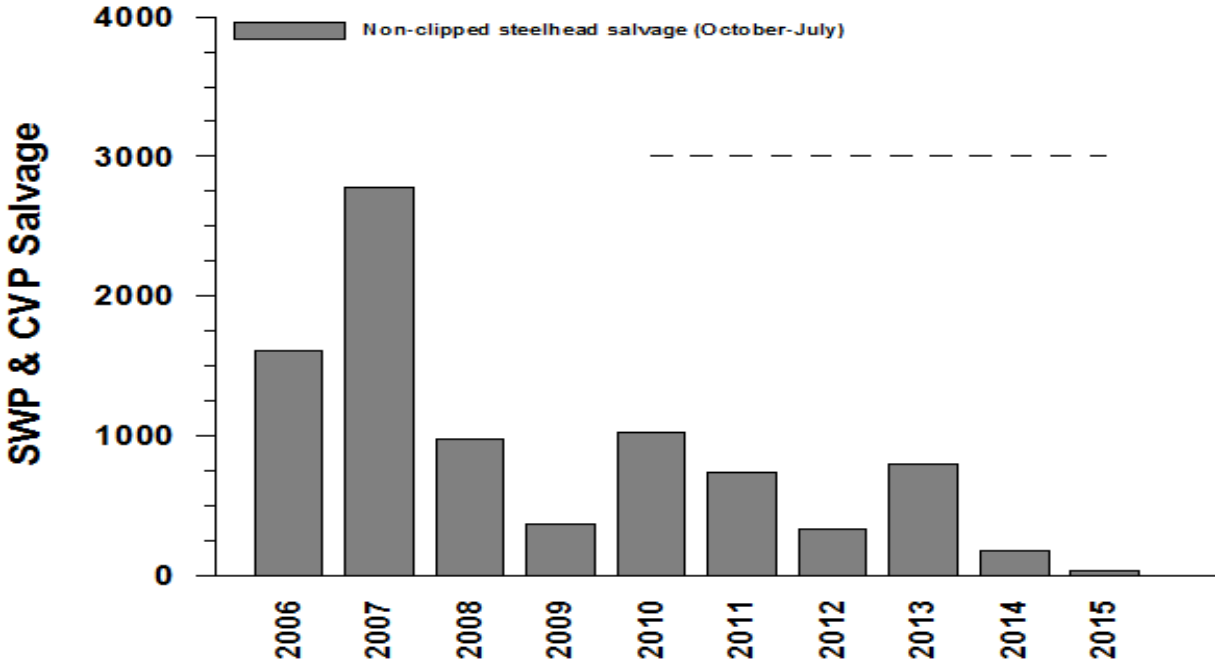


Figure 12. Hatchery (adipose fin clipped) steelhead salvage at the Delta fish facilities from October to July, water years 2006 through 2015.

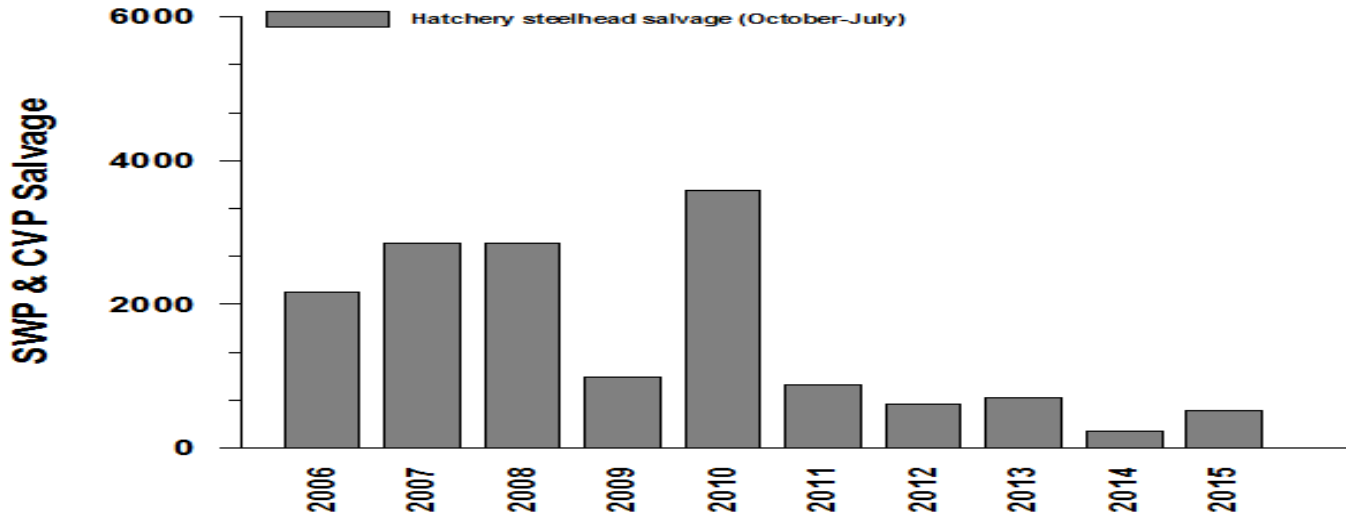


Figure 13. Daily loss and loss density of non-clipped steelhead at the Delta fish facilities using the current loss equation (DFW 2013), October 1, 2014, through July 31, 2015.

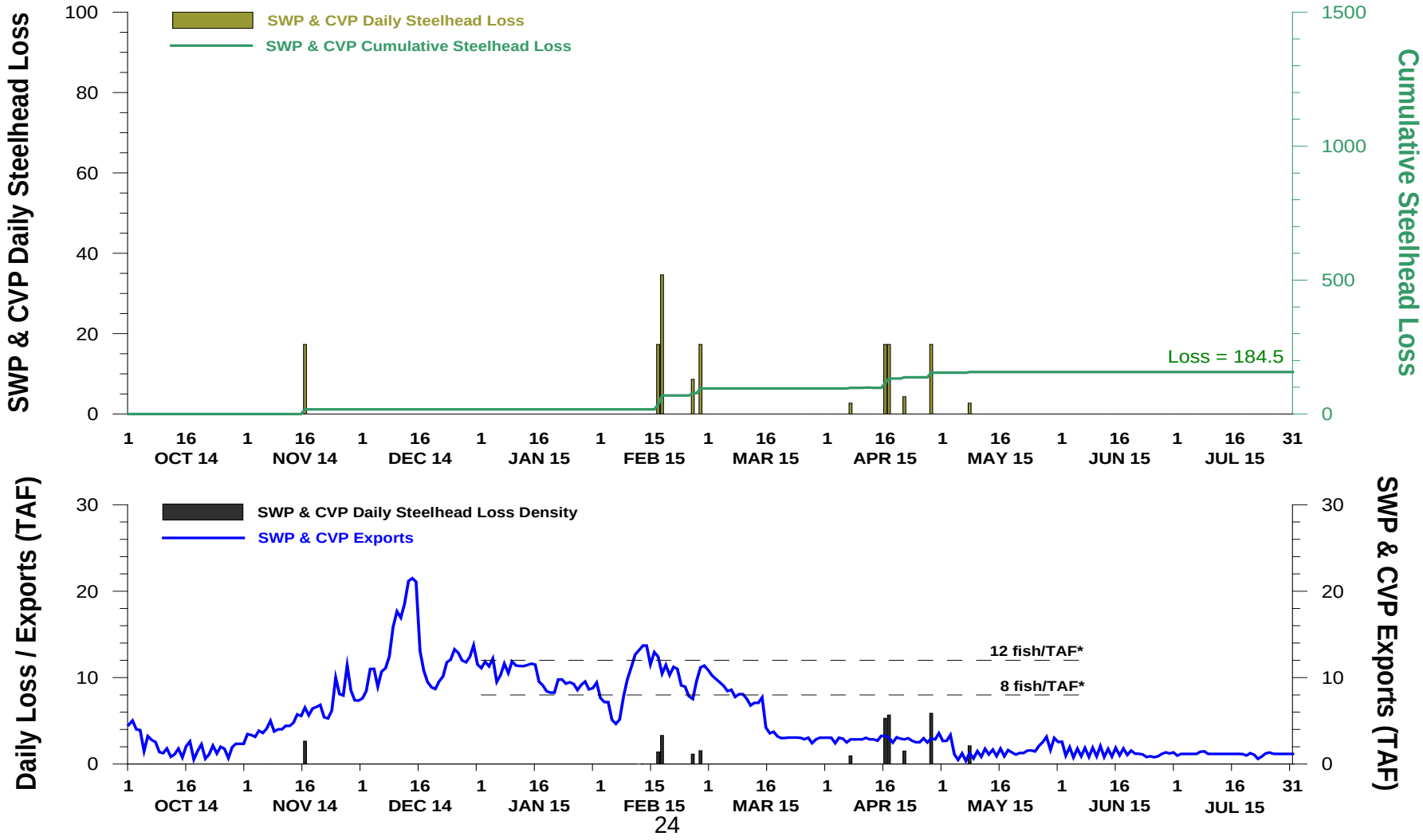


Figure 14. Green sturgeon salvage at the Delta fish facilities from October to July, water years 2006 through 2015.

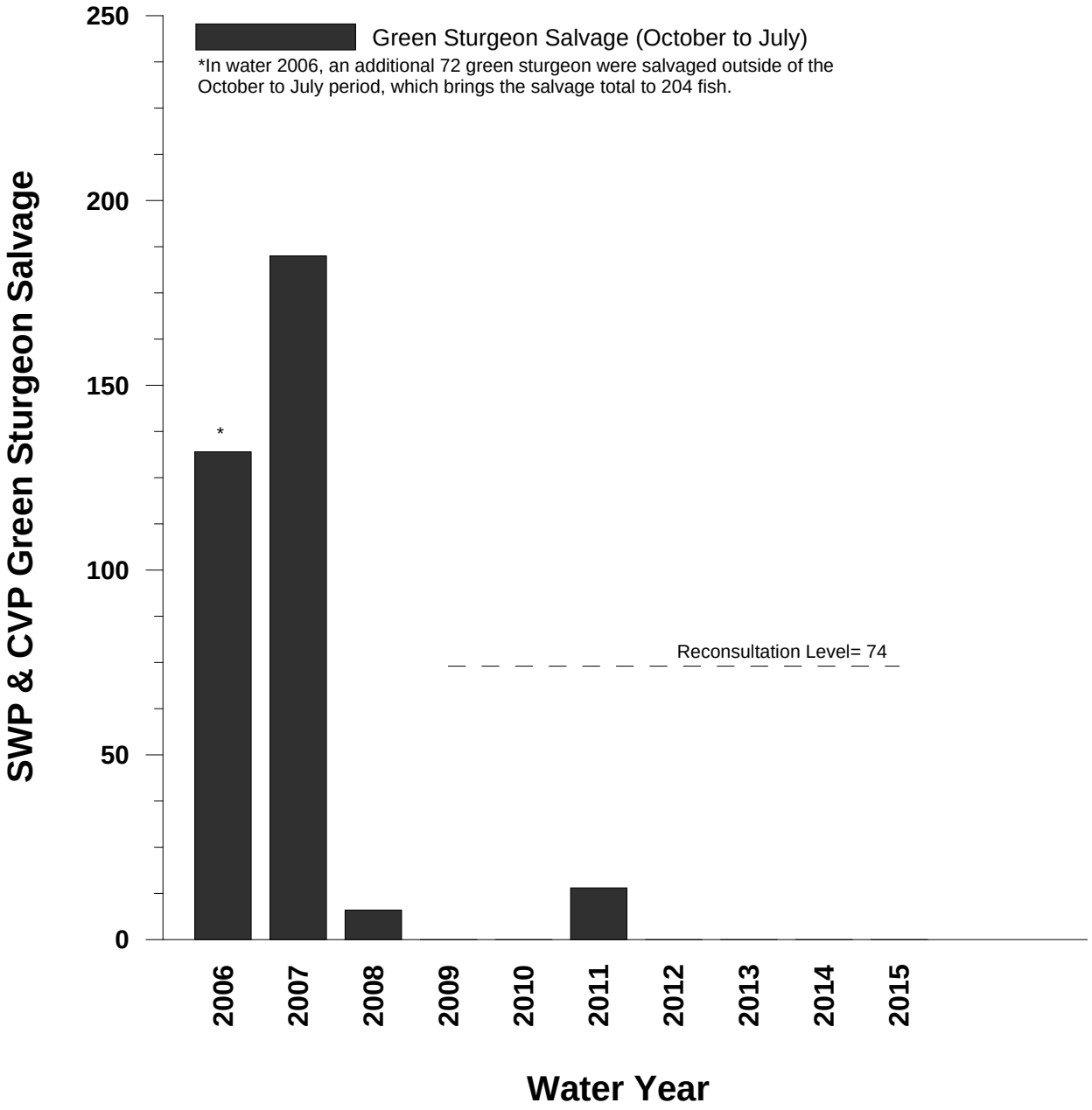


Figure15. Monthly averages of Delta hydrology from October to July, water years 2006 through 2015.

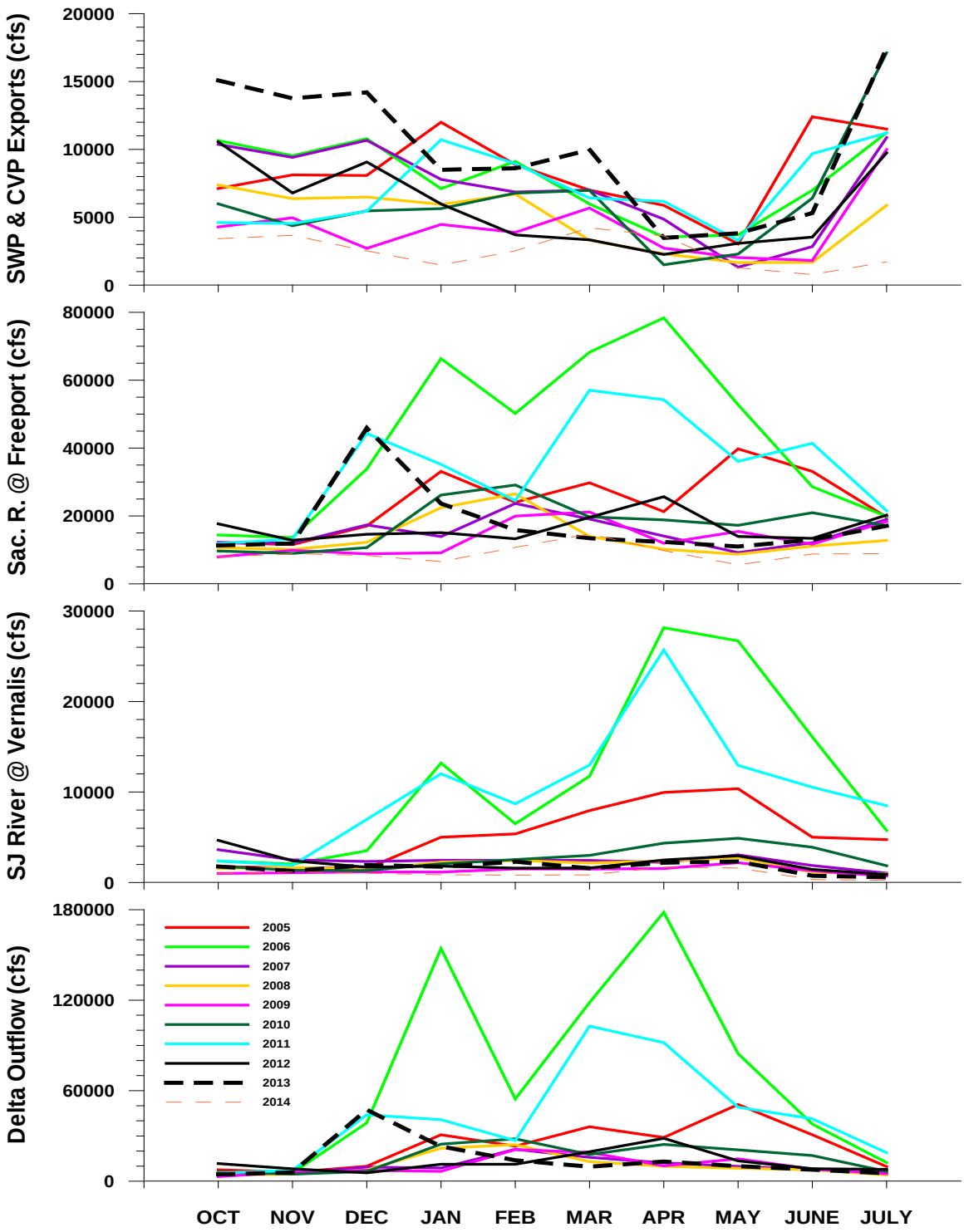


Figure 16. Modeled volumetric water fingerprint for the Clifton Court Forebay (SWP) as derived from DSM2, October 2014 through July 2015.

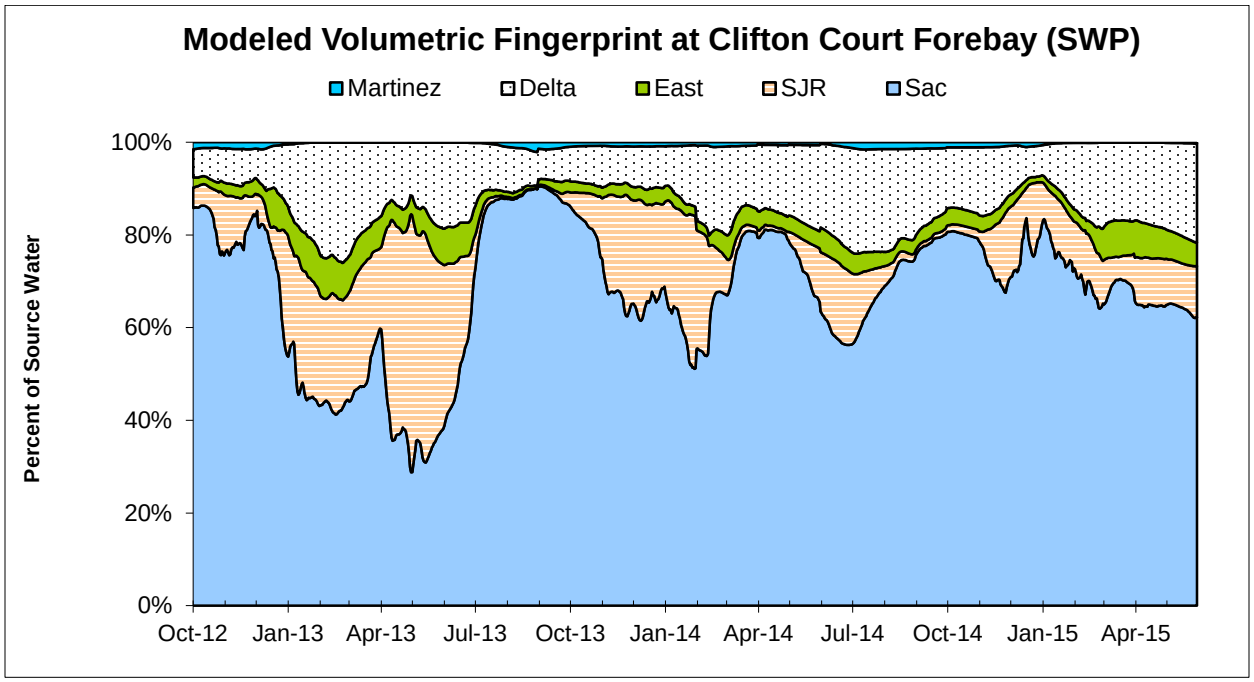
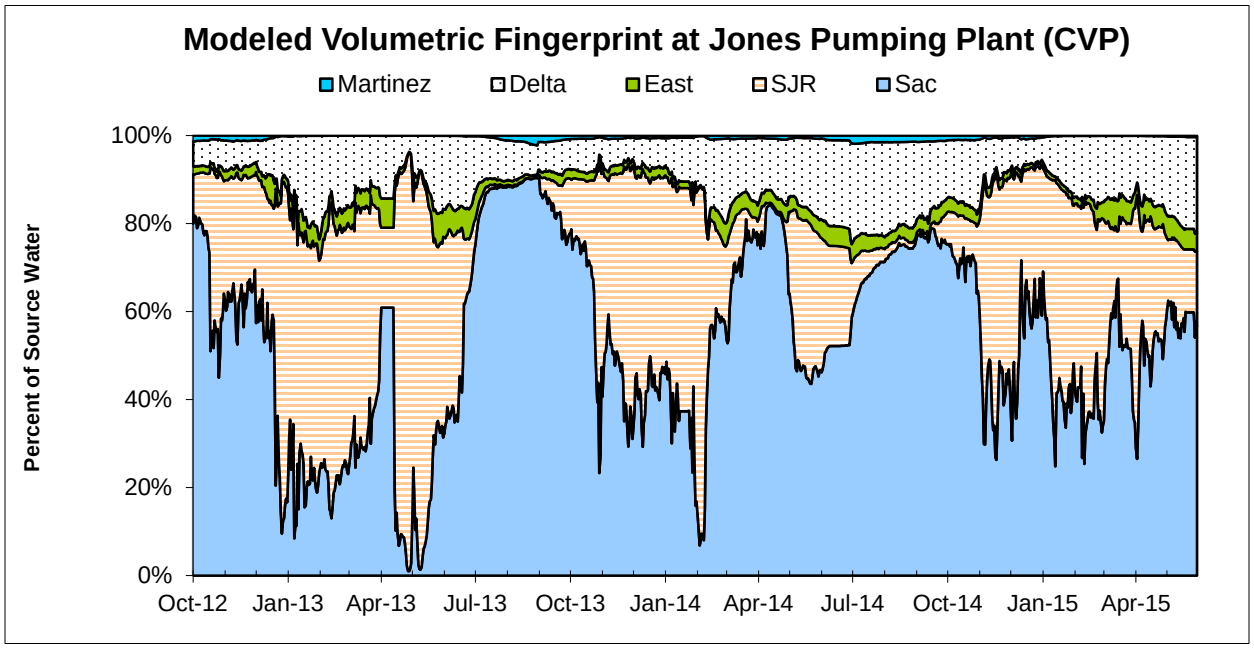


Figure 17. Modeled volumetric water fingerprint for the Jones Pumping Plant (CVP) as derived from DSM2, October 2014 through July 2015.



Delta fingerprint figures from DWR-Operations Control Office.

LIST OF TABLES

Table 1. Hatchery (adipose fin clipped) Chinook salmon loss at the Delta fish facilities using the current loss equation (DFW 2014), October 2014 through June 2015.

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]
12/1/2014	LF	Coleman NFH	Battle Creek	Production	574.59	853,100	n/a	0.067	n/a	n/a	n/a	12/12/2014	1/16/2015
12/4/2014	LF	Coleman NFH	Battle Creek	Spring Surrogate	34.98	77,000	n/a	0.045	n/a	0.5%	1.0%	12/25/2014	12/29/2014
12/18/2014	LF	Coleman NFH	Battle Creek	Spring Surrogate	45.42	78,000	n/a	0.058	n/a	0.5%	1.0%	1/1/2015	1/17/2015
2/5/2015	LF	Coleman NFH	Battle Creek	Spring Surrogate	0.00	83,100	n/a	0.000	n/a	0.5%	1.0%	*	*
2/4 - 2/6/2015	W	Livingstone NFH	Sacramento River	Production	8.40	612,056	188500	0.001	0.00004	0.5%	1.0%	2/25/2015	2/25/2015
3/25-3/31/2015	F	Coleman NFH	Rio Vista net pens	Production	3.72	942,800	n/a	n/a	n/a	n/a	n/a	2/23/2015	2/23/2015
4/2-4/3/2015	F	Coleman NFH	Rio Vista net pens	Production	0.00	109,500	n/a	0.000	n/a	0.5%	1.0%	*	*
4/10-4/19/2015	F	Coleman NFH	Rio Vista net pens	Production	0.00	1,517,900	n/a	0.000	n/a	0.5%	1.0%	*	*
4/18-4/19/2015	F	Coleman NFH	Rio Vista net pens	Production	0.00	207,350	n/a	0.000	n/a	0.5%	1.0%	*	*

SWP and CVP adipose-fin clipped Chinook lost from 10/1/2014 through 6/21/2015.

[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.

Table 2. Unknown hatchery (adipose fin clipped) Chinook salmon loss at the Delta fish facilities using the current loss equation (DFW 2014), October 2014 through June 2015.

Facility	Unknown CWT Loss[5]	Unread CWT Loss[6]	Unknown Hatchery Loss[7]	Acoustic Tag Loss[8]	Number of Unassigned CWTs[9]
SWP	18.01	0.00	0.00	17.00	0
CVP	26.62	0.00	0.00	0.00	0
TOTAL	**44.63**	**0.00**	**0.00**	**17.00**	**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.

Table 3. Monthly averages of hydrologic parameters in the Sacramento-San Joaquin River Delta, October 2014 through July 2015.

Month	SWP Average Exports taf	SWP Average Exports cfs	CVP Average Exports taf	CVP Average Exports cfs	Sacramento R. Average Flow cfs	San Joaquin R. Average Flow cfs	Delta Outflow Average Flow cfs
October	22	352	44	718	6355	611	4186
November	124	2090	48	814	7663	984	5151
December	260	4227	136	2215	33552	1282	32053
January	238	3877	77	1251	10853	931	6311
February	221	3977	56	1001	18035	870	15837
March	72	1178	104	1698	7875	636	4981
April	30	509	56	943	6308	845	5362
May	31	501	20	319	7070	399	5164
June	18	296	22	363	6716	192	4030
July	17	276	19	306	7550	131	3432

Appendix C
Feedback from DOSS to NMFS re: Increased Salvage Sampling during Drought Years

Feedback from DOSS to NMFS re:
Increased Salvage Sampling During Drought Years
December 12, 2014

In November 2014, NMFS asked DOSS to "consider and make a recommendation on whether fish salvage counts at the Tracy Fish Collection Facility and Skinner Fish Facility should be increased to a minimum 60 minutes for every 2 hours of operational time during drought years." The full request, inspired by discussions related to potential actions to include in the 2015 Drought Monitoring Plan, is provided in Attachment A.

In response to a request for clarification during the initial discussion on the 11/12/14 DOSS call, NMFS confirmed that the suggested change to salvage sampling was intended to improve confidence in the daily loss densities used for Old and Middle River (OMR) flow management per Action IV.2.3 of the NMFS Biological Opinion on Long-term Operations of the Central Valley Project (CVP) and State Water Project (SWP) (NMFS BiOp) in January through mid-June. Via discussion during DOSS calls, e-mail, offline conversations, and a DOSS subgroup meeting on 12/5/14, DOSS members have identified some advantages, disadvantages, and concerns regarding the proposed increase in salvage sampling as a means to reduce uncertainty in the estimates of daily loss density. The DOSS feedback is summarized below.

1. **Document potential benefits/pros (*e.g.*, more accurate quantification of expanded salvage and loss) or cons (*e.g.*, potential increase in incidental take and mortality) of increased sample time at the fish facilities**

Advantages:

- Increasing the count time from 30 minutes to 60 minutes for each 2-hours of the export period will reduce the un-sampled salvage period. The uncertainty of the salvage estimate is presumed to be decreased by the increased sampling, particularly when daily salvage is low and salvage is expected to be patchy over a 24-hour period.
- The salvage expansion factor associated with observing listed species in samples will be reduced similarly.

Disadvantages:

- Increased labor[1] required to collect, process (including special length measurement, marked fish, DNA, CWT, larval fish, sexual maturation, etc. sampling), and report samples. During times when operators have limited time between counts (heavy debris, incidental fish loads, and fish transport hauls) the extra labor demands may compromise the accuracy of the counts.
- Direct lethal take of delta smelt, longfin smelt and adipose-fin clipped Chinook salmon, due to mandated fish identification QC or sexual maturation, or CWT recovery, will also increase with increased sampling time.

[1] Some of the logistical disadvantages (e.g. labor, some handling stress) might be less significant if the processing (enumeration, length measurement, etc.) of salvaged fish sampling during the second 30-minute sampling time is limited to listed species only.

- Will increase known loss reporting bias[2] with adipose-fin clipped Chinook salmon.
- Acute mortality and injury associated with count collection and handling will increase for all fish species.
- Increased sampling time may increase the frequency at which the facilities encounter conditions of high incidental fish catch or extreme debris.

Concerns:

- Gain in certainty by increasing sampling may be small relative to other uncertainties associated with the estimated daily loss densities.
- Extreme debris or high incidental fish numbers are likely to reduce count times under any sampling regime.

Other:

- The specific reduction in uncertainty gained by increasing sampling to 60 minutes depends on the patchiness and overall level of daily salvage.
- There was general consensus that because of the lower pre-screen loss expansion factor, and steadier operations (steady inflow into facility from delta vs. sporadic radial gate operations at the SWP) at the CVP facility, daily loss densities might be less uncertain if most export was shifted to the CVP. Operators noted that the logistics of preferential CVP pumping were a significant challenge.
- If additional sampling is implemented; the implementation should be designed to allow a retrospective analysis of the alternative sampling regime.

2. Consider/propose the timing to initiate, and the duration of, the 60-minute counts, if appropriate

- 60 minute counts may not be feasible or appropriate during times of high debris or high incidental fish counts
- Most relevant for implementation of RPA Action IV.2.3 (OMR Management) which can affect OMR limits based on daily loss densities. If Action IV.2.3 is not controlling export operations, additional sampling may not be needed, though the additional sampling may be warranted for evaluation of potential drought management decisions.
- Coordination with FWS and DFW is necessary to determine whether or not additional sampling and resulting salvage is a concern for management of delta smelt and longfin.

3. Consider the Federal and State fish facilities implementing a test to determine whether the additional 30 minutes of sampling would significantly improve daily salvage or loss estimates.

- The results of any pilot test will likely be specific to the range of salvage, and conditions (debris, high incidental fish catch), observed during that pilot test. It may be appropriate to do multiple pilot tests under different levels of salvage and conditions, perhaps using non-target species or runs.

[2] Because the estimated loss is not adjusted to account for the sacrifice of ad-clipped fish, the current loss equation underestimates actual loss of ad-clipped fish.

ATTACHMENT A:

Request from NMFS to DOSS for feedback on a salvage sampling increase

Monitoring Salvage at Tracy Fish Collection Facility (CVP) and Skinner Fish Facility (SWP)

The Delta Operations for Salmon and Sturgeon (DOSS) technical advisory team will convene (a subgroup) to consider and make a recommendation on whether fish salvage counts at the Tracy Fish Collection Facility and Skinner Fish Facility should be increased to a minimum 60 minutes for every 2 hours of operational time during drought years. NMFS' BiOp, RPA Action IV.4.3(1) requires sampling at the fish facilities for fish salvage counts no less than 30 minutes every 2 hours (25 percent of operational time). However, during drought years, juvenile survival throughout their freshwater life history stages is expected to decrease. Likewise, salvage of salmonids at the fish facilities may also decrease, and the 30-minute salvage counts may introduce inadvertent errors in expanded salvage (*e.g.*, fish may be salvaged during operations, but not during the 30-minute counts, therefore, underestimating expanded salvage and loss. Conversely, a single fish salvaged during the 30-minute count when there is no other salvage for the rest of the 2-hour time period may overestimate expanded salvage and loss.). During the discussions and associated recommendations, the DOSS technical advisory team should:

- document potential benefits/pros (*e.g.*, more accurate quantification of expanded salvage and loss) or cons (*e.g.*, potential increase in incidental take and mortality) of increased sample time at the fish facilities;
- consider/propose the timing to initiate, and the duration of, the 60-minute counts, if appropriate; and
- consider the Federal and State fish facilities implementing a test to determine whether the additional 30 minutes of sampling would significantly improve daily salvage or loss estimates.

Appendix D
Old and Middle River Flows

Old and Middle River Flow (OMR)

Preliminary Data - Subject to Change

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

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	Index	Mean Daily	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
10/1/2014							
10/2/2014							
10/3/2014							
10/4/2014							
10/5/2014							
10/6/2014							
10/7/2014							
10/8/2014							
10/9/2014							
10/10/2014							
10/11/2014							
10/12/2014							
10/13/2014	-1179	-1420			-1180		
10/14/2014	-1372	-1650			-1370		
10/15/2014	-846	-160			-850		
10/16/2014	-1257	-420			-1260		
10/17/2014	-1516	-810	-890		-1520	-1230	
10/18/2014	-634	-740	-760		-630	-1120	
10/19/2014	-1216	-1060	-640		-1220	-1090	
10/20/2014	-1443	-990	-800		-1440	-1210	
10/21/2014	-694	-180	-760		-690	-1100	
10/22/2014	-1156	-630	-720		-1160	-1030	
10/23/2014	-1381	-1080	-790		-1380	-1180	
10/24/2014	-816	-1410	-860		-820	-1100	
10/25/2014	-1150	-1060	-870		-1150	-1040	
10/26/2014	-1418	-360	-910	-850	-1420	-1180	-1150
10/27/2014	-552	-200	-820	-770	-550	-1060	-1100
10/28/2014	-881	-540	-710	-690	-880	-960	-1070
10/29/2014	-1033	0			-1030	-1010	-1080
10/30/2014	-991	0			-990	-970	-1060
10/31/2014	-957	0			-960	-880	-1020
11/1/2014	-1375	0			-1370	-1050	-1080
11/2/2014	-1405	0			-1400	-1150	-1090
11/3/2014	-1680	0			-1680	-1280	-1110
11/4/2014	-1695	0			-1690	-1420	-1180
11/5/2014	-1716	0			-1720	-1570	-1220
11/6/2014	-1998	-1910			-2000	-1700	-1260
11/7/2014	-1829	-1820			-1830	-1780	-1330
11/8/2014	-1404	-1440			-1400	-1730	-1350
11/9/2014	-1911	-1880			-1910	-1770	-1390
11/10/2014	-1948	-2270	-1870		-1950	-1820	-1490

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	Index	Mean Daily	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
11/11/2014	-1956	-1600	-1800		-1960	-1810	-1560
11/12/2014	-1993	-900	-1620		-1990	-1840	-1630
11/13/2014	-2481	-1400	-1610		-2480	-2060	-1740
11/14/2014	-2956	-2050	-1640		-2960	-2270	-1880
11/15/2014	-2668	-1120	-1410		-2670	-2410	-1970
11/16/2014	-3013	650	-960		-3010	-2620	-2090
11/17/2014	-3001	-500	-890		-3000	-2820	-2180
11/18/2014	-3115	-2840	-1170		-3110	-2950	-2280
11/19/2014	-2823	-3030	-1370	-1580	-2820	-2920	-2360
11/20/2014	-2352	-2490	-1640	-1620	-2350	-2860	-2390
11/21/2014	-2810	-2520	-2280	-1670	-2810	-2820	-2460
11/22/2014	-2803	-2530	-2680	-1750	-2800	-2780	-2560
11/23/2014	-2754	-2020	-2520	-1760	-2750	-2710	-2620
11/24/2014	-3401	-2910	-2490	-1800	-3400	-2820	-2720
11/25/2014	-3687	-3480	-2690	-1940	-3690	-3090	-2850
11/26/2014	-3999	-3800	-2950	-2150	-4000	-3330	-2990
11/27/2014	-4044	-4180	-3280	-2350	-4040	-3580	-3100
11/28/2014	-3771	-4430	-3760	-2520	-3770	-3780	-3160
11/29/2014	-3312	-3370	-3850	-2680	-3310	-3760	-3210
11/30/2014	-3316	-2560	-3670	-2900	-3320	-3690	-3230
12/1/2014	-3328	-2840	-3480	-3070	-3330	-3550	-3250
12/2/2014	-3754	-3510	-3340	-3120	-3750	-3500	-3300
12/3/2014	-4175	0			-4180	-3580	-3390
12/4/2014	-4603	0			-4600	-3840	-3550
12/5/2014	-4598	0			-4600	-4090	-3680
12/6/2014	-4756	0			-4760	-4380	-3820
12/7/2014	-4721	0			-4720	-4570	-3960
12/8/2014	-5180	-4930			-5180	-4770	-4090
12/9/2014	-7480	-5990			-7480	-5350	-4360
12/10/2014	-8234	-7710			-8230	-6070	-4660
12/11/2014	-8416	-8490			-8420	-6810	-4970
12/12/2014	-8936	-6080	-6640		-8940	-7650	-5340
12/13/2014	-9638	-6710	-7000		-9640	-8540	-5800
12/14/2014	-9047	-8010	-7400		-9050	-8850	-6200
12/15/2014	-8271	-8290	-7520		-8270	-8860	-6560
12/16/2014	-5894	-6090	-7040		-5890	-8360	-6710
12/17/2014	-5048	-3380	-6500		-5050	-7580	-6770
12/18/2014	-4160	-3180	-5790		-4160	-6480	-6740
12/19/2014	-3787	-3470	-4880		-3790	-5430	-6680
12/20/2014	-3831	-3040	-3830		-3830	-4540	-6620
12/21/2014	-3867	-2710	-3160	-5580	-3870	-4140	-6560
12/22/2014	-4440	-3010	-3080	-5440	-4440	-4020	-6500
12/23/2014	-5012	-5040	-3460	-5370	-5010	-4190	-6330
12/24/2014	-5358	-5670	-3900	-5230	-5360	-4500	-6120
12/25/2014	-5535	-3800	-4050	-4890	-5540	-4840	-5920

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	Index	Mean Daily	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
12/26/2014	-5393	-3860	-4280	-4730	-5390	-5150	-5660
12/27/2014	-5314	-3980	-4470	-4540	-5310	-5320	-5350
12/28/2014	-4965	-4340	-4330	-4280	-4960	-5310	-5060
12/29/2014	-5425	-5140	-4220	-4050	-5420	-5330	-4860
12/30/2014	-5804	-4610	-4390	-3950	-5800	-5380	-4850
12/31/2014	-5805	-4990	-4610	-4060	-5800	-5460	-4910
1/1/2015	-4990	-5450	-4910	-4220	-4990	-5400	-4970
1/2/2015	-4998	-4990	-5040	-4330	-5000	-5400	-5050
1/3/2015	-5004	-4530	-4910	-4440	-5000	-5320	-5140
1/4/2015	-4983	-4060	-4800	-4530	-4980	-5160	-5220
1/5/2015	-4990	-3870	-4580	-4600	-4990	-4990	-5260
1/6/2015	-4471	-4080	-4310	-4530	-4470	-4890	-5220
1/7/2015	-5033	-4670	-4240	-4460	-5030	-4900	-5190
1/8/2015	-5016	-4660	-4270	-4520	-5020	-4900	-5160
1/9/2015	-5128	-4300	-4320	-4550	-5130	-4930	-5140
1/10/2015	-5006	-4430	-4430	-4580	-5010	-4930	-5120
1/11/2015	-5065	-4190	-4450	-4570	-5070	-5050	-5120
1/12/2015	-5022	-4230	-4360	-4500	-5020	-5050	-5090
1/13/2015	-4967	-4760	-4380	-4520	-4970	-5040	-5030
1/14/2015	-5031	-4940	-4510	-4510	-5030	-5020	-4980
1/15/2015	-4862	-4590	-4540	-4450	-4860	-4990	-4970
1/16/2015	-4201	-4230	-4550	-4400	-4200	-4820	-4910
1/17/2015	-4043	-3610	-4430	-4330	-4040	-4620	-4840
1/18/2015	-4138	-3520	-4180	-4290	-4140	-4450	-4780
1/19/2015	-4135	-3620	-3910	-4270	-4140	-4280	-4720
1/20/2015	-4150	-3990	-3790	-4270	-4150	-4130	-4700
1/21/2015	-3955	-3430	-3630	-4180	-3960	-4080	-4620
1/22/2015	-4137	-3180	-3550	-4070	-4140	-4100	-4560
1/23/2015	-4325	-3720	-3590	-4030	-4330	-4140	-4500
1/24/2015	-4141	-3570	-3580	-3970	-4140	-4140	-4440
1/25/2015	-4070	-3580	-3500	-3930	-4070	-4130	-4370
1/26/2015	-3978	-3740	-3560	-3890	-3980	-4130	-4300
1/27/2015	-3880	-3780	-3680	-3820	-3880	-4080	-4220
1/28/2015	-3943	-3750	-3680	-3740	-3940	-4000	-4140
1/29/2015	-3967	-4150	-3800	-3700	-3970	-3970	-4080
1/30/2015	-4044	-3990	-3880	-3690	-4040	-3960	-4060
1/31/2015	-3851	-3340	-3800	-3670	-3850	-3940	-4050
2/1/2015	-2945	-2710	-3590	-3610	-2950	-3750	-3970
2/2/2015	-2950	-2380	-3310	-3520	-2950	-3550	-3880
2/3/2015	-2920	-2270	-2940	-3400	-2920	-3340	-3790
2/4/2015	-2017	-2100	-2560	-3300	-2020	-2940	-3650
2/5/2015	-2119	-2350	-2360	-3240	-2120	-2590	-3510
2/6/2015	-2109	-2270	-2270	-3140	-2110	-2420	-3350
2/7/2015	-3462	-1930	-2180	-3020	-3460	-2530	-3300
2/8/2015	-4465	-3940	-2520	-3050	-4460	-2830	-3330

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	Index	Mean Daily	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
2/9/2015	-4998	-3730	-2840	-3050	-5000	-3430	-3410
2/10/2015	-5041	-3740	-3120	-3050	-5040	-4010	-3490
2/11/2015	-5652	-5230	-3710	-3150	-5650	-4720	-3610
2/12/2015	-5937	-5970	-4520	-3280	-5940	-5220	-3750
2/13/2015	-5966	-5900	-4910	-3420	-5970	-5520	-3890
2/14/2015	-5011	-5520	-5270	-3570	-5010	-5520	-3970
2/15/2015	-5504	-5110	-5550	-3750	-5500	-5610	-4150
2/16/2015	-5513	-5110	-5520	-3940	-5510	-5590	-4340
2/17/2015	-4986	-4670	-5260	-4110	-4990	-5400	-4480
2/18/2015	-4498	-3910	-4860	-4240	-4500	-5100	-4660
2/19/2015	-4529	-3930	-4550	-4350	-4530	-5010	-4830
2/20/2015	-4507	-4300	-4380	-4500	-4510	-4810	-5000
2/21/2015	-5026	-4940	-4350	-4710	-5030	-4710	-5120
2/22/2015	-4517	-4480	-4310	-4750	-4520	-4620	-5120
2/23/2015	-3531	-3480	-4230	-4740	-3530	-4420	-5020
2/24/2015	-3513	-3250	-4090	-4700	-3510	-4220	-4910
2/25/2015	-3484	-3260	-3880	-4560	-3480	-4010	-4750
2/26/2015	-4229	-4530	-3800	-4460	-4230	-3850	-4630
2/27/2015	-4942	-5370	-3980	-4420	-4940	-3940	-4560
2/28/2015	-4952	-4470	-4180	-4340	-4950	-4220	-4550
3/1/2015	-4935	-4430	-4410	-4300	-4940	-4510	-4510
3/2/2015	-4504	-4600	-4680	-4260	-4500	-4710	-4440
3/3/2015	-4444	-4140	-4600	-4220	-4440	-4760	-4400
3/4/2015	-4484	-3960	-4320	-4220	-4480	-4660	-4400
3/5/2015	-4272	-3640	-4150	-4200	-4270	-4530	-4380
3/6/2015	-4125	-4240	-4120	-4200	-4130	-4370	-4350
3/7/2015	-4201	-4280	-4050	-4150	-4200	-4310	-4300
3/8/2015	-3768	-4110	-4050	-4130	-3770	-4170	-4240
3/9/2015	-3875	-4220	-4100	-4180	-3880	-4050	-4270
3/10/2015	-3873	-4240	-4220	-4250	-3870	-3970	-4290
3/11/2015	-3537	-3340	-4040	-4260	-3540	-3850	-4300
3/12/2015	-3676	-3470	-3880	-4180	-3680	-3750	-4260
3/13/2015	-3518	-3860	-3830	-4070	-3520	-3700	-4150
3/14/2015	-3565	-3980	-3780	-4040	-3560	-3630	-4060
3/15/2015	-3529	-3490	-3630	-3970	-3530	-3570	-3960
3/16/2015	-2418	-2500	-3460	-3820	-2420	-3340	-3810
3/17/2015	-1961	-2480	-3260	-3700	-1960	-3000	-3630
3/18/2015	-1603	-1750	-2840	-3540	-1600	-2620	-3420
3/19/2015	-1756	-1840	-2410	-3410	-1760	-2250	-3240
3/20/2015	-1649	-1700	-2050	-3230	-1650	-1880	-3070
3/21/2015	-1665	-1490	-1850	-3030	-1670	-1730	-2890
3/22/2015	-1719	-970	-1550	-2810	-1720	-1680	-2740
3/23/2015	-1709	-1410	-1480	-2610	-1710	-1700	-2580
3/24/2015	-1707	-1530	-1420	-2410	-1710	-1690	-2430
3/25/2015	-1702	-1250	-1330	-2260	-1700	-1700	-2300

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	Index	Mean Daily	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
3/26/2015	-1718	-1430	-1320	-2120	-1720	-1710	-2160
3/27/2015	-1630	-1300	-1380	-1940	-1630	-1690	-2020
3/28/2015	-1481	-840	-1270	-1710	-1480	-1650	-1870
3/29/2015	-1396	-940	-1150	-1530	-1400	-1590	-1720
3/30/2015	-1360	-1200	-1140	-1440	-1360	-1520	-1650
3/31/2015	-1367	-920	-1040	-1320	-1370	-1450	-1600
4/1/2015	-1296	-480	-870	-1230	-1300	-1380	-1580
4/2/2015	-1378	-910	-890	-1170	-1380	-1360	-1560
4/3/2015	-1438	-1510	-1000	-1150	-1440	-1370	-1540
4/4/2015	-1530	-2170	-1200	-1200	-1530	-1400	-1530
4/5/2015	-1579	-1840	-1380	-1270	-1580	-1440	-1520
4/6/2015	-1538	-2170	-1720	-1320	-1540	-1490	-1510
4/7/2015	-1798	-1960	-1930	-1350	-1800	-1580	-1520
4/8/2015	-1783	-980	-1820	-1330	-1780	-1650	-1520
4/9/2015	-1809	-1590	-1710	-1340	-1810	-1700	-1530
4/10/2015	-1792	-1810	-1700	-1380	-1790	-1740	-1540
4/11/2015	-1773	-1520	-1570	-1430	-1770	-1790	-1560
4/12/2015	-1830	-1430	-1460	-1460	-1830	-1800	-1590
4/13/2015	-1792	-1570	-1580	-1490	-1790	-1800	-1620
4/14/2015	-1603	-850	-1430	-1480	-1600	-1760	-1640
4/15/2015	-1807	-1280	-1330	-1540	-1810	-1760	-1670
4/16/2015	-1830	-2000	-1420	-1620	-1830	-1770	-1710
4/17/2015	-1853	-2330	-1600	-1680	-1850	-1780	-1740
4/18/2015	-1853	-2330	-1760	-1690	-1850	-1790	-1760
4/19/2015	-1862	-2100	-2010	-1710	-1860	-1840	-1780
4/20/2015	-1891	-1880	-2130	-1690	-1890	-1860	-1810
4/21/2015	-1857	-1490	-2030	-1650	-1860	-1860	-1810
4/22/2015	-1867	-1550	-1870	-1690	-1870	-1870	-1820
4/23/2015	-1804	-2090	-1820	-1730	-1800	-1860	-1820
4/24/2015	-1734	-1890	-1780	-1740	-1730	-1830	-1810
4/25/2015	-1721	-1210	-1650	-1710	-1720	-1800	-1810
4/26/2015	-1863	-940	-1540	-1680	-1860	-1800	-1810
4/27/2015	-1862	-1730	-1570	-1690	-1860	-1800	-1810
4/28/2015	-1959	-2050	-1560	-1780	-1960	-1830	-1840
4/29/2015	-1941	-1880	-1560	-1820	-1940	-1870	-1850
4/30/2015	-1917	-1930	-1700	-1810	-1920	-1910	-1860
5/1/2015	-1663	-2450	-2010	-1820	-1660	-1870	-1840
5/2/2015	-1480	-2220	-2100	-1810	-1480	-1790	-1820
5/3/2015	-958	-1400	-1980	-1760	-960	-1590	-1750
5/4/2015	-1288	-750	-1750	-1680	-1290	-1460	-1710
5/5/2015	-982	-1050	-1580	-1650	-980	-1270	-1650
5/6/2015	-1289	-1320	-1350	-1640	-1290	-1200	-1600
5/7/2015	-902	-1100	-1120	-1570	-900	-1080	-1540
5/8/2015	-1353	-1300	-1100	-1520	-1350	-1160	-1510
5/9/2015	-878	-1100	-1170	-1520	-880	-1080	-1450

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	Index	Mean Daily	Mean 5-Day	Mean 14-Day	Mean Daily	Mean 5-Day	Mean 14-Day
5/10/2015	-1251	-980	-1160	-1520	-1250	-1130	-1410
5/11/2015	-983	-1160	-1130	-1480	-980	-1070	-1350
5/12/2015	-1406	-1310	-1170	-1420	-1410	-1170	-1310
5/13/2015	-1104	-1310	-1170	-1380	-1100	-1120	-1250
5/14/2015	-1465	-1700	-1290	-1370	-1470	-1240	-1210
5/15/2015	-1058	-1760	-1450	-1320	-1060	-1200	-1170
5/16/2015	-1460	-1600	-1530	-1270	-1460	-1300	-1170
5/17/2015	-1049	-1450	-1560	-1280	-1050	-1230	-1180
5/18/2015	-1478	-1390	-1580	-1320	-1480	-1300	-1190
5/19/2015	-1249	-1410	-1520	-1350	-1250	-1260	-1210
5/20/2015	-1277	-1690	-1510	-1380	-1280	-1300	-1210
5/21/2015	-1284	-1270	-1440	-1390	-1280	-1270	-1240
5/22/2015	-1300	-810	-1310	-1350	-1300	-1320	-1230
5/23/2015	-1317	-1070	-1250	-1350	-1320	-1290	-1260
5/24/2015	-1314	-1210	-1210	-1370	-1310	-1300	-1270
5/25/2015	-1312	-1140	-1100	-1360	-1310	-1310	-1290
5/26/2015	-1788	-1630	-1170	-1390	-1790	-1410	-1320
5/27/2015	-1813	-1830	-1370	-1420	-1810	-1510	-1370
5/28/2015	-2070	-1900	-1540	-1440	-2070	-1660	-1410
5/29/2015	-1611	-1900	-1680	-1450	-1610	-1720	-1450
5/30/2015	-2064	-2110	-1870	-1490	-2060	-1870	-1490
5/31/2015	-1660	-1850	-1920	-1510	-1660	-1840	-1540
6/1/2015	-1643	-1010	-1750	-1490	-1640	-1810	-1550
6/2/2015	-1204	-1260	-1620	-1480	-1200	-1640	-1550
6/3/2015	-1725	-1870	-1620	-1490	-1730	-1660	-1580
6/4/2015	-1180	-1800	-1560	-1530	-1180	-1480	-1570
6/5/2015	-1675	-1810	-1550	-1600	-1680	-1490	-1600
6/6/2015	-1265	-1080	-1570	-1600	-1270	-1410	-1590
6/7/2015	-1733	-810	-1480	-1570	-1730	-1520	-1620
6/8/2015	-1263	-1140	-1330	-1570	-1260	-1420	-1620
6/9/2015	-1749	-1560	-1280	-1570	-1750	-1540	-1620
6/10/2015	-1334	-640	-1050	-1480	-1330	-1470	-1580
6/11/2015	-1884	-1250	-1080	-1430	-1880	-1590	-1570
6/12/2015	-1433	-1890	-1290	-1430	-1430	-1530	-1560
6/13/2015	-1895	-2130	-1490	-1440	-1890	-1660	-1550
6/14/2015	-1490	-1010	-1380	-1380	-1490	-1610	-1530
6/15/2015	-1869	-1050	-1470	-1380	-1870	-1710	-1550
6/16/2015	-1412	-1030	-1420	-1360	-1410	-1620	-1560
6/17/2015	-1869	-830	-1210	-1290	-1870	-1710	-1580
6/18/2015	-1431	-1620	-1110	-1270	-1430	-1610	-1590
6/19/2015	-1765	-1460	-1200	-1250	-1770	-1670	-1600
6/20/2015	-1559	-1570	-1300	-1290	-1560	-1610	-1620
6/21/2015	-1564	-1240	-1350	-1320	-1560	-1640	-1610
6/22/2015	-1588	-1080	-1390	-1310	-1590	-1580	-1630
6/23/2015	-1587	-1390	-1350	-1300	-1590	-1610	-1620

		USGS Tidally Filtered OMR*** (cfs)			OMR Index Calculation (cfs)		
Date	**Index**	**Mean Daily**	**Mean 5-Day**	**Mean 14-Day**	**Mean Daily**	**Mean 5-Day**	**Mean 14-Day**
6/24/2015	-1591	-1710	-1400	-1380	-1590	-1580	-1640
6/25/2015	-1608	-1820	-1450	-1420	-1610	-1590	-1620
6/26/2015	-1636	-2180	-1640	-1440	-1640	-1600	-1630
6/27/2015	-1688	-1820	-1780	-1420	-1690	-1620	-1620
6/28/2015	-1692	-1370	-1780	-1440	-1690	-1640	-1630
6/29/2015	-1610	-1270	-1690	-1460	-1610	-1650	-1610
6/30/2015	-1609	-1500	-1630	-1490	-1610	-1650	-1630

Appendix E
Salmon Loss-Density Table

Downloaded from: ftp://ftp.delta.dfg.ca.gov/salvage/DOSS_Salvage_Tables/

Chinook Salmon - Daily Summary Table

California Department of Fish and Wildlife - Results Subject to Revision

Prepared by Geir Aasen *Report Date:* 9/30/2015 *Report Time:* 1:00 PM

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT									
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED				RACE*		OLDER JUV LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	LENGTH (FL mm)	SIZE	CWT	DENSITY
12/12/2014	3	28	17.54**	2	7	30.80							146 - 710	LF, F, U	LF	0.94
12/13/2014				3	12	52.72							155 - 191	LF, F	LF	
12/14/2014				2	8	35.06				1	12	7.81	125 - 184	LF, F, W	LF	
12/15/2014										2	24	15.62	135 - 137	LF, W	*	
12/16/2014										1	4	3.19	131	W	*	
12/17/2014										1	4	3.19	168	LF	LF	
12/18/2014				7	26	113.96							155 - 203	F, LF	LF	
12/19/2014				4	14	61.41							143 - 195	F, LF	LF	
12/20/2014				3	8	35.11				2	8	7.04	131 - 186	LF, W	LF	
12/21/2014	1	2	8.93	4	12	54.74							143 - 189	F, LF	LF	0.94
12/22/2014				2	8	35.32							151 - 189	F, LF	LF	
12/23/2014				3	8	35.95							122 - 190	F, LF, W	LF	
12/24/2014							1	12	9.56	1	12	9.56	143 - 191	LF, W	LF	0.79
12/25/2014				1	4	16.79							145	W	LF	
12/26/2014	2	8	34.13										143 - 145	W		2.66
12/27/2014				1	2	9.15							170	LF	LF	
12/28/2014				1	4	18.11							182	LF	LF	
12/29/2014				1	4	18.19							165	LF	LF	
12/30/2014				2	16	18.21**							160 - 549	LF, U	LF	
12/31/2014										1	12	9.56	181	LF	LF	
1/1/2015										1	12	9.56	168	LF	LF	
1/4/2015				2	8	36.75	1	12	9.56				120 - 154	W	LF	0.78
1/13/2015	1	4	18.29	1	4	18.27							147 - 170	W	LF	1.60
1/16/2015				1	4	17.23							165	W	LF	
1/17/2015				1	4	17.47							143	W	LF	
1/21/2015							1	12	11.65				135	W		1.19
2/3/2015	1	4	18.37										114	W		2.56
2/19/2015							1	12	9.02				39	F		
2/23/2015				1	4	18.0071							162	W	***	
2/24/2015				1	4	17.00							161	W	****	
2/25/2015				1	2	8.40							92	W	W	
3/6/2015	1	4	17.27										55	F		
3/30/2015							3	10.5	9.19				76-103	S		
3/31/2015	1	1	4.33										190	W		1.42
4/5/2015							1	4	3.27				87	S		
4/6/2015							1	4	3.27				83	S		
4/9/2015							1	4	3.27				80	S		
4/19/2015	1	2	9.91										96	S		
4/22/2015							2	8	6.54				88-94	S		
4/23/2015	1	4	19.83							1	4	3.27	86-92	S	F	
4/24/2015							1	4	3.27				90	S		
4/28/2015							1	4	3.27				90	S		
4/30/2015										1	4	3.27	92	S	*****	
5/4/2015	1	1	4.33										110	S		
5/18/2015							1	4	3.88				105	S		
Season		58	152.93		163	668.62		90.5	75.74		96	72.05				
Weekly		0	0.00		0	0.00		0	0.00		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).*

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)

** Does not include loss for sub-adult unknown race salmon

***Clipped Chinook salmon was released by mistake

****Clipped Chinook Salmon was acoustic tagged and released according to NMFS protocol

*****Clipped salmon released since it did not have a CWT when wanded

Season = 10/1/14 to present; Weekly = 7/6/15 to 7/12/15

Appendix F
Steelhead Loss-Density Table

Steelhead - Daily Summary Table

California Department of Fish and Wildlife - Results Subject to Revision

Prepared by Geir Aasen *Report Date:* 10/1/2015 *Report Time:* 1:00 PM

	STATE WATER PROJECT						CENTRAL VALLEY PROJECT							
	NON-CLIPPED			CLIPPED			NON-CLIPPED			CLIPPED			LENGTH	LOSS
DATE	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	CATCH	SALVAGE	LOSS	(FL mm)	DENSITY
11/16/2014	1	4	17.32										287	2.65
1/23/2015				1	4	17.32							210	
1/25/2015				1	4	17.32							224	
1/27/2015				2	8	34.64							210-240	
1/28/2015				1	4	17.32							240	
1/29/2015				1	4	17.32							243	
1/30/2015				1	4	17.32							210	
2/8/2015				1	4	17.32							225	
2/12/2015				3	6	25.98							215-251	
2/13/2015				1	4	17.32							210	
2/16/2015	1	4	17.32	3	12	51.96				1	4	2.72	230-600	1.40
2/17/2015	2	8	34.64	3	6	25.98				3	12	8.16	217-278	3.31
2/18/2015				12	36	155.88							220-278	
2/19/2015				7	28	121.24							197-244	
2/20/2015				2	8	34.64							198-210	
2/21/2015				2	6	25.98				2	24	16.32	214-251	
2/22/2015				3	8	34.64							228-249	
2/23/2015				9	30	129.90				1	4	2.72	202-271	
2/24/2015				7	16	69.28							221-271	
2/25/2015	1	2	8.66	3	6	25.98							206-248	1.15
2/26/2015				12	44	190.52							210-266	
2/27/2015	1	4	17.32	12	38	164.54							196-274	1.55
2/28/2015				4	14	60.62							229-270	
3/1/2015				8	24	103.92							198-258	
3/2/2015				7	18	77.94				2	8	5.44	220-270	
3/3/2015				2	6	25.98				1	4	2.72	240-248	
3/4/2015				5	14	60.62				1	4	2.72	214-268	
3/5/2015				2	6	25.98							226-245	
3/6/2015				1	4	17.32				2	8	5.44	220-261	
3/7/2015				2	8	34.64							238-240	
3/8/2015				2	8	34.64							255-259	
3/9/2015										2	8	5.44	244-246	
3/10/2015				1	4	17.32				2	8	5.44	231-275	
3/11/2015				1	4	17.32							240	
3/12/2015										2	8	5.44	235-251	
3/13/2015										1	4	2.72	253	
3/16/2015				1	2	8.66							251	
3/17/2015				2	4	17.32							247-255	
3/18/2015				1	4	17.32				1	4	2.72	235-240	
3/31/2015				1	1	4.33							270	
4/1/2015										1	4	2.72	264	
4/3/2015				1	2	8.66							259	
4/5/2015										2	8	5.44	273-299	
4/7/2015							1	4	2.72				246	0.95
4/14/2015				1	2	8.66							262	
4/15/2015				1	2	8.66							425	
4/16/2015	1	4	17.32										449	5.29
4/17/2015	1	4	17.32										370	5.67
4/21/2015	1	1	4.33										274	1.52
4/23/2015										1	4	2.72	245	
4/28/2015	1	4	17.32										224	5.87
5/8/2015							1	4	2.72				239	2.11
Season		35	151.55		407	1762.31		8	5.44		116	78.88		
Weekly		0	0.00		0	0.00		0	0.00		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)

Season = 10/1/14 to present; Weekly = 7/6/2015 to 7/12/2015