



# Weekly Assessment of CVP and SWP Delta Operations on ESA-listed Species

March 5, 2024

## Executive Summary

### Operational Conditions

See Weekly Fish and Water Operation Outlook document for March 5 – March 12.

### Winter-run Chinook Salmon

Loss of natural winter-run Chinook Salmon (by length at date, LAD) has occurred in the past week at the State and Federal fish salvage facilities. Loss of genetically confirmed winter-run Chinook Salmon in WY 2024 occurred on 1/16, 2/12, 2/21, 2/23, 3/1,3/2, and 3/3. Loss of natural winter-run Chinook Salmon at the Central Valley Project (CVP) and State Water Project (SWP) fish collection facilities is likely to occur over the next week. 75-94% of juvenile natural winter-run Chinook Salmon from brood year (BY) 2023 are estimated to be present in the Delta. The 50% single year loss threshold for LAD winter-run Chinook Salmon period was exceeded on 2/25/2024.

### Spring-run Chinook Salmon

Loss of natural YOY spring-run Chinook Salmon LAD has occurred in the past week at the State or Federal fish salvage facilities. 45-60% of juvenile natural YOY spring-run Chinook Salmon was estimated in the Delta. CV spring-run Chinook Salmon fry are rearing and migrating downstream. Loss of genetically confirmed yearling spring-run Chinook Salmon for WY 2024 has occurred in February and March. Loss of natural Spring-run Chinook Salmon at the CVP and SWP fish collection facilities may occur over the next week.

### Central Valley Steelhead

Loss of natural CCV steelhead has occurred in the past week at the State and Federal fish salvage facilities. Loss of CCV steelhead at the CVP and SWP fish collection facilities is likely to occur over the next week. 35-60% of CCV steelhead were estimated in the Delta. The 50% single year loss threshold for the Dec 1 to March 31 period was exceeded on 2/11/2024 the 75% single year loss threshold was exceeded on 2/22/2024, and the 100% single year loss threshold was exceeded on 2/23/2024. For the week of 2/19/2024 WOMT accepted a recommendation to operate the CVP and SWP to -2,500 OMRI in order to reduced Steelhead loss and will respond to the 100% exceedance (Monitoring Teams Summary). As 3/4/2024 total loss is 2,153 and the incidental take statement threshold is 2,760.

## DCC gates recommendation

The DCC gates were closed for the OMR Season on 11/27/2023.

## Delta Smelt

Based on recent detection data and distribution patterns over the past decade, Delta Smelt have likely completed their population-level spawning migration and distributed throughout the Delta, and temperatures are suitable for spawning. Four marked Delta Smelt have been detected by surveys in Suisun Marsh and the lower San Joaquin River since 2/20/2024. Additionally, three marked Delta Smelt have been detected in salvage (pre expansion) since 2/20/2024. Risk of entrainment in the OMR corridor remains moderate for adults, based on the detection of multiple DS in the lower San Joaquin River and salvage, historical salvage timing, ongoing adult presence, and high turbidity in portions of the OMR corridor. Risk of entrainment in the OMR corridor also remains moderate for larvae, based on suitable spawning temperatures and high turbidity in the South Delta. Risk remains low for fish outside of the OMR corridor. The implementation of COA 8.5.2 (triggered 2/5/2024 and implemented from 2/7/2024 and retriggered by SLS survey 5 on 3/4/2024) and implementation of steelhead protections (OMRI of -2500 cfs) are expected to reduce the chance of entraining larval and juvenile Delta Smelt. Reduced OMRI will also reduce the chance that adult Delta Smelt will move into areas with a high likelihood of entrainment.

## Monitoring Teams summary

The current average loss of CCV Steelhead is 53.55 per day over the last week while targeting an OMR of -2,500 cfs with a total loss of 2,152.81. At this rate the NMFS Incidental Take Limit (ITL) of 2,760 for the December to March period will be exceeded before March 31. To remain under the ITL loss needs to be at 21 fish per day or less. According to the Tillotson Model runs, a more positive OMR flow would decrease loss of steelhead. Looking at the Tillotson Model results at OMR of 0 to -500 cfs we would have an average loss of 49.89 per day. At an export level of 1,500 cfs (OMR of +3,900 cfs), the Tillotson Model predicts an average loss of 30.75 per day. Since the 100% threshold is exceeded and the ITL is likely to be exceeded this month, any decrease in loss of steelhead would benefit the species.

SaMT therefore recommends to avoid exceeding the annual ITL with an OMRI from 0 cfs to -500 cfs; then reassessing next week to see if a decrease in salvage has occurred and compare loss rates relative to the Tillotson Model predictions.

For reference see Figures 1 and 2 below.

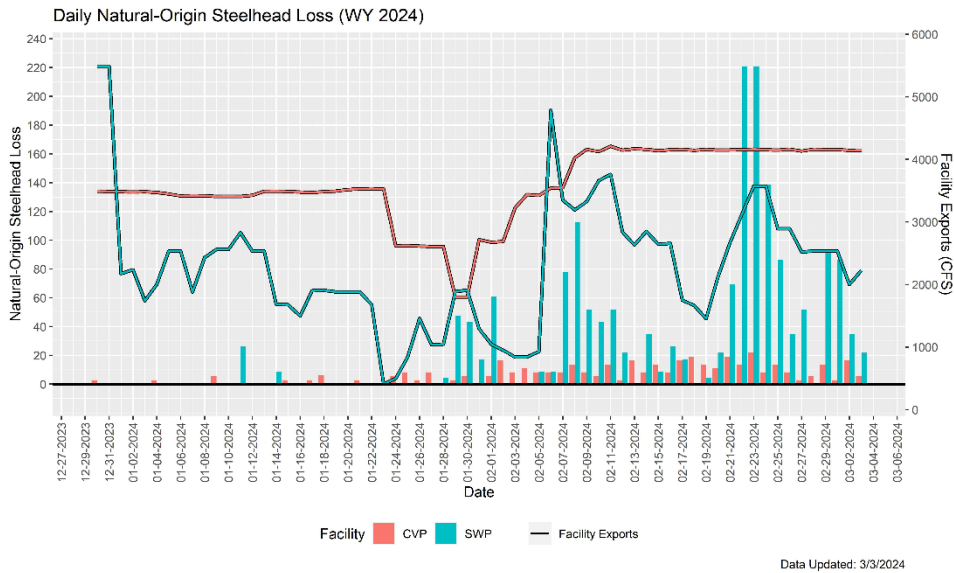


Figure 1. Daily Natural-Origin Steelhead Loss for Water Year 2024.

Figure 1 is a complex line graph showing the natural-origin steelhead loss as compared to the facility exports (cfs) from December 27, 2023, to March 6, 2024.

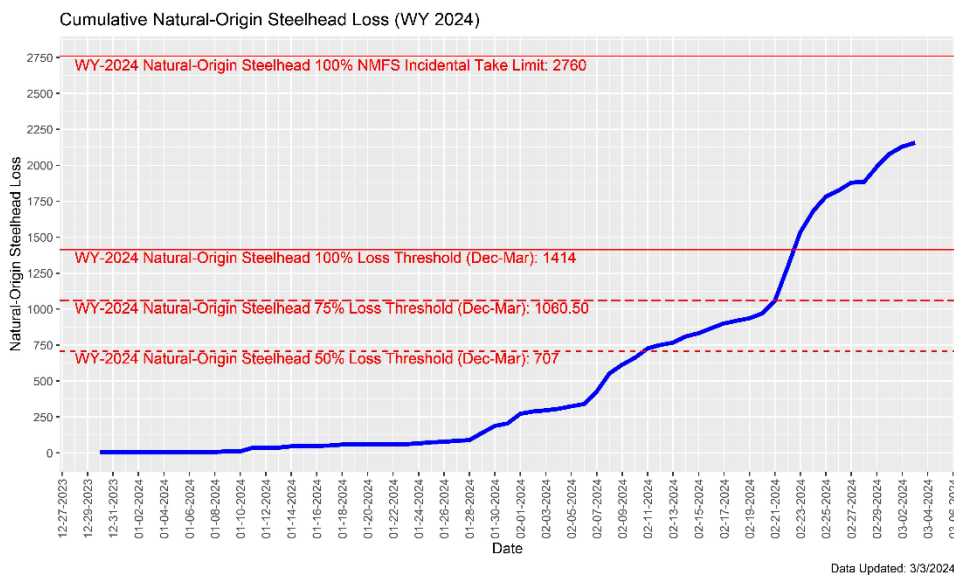


Figure 1. Cumulative Natural-Origin Steelhead Loss for Water Year 2024.

Figure 1 is a line graph showing an increase in natural-origin steelhead loss from December 27, 2023, to March 6, 2024.

There were no non-consensus issues to report from the Salmon Monitoring Team or Smelt Monitoring Team.

## Operational and Regulatory Conditions

See current Weekly Fish and Water Operation Outlook document.

## Biology, Distribution, and Evaluation Winter-run Chinook salmon, Spring-run Chinook salmon, Central Valley Steelhead

### Population Status

#### *Winter-run Chinook Salmon*

- Delta Life Stages:
  - Juveniles, Adults
- Brood Year 2023 Productivity:
  - Natural winter-run Chinook salmon: The Final WR JPE for BY 2023 is 234,896.
  - Mean cumulative weekly passage of winter-run Chinook salmon through January 14th at Red Bluff Diversion Dam (RBDD) for the last 21 years of passage data is 98.8% (one SD of 1.4%). By 2/11/2024, 1,094,216 winter-run Chinook salmon were estimated to have passed RBDD compared to the total cumulative passage for WY 2023 of 240,059 winter-run Chinook salmon.
  - Hatchery winter-run Chinook salmon:
    - One release of Livingston Stone National Fish Hatchery CWT tagged winter-run Chinook salmon occurred on 12/28/23
    - The second release of LSNFH CWT tagged winter-run Chinook salmon occurred on 1/19/24.
    - A third release of LSNFH CWT tagged winter-run Chinook salmon occurred on 2/16/24. A subset of these fish were acoustically tagged and will be tracked through CalFish
    - 47,937 Coleman NFH Complex brood year 2023 winter Chinook Salmon on March 4, 2024. The release will take place on the North Fork Battle Creek at Wilson Hill Bridge near Manton, CA. 100% marked (with an adipose-fin and a left pelvic-fin clip and CWT) and has an overall estimated average fork length of 85 mm.

#### *Spring-run Chinook Salmon*

- Delta Life Stages:
  - Young-of-year (YOY) and Yearlings
- Brood Year 2023 Productivity:
  - Natural spring-run Chinook salmon: No JPE has been established for spring-run Chinook salmon.
  - Hatchery spring-run Chinook salmon surrogates associated with the Proposed Action (PA 4.10.5.10.2 Additional Real-Time OMR Restrictions and Performance Objectives):
    - Approximately 60,764 brood year 2023 late-fall Chinook salmon were released on December 22, 2023 into Battle Creek at the Coleman NFH. This group is 100% marked with an adipose-fin clip and coded-wire tagged.
    - Approximately 71,049 Coleman NFH brood year 2023 late-fall Chinook Salmon were released on December 29, 2023 into Battle Creek at Coleman NFH. This group is 100% marked (with an adipose-fin clip and CWT) and has an overall estimated average fork length of 145 mm.
    - Approximately 67,018 Coleman NFH brood year 2023 late-fall Chinook Salmon were released on January 11, 2024 into Battle Creek at Coleman NFH. This group is 100% marked (with an adipose-fin clip and CWT) and has an overall estimated average fork length of 145 mm.
  - Loss has occurred for release group 1, release group 2, and release group 3 of the hatchery spring-run surrogates.

***Central Valley Steelhead***

- Delta Life Stages:
  - Spawning Adults, Kelts, Juveniles
- Brood Year 2023 Productivity:
  - Spawner abundance: There is limited information about the adult steelhead population. It is estimated to be small, contributing to the limited productivity of the population.
  - Natural steelhead: No JPE has been established for steelhead. Data are limited.
  - Hatchery steelhead: Reclamation’s Proposed Action has no hatchery steelhead triggers.

## Distribution

### *Winter-run Chinook Salmon*

#### Current Distribution:

- For winter-run Chinook Salmon observations reported to SaMT since previous meeting, see Table 1.
- For SaMT distribution estimates, see Table 2.
- As of 3/5/2024, 6 genetic natural winter-run Chinook Salmon has been identified at the SWP facility. As of 3/4/2024, 4 genetic natural winter-run Chinook Salmon have been identified at the CVP facility.
- Under the 2023 IOP Reclamation will be operating to the COA 8.6.3 Mid- and Late-season Natural Winter-run Chinook Salmon Daily Loss Threshold:
  - January 1 – January 31:  $0.0000635 * 234,896 = 14.92$
  - February 1 – February 28:  $0.0000991 * 234,896 = 23.28$
  - March 1 – March 31:  $0.000146 * 234,896 = 34.29$
  - April 1 – April 30:  $0.0000507 * 234,896 = 11.91$
  - May 1 – May 31:  $0.000077 * 234,896 = 18.09$
- Daily loss threshold under the 2023 IOP COA 8.6.3 of LAD winter run was triggered 5 times in the previous week (2/26/2024; 2/29/2024-3/3/2024).

#### Historical Trends

- For historical winter-run Chinook salmon trends in salvage, see Table 3.
- Loss of natural winter-run Chinook salmon at the CVP and SWP fish collection facilities is likely to occur over the next week based on hydrology. Based on historic trends in salvage winter-run Chinook salmon loss may increase over the next week.

#### Forecasted Distribution within Central Valley and Delta regions

- The STARS model projects route-specific proportion of entrainment, survival, and travel times (Table 5). This model does not estimate entrainment into the lower Sacramento River sloughs (i.e., Three-Mile Slough).

### *Spring-run Chinook salmon*

#### Current Distribution

- For spring-run Chinook salmon observations reported to SaMT since previous meeting, see Table 1.

- For SaMT distribution estimates, see Table 2.

#### **Historical Trends**

- For historical spring-run Chinook salmon trends in salvage, see Table 3. Based on historic trends in salvage YOY spring-run Chinook salmon loss may increase over the next week.

#### **Forecasted Distribution within Central Valley and Delta regions**

- YOY spring-run Chinook are migrating into the Delta.

#### ***Central Valley Steelhead***

##### **Current Distribution**

- For CCV Steelhead observations reported to SaMT since previous meeting, see Table 1.
- For SaMT distribution estimates, see Table 2.
- As of 3/4/2024, 295 unclipped CCV steelhead have been observed at the CVP or SWP facilities.
- Loss of CCV Steelhead exceeded the 50% of the annual loss threshold for the Dec. 1 to March 31 period on 2/11/2024.
- Loss of CCV Steelhead exceeded the 75% of the annual loss threshold for the Dec. 1 to March 31 period on 2/22/2024.
- Loss of CCV Steelhead exceeded the 100% of the annual loss threshold for the Dec. 1 to March 31 period on 2/23/2024.
- Steelhead have been observed within the Delta and at the salvage facilities in the last 7 days.
- Steelhead have also been observed in the Chipps Island Trawl which supports out-migrating is occurring.
- Acoustically tagged wild steelhead from the Stanislaus were observed passing receivers at Benicia Bridge.

##### **Historical Trends**

- For historical CCV steelhead trends in salvage, see Table 2. Based on historic trends in salvage, juvenile CCV steelhead loss may occur over the next week.
- Based on historical trends in steelhead observations, salvage is expected to increase and observations of out-migrating steelhead should increase as the season progresses.

#### **Forecasted Distribution within Central Valley and Delta regions**

- The entrainment tool estimates CCV steelhead loss to be increasing (Table 6, Fig. 1)

Table 1. Fish observation reported since the previous SaMT meeting. NAs represent no data reported. See Operations Outlook for notes on interruptions in any surveys.

Locations	Reporting Period	SR Chinook	WR Chinook	LFR Chinook	Steelhead (Wild)	Green Sturgeon
Butte Creek RST	2/25-3/3	30	0	0	2	0
Tisdale RST	2/24-3/2	6	2	0	0	0
Knights Landing RST	2/25-3/2	4	1	0	0	0
Lower Sacramento RST	2/18-2/24	15	7	0	0	0
Beach Seines	2/25-3/2	8	0	0	0	0
Sac. Trawl	2/25-3/2	7	1	0	0	0
Chippis Island Midwater Trawl	2/25-3/2	1	3	0	0	0
Mossdale Kodiak Trawl	2/25-3/2	0	0	0	1	0
EDSM	2/25-3/2	2	0	0	0	0
Feather River Herringer RST	2/25-3/4	2	0	0	1	0
Feather River Eye Side RST	2/24-3/4	0	0	0	5	0
Lower Feather River	2/26-3/3	5	0	0	1	0

Table 2. Salmonid distribution estimates

Location	Yet to Enter Delta (%)	In the Delta (%)	Exited Delta past Chippis Island (%)
Young-of-year (YOY) winter-run Chinook salmon	Current: 1-5% Last Week: 10-15%	Current: 75-89% Last Week: 75-94%	Current: 10-20% Last Week: 5-15%
YOY spring-run Chinook salmon	Current: 38-54 % Last Week: 45-60%	Current: 45-60% Last Week: 40-55%	Current: 1-2% Last Week: 0%
YOY hatchery winter-run Chinook salmon	Current: 95-100% Last Week: 95-100%	Current: 0-5% Last Week: 0-5%	Current: 0% Last Week: 0%
Natural origin steelhead	Current: 25-40% Last Week: 30-45%	Current: 35-60% Last Week: 45-60%	Current: 15-25 % Last Week: 10-20%



Table 3. Historic migration and salvage patterns. Last updated 03/04/2023.

Species	Red Bluff Diversion Dam	Tisdale Rst	Knights Landing Rst	Sac Trawl Sherwood Catch Index	Chippis Island Trawl Catch Index	Salvage
Chinook, Winter-run, Unclipped	99.0%(98.2%,99.8%) BY: 2014 - 2022	97.5%(95.9%,99.2%) BY: 2014 - 2022	97.9%(96.7%,99.1%) BY: 2014 - 2022	55.1%(29.1%,81.2%) BY: 2014 - 2022	16.8%(4.1%,29.5%) BY: 2014 - 2022	46.3%(21.0%,71.6%) WY: 2014 - 2023
Chinook, Spring-run, Unclipped	17.8%(5.9%,29.7%) BY: 2014 - 2022	26.6%(5.2%,48.0%) BY: 2014 - 2022	36.7%(11.5%,61.9%) BY: 2014 - 2022	10.0%(-1.5%,21.4%) BY: 2014 - 2022	0.0%(-0.0%,0.1%) BY: 2014 - 2022	1.0%(-1.2%,3.3%) WY: 2014 - 2023
Steelhead, Unclipped (January-December)	2.5%(0.2%,4.8%) BY: 2014 - 2023	41.5%(22.5%,60.4%) BY: 2014 - 2023	38.6%(22.0%,55.1%) BY: 2014 - 2023	51.6%(26.4%,76.8%) BY: 2014 - 2023	42.5%(24.4%,60.6%) BY: 2014 - 2023	N/A
Steelhead, Unclipped (December-March)	N/A	N/A	N/A	N/A	N/A	49.8%(25.4%,74.2%) WY: 2014 - 2023
Steelhead, Unclipped (April-June)	N/A	N/A	N/A	N/A	N/A	N/A

Table 4. Mean daily flow and percent change (Wilkins Slough, Deer Creek, Mill Creek; cfs from CDEC) and temperature and percent change (Knights Landing; °F from RST).

Date	Mill Creek (MLM): mean daily flow (cfs)	Mill Creek (MLM): flow percent change	Mill Creek (MLM): Alert	Deer Creek (DCV): mean daily flow (cfs)	Deer Creek (DCV): percent change	Deer Creek (DCV): Alert	Wilkins Slough (WLK): mean daily flow (cfs)	Knights Landing RST: water temperature (f)	Alert Triggered
3/3/2024	419.5	-15.5%	Flow>95cfs	580.5	-14.6%	Flow>95cfs	24,910.2	N/A	N/A
3/2/2024	496.7	1.0%	Flow>95cfs	679.7	1.1%	Flow>95cfs	25,148.9	N/A	N/A
3/1/2024	491.6	34.9%	Flow>95cfs	672.4	38.6%	Flow>95cfs	25,385.2	N/A	N/A
2/29/2024	364.4	5.8%	Flow>95cfs	485.1	2.5%	Flow>95cfs	25,720.5	N/A	N/A

Date	Mill Creek (MLM): mean daily flow (cfs)	Mill Creek (MLM): flow percent change	Mill Creek (MLM): Alert	Deer Creek (DCV): mean daily flow (cfs)	Deer Creek (DCV): flow percent change	Deer Creek (DCV): Alert	Wilkins Slough (WLK): mean daily flow (cfs)	Knights Landing RST: water temperature (f)	Alert Triggered
2/28/2024	344.3	-8.6%	Flow>95cfs	473.2	-11.5%	Flow>95cfs	25,989.7	N/A	N/A
2/27/2024	376.9	-9.5%	Flow>95cfs	534.4	-10.7%	Flow>95cfs	26,062.8	N/A	N/A
2/26/2024	416.5	-9.5%	Flow>95cfs	598.4	-12.1%	Flow>95cfs	26,184.5	N/A	N/A

Table 5. STARS model simulations for route-specific entrainment, travel times, and survival. Travel time is calculated in days.

Stock	Date	Route	Median Travel Time	Survival	Routing Probability
Winter Chinook	2024-03-03	Overall	6.86	0.73	N/A
Winter Chinook	2024-03-03	Sacramento River	3.51	0.81	0.31
Winter Chinook	2024-03-03	Yolo Bypass	9.39	0.68	0.54
Winter Chinook	2024-03-03	Sutter Slough	4.02	0.71	0.06
Winter Chinook	2024-03-03	Steamboat Slough	3.58	0.81	0.04
Winter Chinook	2024-03-03	Interior Delta	6.16	0.75	0.05
Late-fall Chinook	2024-03-03	Overall	3.37	0.65	N/A
Late-fall Chinook	2024-03-03	Delta Cross Channel	N/A	N/A	0.00
Late-fall Chinook	2024-03-03	Georgiana Slough	5.22	0.38	0.18
Late-fall Chinook	2024-03-03	Sacramento River	2.84	0.72	0.47
Late-fall Chinook	2024-03-03	Sutter and Steamboat Slough	3.33	0.71	0.35

The entrainment tool estimates a median and maximum loss of winter-run Chinook Salmon and juvenile CCV Steelhead each week (Table 6a).

Table 6a-c. WY 2024 loss and salvage predictor data: Environmental details, current and forecast. Unless values (i.e. OMR and export) are explicitly stated in Table 6c, covariate values are the same as values listed in 6b. Model results from 3/04/2024.

- a) WY 2024 loss and salvage predictor data: Predicted weekly loss of winter-run Chinook salmon and steelhead at CVP and SWP facilities estimated from model developed in Tillotson et al. (2022).

Parameter	Modeled Current Week	Modeled Next Week
Predicted Steelhead, Median %	403	243
Predicted Steelhead, High %	705	705
Predicted Chinook Winter Run, Median %	337	297
Predicted Chinook Winter Run, High %	729	729

- b) Environmental details, current and forecast.

Parameter	Data	Forecast
Temperature (Mallard Island, C)	12.7	12.7
Precipitation (5-d running sum, inches)	0.25	0.25
Old and Middle River Flows (cfs)	-3413	-3413
Sacramento River Flow (Freeport, cfs)	66503	66503
DCC Gates	closed	closed
San Joaquin River Flow (Vernalis, cfs)	8137	8137
Export	6828	6828

- c) Salvage predictor estimates for natural origin Central Valley Steelhead from model developed in Tillotson et al. (2022)<sup>1</sup> across multiple OMR flow scenarios represented within a range of percentiles. The model was run with low and high expected discharge values (Discharge Range) in the Sacramento and San Joaquin Rivers.

OMR	Exports	San Joaquin Flow	Sacramento Flow	25th Percentile Weekly Loss	Median Weekly Loss	75th Percentile Weekly Loss
3900	1500	11700	60850	90.93	215.23	426.17
0	5775	11700	60850	144.72	349.23	572.15

<sup>1</sup> Tillotson, M.D., J. Hassrick, A.L. Collins, & C. Phillis. 2022. Machine Learning Forecasts to Reduce Risk of Entrainment Loss of Endangered Salmonids at Large-Scale Water Diversions in the Sacramento-San Joaquin Delta, California. *San Francisco Estuary & Watershed Science* 20(2):1-21

<b>OMR</b>	<b>Exports</b>	<b>San Joaquin Flow</b>	<b>Sacramento Flow</b>	<b>25th Percentile Weekly Loss</b>	<b>Median Weekly Loss</b>	<b>75th Percentile Weekly Loss</b>
-500	6350	11700	60850	155.88	349.23	557.98
-1000	6900	11700	60850	215	397.69	579.66
-1500	7400	11700	60850	215	403.41	579.66
-2000	8000	11700	60850	215	403.41	579.66
-2500	8400	11700	60850	215	403.41	579.66
-3000	9100	11700	60850	215	420.17	579.66

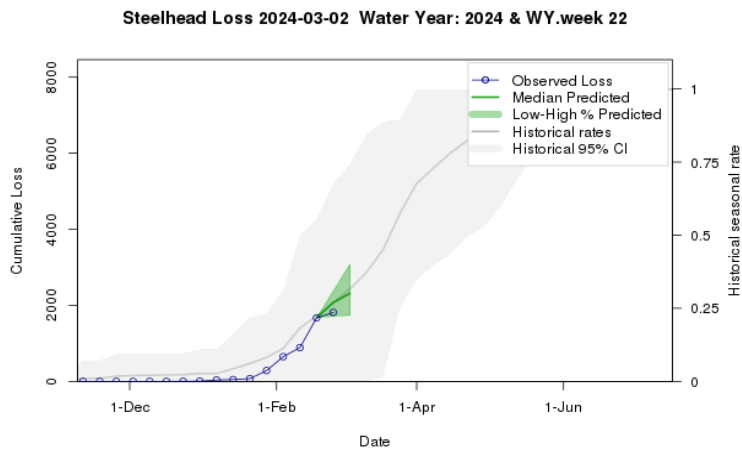
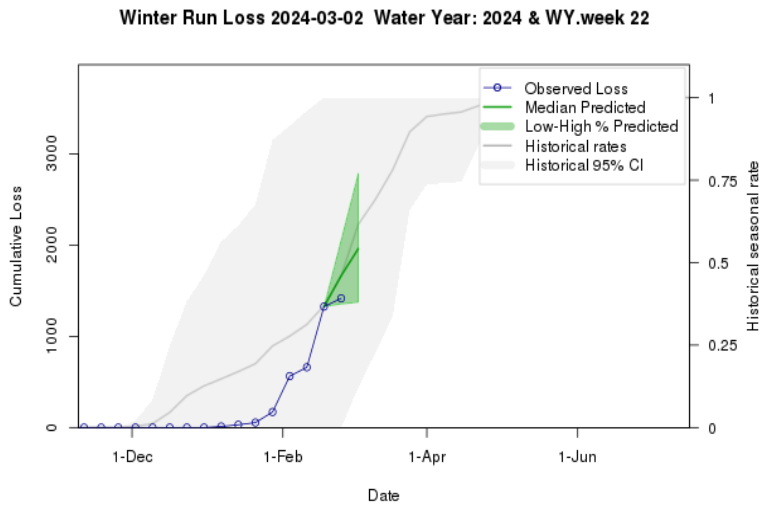
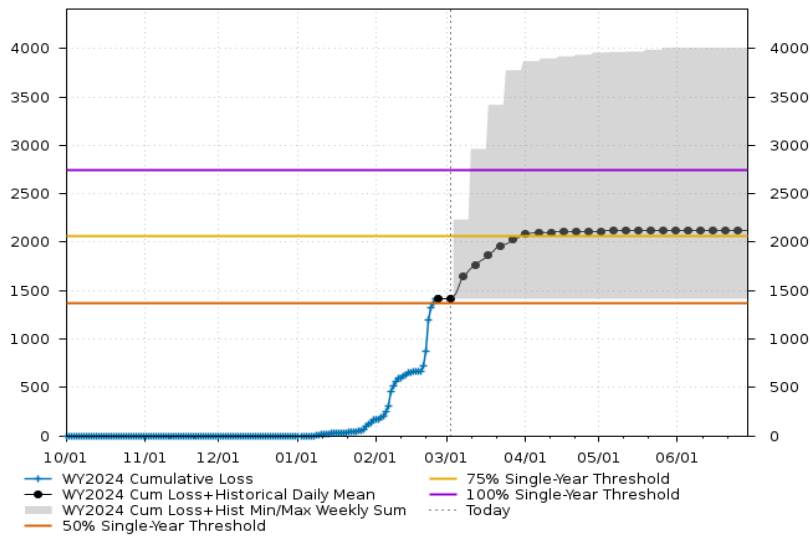


Figure 3. Predicted weekly loss of steelhead and winter-run Chinook salmon at the CVP and SWP facilities

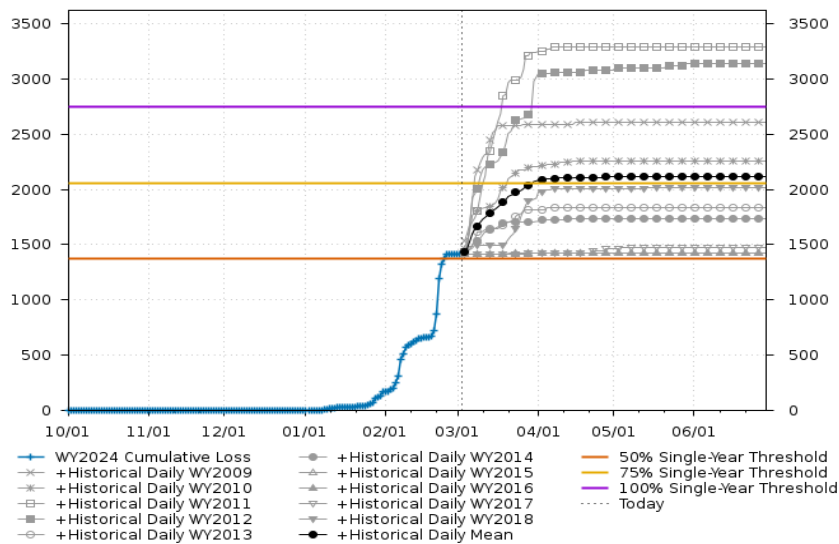
Figure 3 is two-line graphs of the predicted weekly loss of steelhead and winter-run Chinook salmon for water year 2024 beginning on December 1, 2023. The first line graph shows the cumulative loss of winter-run Chinook salmon comparing the predicted loss of 1900 and the observed loss of 1500. The second line graph shows the cumulative loss of Steelhead salmon comparing the median predicted loss of about 2500 and the observed loss of about 1900.

**WY2024 Natural Winter-run Chinook Cumulative Loss with Historical Loss**  
**Cumulative Loss to date: 1415.89**



Winter-run based on Length-at-Date Delta Model. Historical Loss calculated for WY2009-2018.  
[www.cbr.washington.edu/sacramento/](http://www.cbr.washington.edu/sacramento/) 04 Mar 2024 13:49:02 PST

**WY2024 Natural Winter-run Chinook Cumulative Loss with Historical Loss**  
**Cumulative Loss to date: 1415.89**



Winter-run based on Length-at-Date Delta Model. Historical Loss calculated for WY2009-2018.  
[www.cbr.washington.edu/sacramento/](http://www.cbr.washington.edu/sacramento/) 04 Mar 2024 13:49:02 PST

Figure 4. Cumulative natural winter-run Chinook salmon loss for the year (blue) and 2009 – 2018 historic cumulative loss (gray, different symbols). Historic daily mean plotted in black circles.

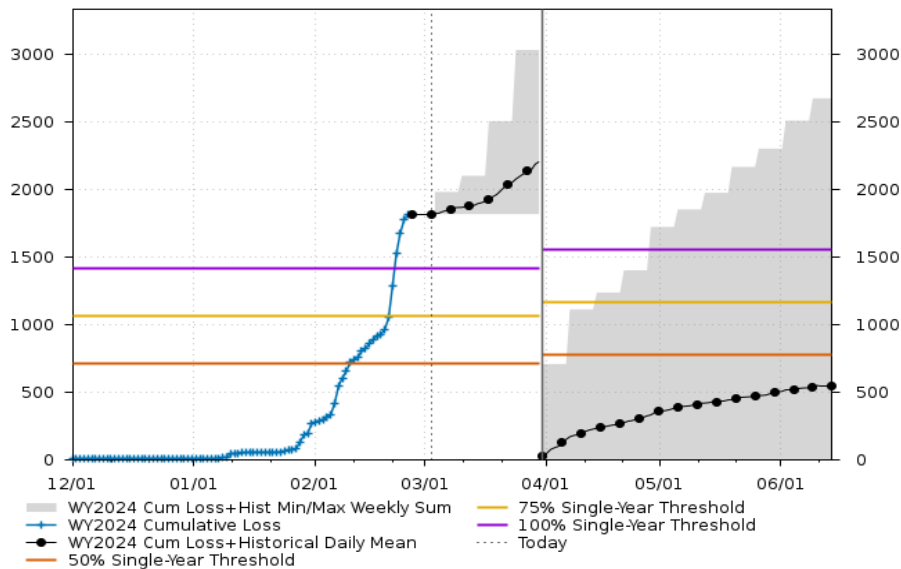
Figure 4 is two line graphs showing the natural winter-run Chinook salmon cumulative loss for water year 2024 beginning on October 1, 2023, and ending on June 30, 2024.

Both graphs combine observed Chinook salmon loss with historical loss calculated for water years 2009 through 2018.

The first line graph shows the water year 2024 cumulative loss combined with the historical minimum and maximum weekly sum and the water year 2024 cumulative loss combined with the historical daily mean. The water year 2024 cumulative loss combined with the historical daily minimum and maximum weekly sum is just above the 50 percent single-year threshold on February 21, 2024. The water year 2024 cumulative loss combined with the historical daily mean reaches the 50 percent single-year threshold on February 21, 2024.

The second line graph shows the water year 2024 cumulative loss combined with historical daily water years from 2009 – 2018. Water year 2024 cumulative loss combined with historical daily water year loss exceeds the 50 percent single-year threshold for water years 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, and 2018.

**WY2024 Natural Steelhead Cumulative Loss with Historical Loss**  
**12/1-3/31 Cumulative Loss to date: 1813.63**  
**4/1-6/15 Cumulative Loss to date: 0**



Steelhead loss tracked separately for 12/1-3/31 and 4/1-6/15. Historical Loss calculated for WY2009-2018.  
[www.cbr.washington.edu/sacramento/](http://www.cbr.washington.edu/sacramento/) 04 Mar 2024 13:49:02 PST

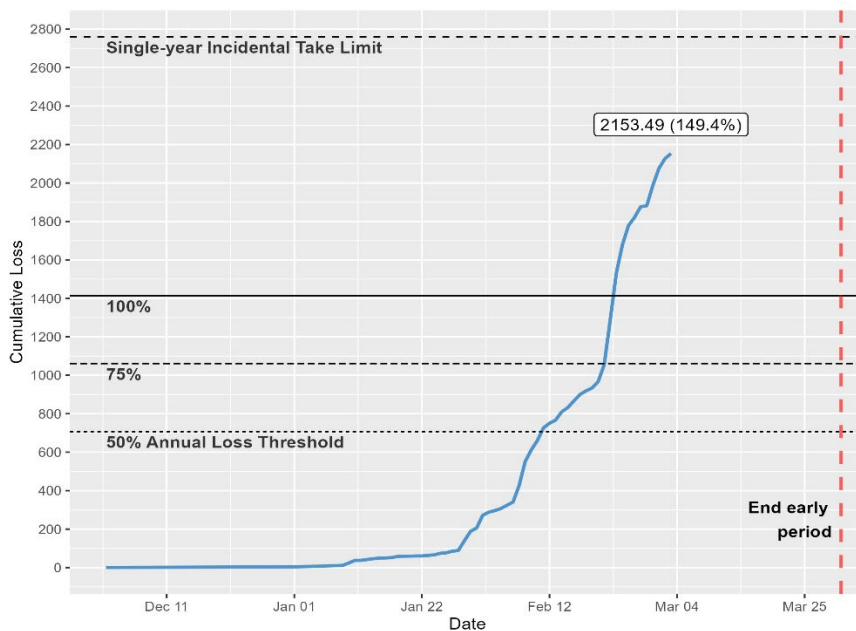


Figure 5. Top Graph: Cumulative natural steelhead loss for the year (blue) and 2009 – 2018 historic cumulative loss (gray). Historic daily mean plotted in black circles. Bottom Graph: Cumulative natural steelhead loss in WY2024 representing the most current steelhead loss numbers.



Figure 5 is two line graphs, the first of which shows the cumulative natural steelhead loss of WY2024 compared with the 2009-2018 historic cumulative natural steelhead loss beginning on December 1, 2023, and finishing on June 15, 2023, and the second of which shows the most current steelhead loss numbers in 2024.

The first line graph shows the WY2024 cumulative loss and historical daily mean at 1800 as of March 1, 2024. The WY2024 cumulative loss and historical daily mean begins to approach the 50% single-year threshold at the start of April 2023 and reaches just above 500 on June 15, 2024.

The second line graph shows the WY2024 cumulative loss at 2153.49 or 149.4% as of March 3, 2024. The cumulative loss passes the 50% annual loss threshold on February 10, 2024 and passes the 100% annual loss threshold on February 22, 2024.

## Evaluation

1. After January 1, are more than 5% of juveniles from one or more salmonid species present in the Delta?

Greater than 5% of all salmonid species are estimated to be present in the Delta.

2. Does the operational outlook's ranges impact fish movement and change the potential distribution of fish?

Potential effects within the 7 days (near-term) in the operations outlook.

OMR flow is expected to remain at or more positive than -5,000 cfs this upcoming week. OMR flows more positive than -5,000 cfs are hypothesized to have a less negative impact on movement and distribution of salmonids in the South Delta (NMFS 2009, SST 2017, Perry et al. 2016).

Potential effects longer than the 7 days (longer-term) in the operations outlook.

Not applicable, see response above to (2) (i).

3. What is the likelihood of increased loss exceeding the next annual loss threshold (50%, 75% or 90% of threshold) resulting in OMR management actions based on population distribution, abundance, and behavior of fish in the Delta?

### Winter-run Chinook salmon

Total juvenile natural winter-run Chinook salmon (LAD) loss is 1720.8 fish (as of 03/04/2024). Loss of juvenile winter-run Chinook salmon (LAD) has occurred in

the past week at the CVP and SWP fish salvage facilities. The 50% single-year loss threshold was exceeded on 2/25/2024. The agencies in the SaMT assessed the likelihood of exceeding the annual loss threshold and are uncertain if loss occurring in the next week will lead to exceedance of the 75% single-year loss threshold. It is possible that the 75% annual loss threshold (2,061), 90% annual loss threshold (2,473) and incidental take limit (4,698) will be exceeded this year, based on length at date.

The length-at-date model is used for tracking exceedance of these thresholds; however, only a small fraction of the winter-run LAD salmon observed at the salvage facilities have been genetically identified as winter-run to date. Figures 1 and 2 also provide a forecast of winter-run loss for the year and indicate possible exceedance of these salvage based winter-run triggers. It is uncertain how well the historical data described in Figure 2 may be relevant this year. Genetic methods provide a more accurate measure of identifying winter-run Chinook salmon than length-at-date. DNA results indicate a loss of 27.55 winter-run Chinook salmon so far this year.

#### Central Valley Steelhead

Total natural juvenile steelhead loss is 2153.49 fish (as of 03/04/2024). Loss of natural juvenile steelhead has occurred in the past week at the CVP and SWP fish salvage facilities. The 50% single year loss threshold for the Dec 1 to March 31 period was exceeded on 2/11/2024, the 75% loss threshold was exceeded on 2/22/2024, and the 100% loss threshold was exceeded on 2/23/2024. See Executive Summary for discussion on weekly recommendation to WOMT.

4. If an annual loss threshold has been exceeded, do continued OMR restrictions benefit fish movement and survival based on real-time information?

#### Winter-run Chinook salmon

The 100% annual loss threshold for winter-run Chinook salmon has not been exceeded in WY 2024. However, the 50% single year loss threshold has been exceeded and export facilities will operate such that the fourteen-day average OMRI flow is no more negative than -3,500 cfs through the end of OMR management season

#### Central Valley Steelhead

The 100% annual loss threshold for steelhead (December 1 – March 31) has been exceeded for WY 2024. Previously, an OMRI of -2,500 cfs had been decided upon by WOMT and will continue to be evaluated each week through March 31.

5. If OMR is more negative than -5,000 cfs, are there changes in spawning, rearing, foraging, sheltering, or migration behavior beyond those anticipated to occur under OMR management at -5,000 cfs?

Expected OMR flows are -2,000 to -2,500 cfs for the next week. Under OMR flows more negative than -5,000 cfs the SaMT expects impacts to rearing, foraging, sheltering, or migration of salmonids present in the south Delta. Salmonid presence in the south Delta is difficult to assess because of limited observations and there is uncertainty in how much of the population might be impacted.

## Biology Distribution and Evaluation of Green Sturgeon

### Population Status

- Delta Life Stages:
  - Adults and Juveniles

### Distribution

#### *Current Distribution*

- Adults: Most abundant during spring spawning migration period of March through May, and post spawning out-migration periods May through June; October through January depending on first winter storm event resulting in significant Sacramento River flow increases. Adult presence year-round to a lesser extent mainly in San Pablo Bay.
- Juveniles: Age-1 through Age-3 juveniles present year-round and widely distributed. Juveniles tagged with acoustic tags in the main channel Sacramento River near Sherman Island detected in the Sacramento River as far upstream as the Cache Slough complex, in the San Joaquin River at the Antioch Bridge, in Threemile, Horseshoe Bend, and Montezuma Sloughs. Seasonal abundance at the primary sampling site (near Sherman Island) appears to be highest during summer in based on capture and telemetry data. Residence time at the primary sampling site for individual fish ranges from one day to over one year but telemetry data show outmigration from the primary sampling site to the Pacific Ocean ranges from 27 to 552 days. Recent capture data shows diurnal depth preference in the main channel of the Sacramento River. No recent documentation of shallow water habitat presence or foraging.

#### *Historical Trends*

- Juvenile and adult green sturgeon are historically present in the San Joaquin and Sacramento rivers and Delta.

### ***Forecasted Distribution within Central Valley and Delta regions***

- Juvenile and adult green sturgeon are likely present in the San Joaquin and Sacramento rivers and Delta during the next week.

## **Evaluation**

1. Is there likely to be salvage that may exceed the annual loss limit?

Green sturgeon salvage is 0 fish (as of 3/04/2024). The agencies in the SaMT assessed the likelihood of salvage occurring in the next week is unlikely to occur.

## **Biology, Distribution, and Evaluation of Delta Smelt**

### **Population Status**

- Delta Smelt Life Stages:
  - Adults, Larvae
- Brood Year 2023:
- Abundance estimate:
  - The most recent non-zero abundance estimate for Delta Smelt is from the week of February 26, 2024 and is 10,103 (95% CI: 4,283 to 20,348).
- Biological Conditions:
  - Adult Delta Smelt are expected to be present in the Western Delta, Suisun Marsh, Liberty Island, lower Sacramento River, the lower San Joaquin River, and the South Delta. Delta Smelt have likely completed their population-level, upstream spawning migration in response to increases in turbidity and flow (i.e., “first flush”) conditions, which were met on 1/21/2024 (Grimaldo, et al. 2009; Sommer et al. 2011). Water temperatures became suitable for spawning on 1/31/2024 (based on temperatures from Damon et al. 2016). The Smelt Monitoring Team discussed the most recent monitoring data (TABLE 7) and considered published literature and professional judgement on the historical trends in regional distribution.

### **Distribution**

#### ***Current Distribution***

- Real time detection data are currently limited to EDSM, Chipps Island Trawl and SLS. Bay Study provides data as available.

- Forty-five Delta Smelt have been detected this water year (surveys and salvage). Forty of these have been from experimental releases.
- Four marked adult Delta Smelt have been detected by surveys (excluding salvage) in Suisun Marsh and lower San Joaquin River since 2/20/2024.
- Three marked Delta Smelt were detected in salvage at the CVP since 2/20/2024. Cumulative seasonal salvage is 56.
- Qualitative Larval sampling began on 2/20/2024 at 0400 at the Tracy Fish Collection Facility (TFCF) and will begin on 3/11/2024 at the Skinner Fish Facility (SFF).
- COA 8.5.2: Triggered 2/5/2024 by SLS survey 3 and implemented starting 2/7/2024; it was retriggered on 2/21/2024 by SLS survey 4 and on 3/4/2024 by SLS survey 5.

Table 7. Summary of newly reported detections of Delta Smelt by Region and Salvage Facilities since the last assessment. Regions are those defined by EDSM sampling. Delta Smelt >58mm FL are considered adults. Subadult fish are considered by the SMT to be fish from the previous year’s cohort based on size and timing of collection. Young of year are considered juveniles and larvae. Salvage values reflect pre-expansion salvage.

Life Stage	North	South	West	Far West	Salvage
Adult	0	2	2*	0	0
Subadult	0	0	0	0	0
Larvae/Juvenile	0	0	0	0	0

\* 1 adult detected by survey on February 7th in the Lower Sacramento was originally identified as a Wakasagi and has since been identified as a Delta Smelt with a poor adipose clip.

Table 8. Summary of recent Delta Smelt detections reported since last assessment and the total detections for the current water year. Notes reflect latest information on reported detections or completion of survey for the water year and include both larval and adult detections. Total Fish counts do not distinguish between hatchery origin and wild Delta Smelt. Table indicates new detections and previously reported detections that have undergone preliminary ID, QA/QC, and genetic confirmation. Numbers are updated as QA/QC and genetic confirmation become available. Tracy and Skinner facility counts reflect pre-expansion salvage.

Sampling Method	Frequency	New Detections	Preliminary Detections	QA/QC Detections	Genetically Confirmed to Date	Total WY2024	Notes
EDSM	Weekly	4*	N/A	30	N/A	30	Phase 1 began 12/4/2023
SKT	Monthly	0	N/A	N/A	N/A	0	not occurring this year
SLS	Biweekly	0	N/A	N/A	N/A	0	Began 12/11/2023
20-mm	Biweekly	0	N/A	N/A	N/A	0	Begins: 3/18/2024
Summer Townet	Biweekly	0	N/A	N/A	N/A	0	Begins:
Bay Study	Monthly	0	N/A	N/A	N/A	0	Ongoing
FMWT	Monthly	0	N/A	N/A	N/A	0	Complete
Chippis Island Trawl	Weekly	0	N/A	N/A	N/A	0	Ongoing
DJFMP Electrofishing survey	Monthly	0	N/A	1	N/A	1	Ongoing
FCCL Brood Stock Collections	Weekly	0	N/A	N/A	N/A	0	Complete
LEPS	As available	0	N/A	N/A	N/A	0	Began 1/2/2024
FRP	Daily	0	N/A	N/A	N/A	0	Ongoing
Tracy Fish Collection Facility (CVP)	Daily	0	N/A	14	N/A	14	Ongoing

Sampling Method	Frequency	New Detections	Preliminary Detections	QA/QC Detections	Genetically Confirmed to Date	Total WY2024	Notes
Skinner Fish Facility (SWP)	Daily	0	N/A	N/A	N/A	0	Ongoing
Total	N/A	N/A	N/A	N/A	N/A	45	Sum of all Delta Smelt observed during the water year

\* 1 adult detected by survey on February 7th in the lower Sacramento was originally identified as a Wakasagi and has since been identified as a Delta Smelt with a poor adipose clip.

### ***Cultured Delta Smelt Experimental Releases***

- Experimental releases completed in Water Year 2024 include:
  - Release 1: 14,104 fish released at Sacramento River at Rio Vista (truck release)
  - Release 2: 13,089 fish released at Sacramento River at Rio Vista (hard and soft releases)
  - Release 3: 12,691 fish released at Sacramento River at Rio Vista (hard carboy and trailer release)
  - Release 4: 25,649 fish released at Sacramento River at Rio Vista (truck release)
  - Release 5: 12,778 fish released at Sacramento River at Rio Vista (hard and soft releases)
  - Release 6: 13,157 fish released at Sacramento River at Rio Vista (hard trailer and soft release)
- See additional details at: [https://www.cbr.washington.edu/sacramento/workgroups/delta\\_smelt.html](https://www.cbr.washington.edu/sacramento/workgroups/delta_smelt.html)

Table 9. Weekly summary of the origin of Delta Smelt. These identifications are considered tentative and additional genetic testing will confirm the identity of individuals. Individuals with no tags are provided alive to the FCCL as potential additions to the FCCL Broodstock.

Date	Survey	Stratum/Station	Total Caught	Ad. Clipped	VIE	No Tag
2/07/2024	EDSM	Lower Sacramento	1*	X	N/A	N/A
2/27/2024	EDSM	Suisun Marsh	1	N/A	X	N/A
2/28/2024	EDSM	Lower San Joaquin	1	N/A	X	N/A
2/28/2024	EDSM	Lower San Joaquin	1	N/A	X	N/A

\* 1 adult detected by survey on February 7th in the lower Sacramento was originally identified as a Wakasagi and has since been identified as a Delta Smelt with a poor adipose clip.

**Historical Trends**

- Upstream migration for Delta Smelt occurs between September and December and in response to “first flush” conditions (Sommer et al. 2011, Grimaldo et al. 2009). Migration typically ranges one to four weeks after flow and turbidity increases, based on salvage data (Sommer et al. 2011).
- Historically, detections of ripe Delta Smelt began in January and peaked in February and March and the majority of Delta Smelt spawning occurs within a temperature range of 9-18°C (Damon et al. 2016).
- Based on historical monitoring data from the past few years (<https://github.com/Delta-Stewardship-Council/deltafish>), first detection of larvae in the Central and South Delta has typically occurred by mid to late March. ([https://www.cbr.washington.edu/sacramento/data/query\\_salvage\\_hrt.html](https://www.cbr.washington.edu/sacramento/data/query_salvage_hrt.html)).
- Salvage data as presented on SacPas indicates that adult Delta Smelt salvage in recent years has reached the 50th percentile at the end of February – beginning of March.
- Historically, the highest peak in salvage is in May and the second highest is in June (Grimaldo et al 2009).



**Forecasted Distribution within Central Valley and Delta regions**

- Predicting the distribution of Delta Smelt is currently difficult because detection data is limited to a few wild individuals and historic patterns may not be representative of the low population levels.
- The SMT uses turbidity as a surrogate for Delta Smelt presence and in making assessments of the likelihood of entrainment for larval Delta Smelt after spawning begins.
- The potential of experimentally released Delta Smelt to distribute from their release site is unknown at this time and SMT cannot predict their distribution beyond the original release site and subsequent recaptures. There is a high degree of uncertainty regarding the response of cultured fish to environmental cues typically applied to wild Delta Smelt.

**Abiotic Conditions**

**Turbidity**

- Partially sunny or mostly sunny through Sunday. In Stockton, light winds less than 10mph, SSE shifting to NNW by Thursday. In Antioch slight chance of rain, NNW winds today up to 9 mph.
- Turbidity is below 12 FNU at OBI and at other stations in the central and south Delta. Turbidity will likely remain stable or increase this week. The SLS survey 5 mean Secchi depth for 11 of the 12 South Delta stations was 0.95 m as of 3/4/2024.

Table 10. Relevant Environmental Factors to the current management actions for Delta Smelt.

Date Reported	OBI Daily Average Turbidity (FNU)	SJJ 3-day Average Water temperature (°C/°F)	SLS 5 (3/4/2024) 12-station average Secchi Depth (m)
3/4/2024	3.7	12.6/54.6	0.95 (11 of 12 stations measured)

**X2 Conditions**

- As of 3/4/2024, X2 was estimated to be < 56 km.

**Other Environmental Conditions**

- The Fish and Water Operation Outlook OMR Index values are expected to range between -2,000 to -2,500 cfs this week.
- QWEST was +19,350 cfs as of 3/4/2024 and is estimated to range between +19,000 to +9,000 cfs. Real time tracking of environmental conditions, relevant thresholds and Delta Smelt catch data are updated daily at: [SacPAS: Central Valley Prediction & Assessment of Salmon](#).

- Water temperature was 10.9°C at Rio Vista and 12.4°C at Antioch as of 3/4/2024.
- Anticipated Vernalis Flows: 8,000 to 13,000 cfs

## Evaluation

### USBR and DWR Proposed Operations:

- Effective 2/7 operations will be limited to a 7-day average OMRI flow no more negative than -3,500 cfs per the 2023 IOP/ITP COA 8.5.2. until the average measured Secchi depth, as defined in the IOP and ITP, is greater than 1 meter; X2 at Port Chicago for 26 days (estimated) in March; E/I  $\leq$  0.35.
- Effective 2/26 operations will be limited to a 14-day average OMRI flow no more negative than -3,500 cfs per the ITP COA 8.6.1 with 50% of the annual loss threshold of natural-origin LAD winter-run being exceeded on 2/25
- Proposed Action- Water project operations are currently limited to a 14-day average OMRI of no more negative than -2,500 cfs based on the 75% loss threshold for Steelhead being exceeded.

1. Between December 1 and January 31, has any first flush condition been exceeded?

First flush conditions were exceeded on 1/21/2024. Integrated Early Winter Pulse Protection (IEWPP) was implemented from 01/23/2024 through 2/5/2024.

2. Do DSM have a high risk of migration and dispersal into areas at high risk of future entrainment? (December 1- January 31)

No longer relevant.

3. Has a spent female been collected?

Neither a ripe nor spent female has been collected.

4. If OMR of -2000 cfs does not reduce OBI turbidity below 12NTU/FNU, what OMR target is deemed protective between -2000 and -5000 cfs?

One-day average turbidity at OBI is  $<$  12 FNU.

Implementation of COA 8.5.2 for larval and juvenile DS will limit 7-day average OMRI to no more negative than -3500 cfs. This action, while targeting larval and juvenile DS, will also reduce the chance that migrating adult DS will move into areas with a high likelihood of entrainment.

5. If OBI is 12 NTU/FNU, what do other station locations show?

OBI, Holland Cut, and Victoria Canal turbidities are all < 12 NTU/FNU, Clifton Court Forebay turbidity is 12.9 NTU as of 3/4/2024. The SLS survey 5 mean Secchi depth for 11 of the 12 South Delta stations was 0.95 m as of 3/4/2024.

6. If OBI is 12 NTU/FNU, is a turbidity bridge avoidance action not warranted? What is the supporting information?

Turbidity bridge action is not warranted at this time based on OBI turbidity < 12 FNU.

Given current distribution of detected adult DS and high turbidities surrounding the OMR corridor, entrainment risk is moderate for adult DS and individuals are likely to continue to be detected in salvage.

7. After March 15 and if QWEST is negative, are larval or juvenile DSM within the entrainment zone of the CVP and SWP pumps based on surveys?

Due to following the IOP 2023, we are not considering the March 15 date; instead, we are following COA 8.5.2. QWEST is highly positive and expected to remain positive throughout the week. Temperatures became suitable for spawning on 1/31/2024 (> 12°C three-day average at SJJ; Damon et al. 2016), but no ripe or spent adult female or larval DS have been detected. Mean Secchi depth for 11 of the 12 South Delta stations was < 1 m as of 3/4/2024. Implementation of COA 8.5.2 starting 2/7/2024 and retriggered 3/4/2024 will reduce entrainment risk due to maintaining a 7-day average of no more negative than -3500 cfs. Additionally, operations continue to target a 14-day average OMRI no more negative than -2500 cfs for steelhead protection.

8. Based on real-time spatial distribution of Delta Smelt and currently available turbidity information, should OMR be managed to no more negative than -3,500?

Yes. Water temperatures became suitable for spawning on 1/31/2024 and mean Secchi depth for the 11 of the 12 South Delta stations is < 1 m as of 3/4/2024, thus risk remains moderate for larval DS. ITP COA 8.5.2 was triggered on 2/5/2024 (retriggered on 3/4/2024) and implemented by both agencies starting 2/7/2024. Implementation of COA 8.5.2 (7-day average OMR no more negative than -3500 cfs) is expected to reduce the chance of entraining larval and juvenile Delta Smelt.

9. What do hydrodynamic models, informed by EDSM or other relevant data, suggest the estimated percentage of larval and juvenile DSM that could be entrained may be?

No larval DS have been detected, and no PTM runs were requested by the SMT in advance of the SMT meeting. Flows at Vernalis and QWEST are and will remain positive throughout the week.

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