BUREAU OF RECLAMATION

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

March 26, 2024

Executive Summary

Operational Conditions

See Weekly Fish and Water Operation Outlook document for March 26 – April 1.

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 at both facilities between 1/16/2024 and 3/16/2024. 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. 55-69% 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 was exceeded on 2/25/2024. The 75% single year loss threshold for LAD winter-run Chinook Salmon was exceeded on 3/7/2024. The 100% single year loss threshold for LAD winter-run Chinook Salmon was exceeded on 3/20/2024. Loss of natural LAD winter-run Chinook Salmon at the CVP and SWP fish collection facilities is expected to continue over the next week and exceedance of the Incidental Take Limit (ITL) for the season is possible.

Spring-run Chinook Salmon

Loss of natural YOY spring-run Chinook Salmon LAD has occurred in the past week at the State and Federal fish salvage facilities. 60-75% 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 natural spring-run Chinook Salmon at the CVP and SWP fish collection facilities is likely to 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. 40-60% 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. The ITL was exceeded on 3/20/2024.

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 are 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 Sacramento River since 3/12/2024. Risk of entrainment throughout the Delta remains low for adults and larvae based on low turbidity/ Secchi depth >1m and lack of detections in salvage and the central and south Delta. Implementation of steelhead protections may reduce the chance of entraining Delta Smelt as less negative OMRI tends to entrain less fish.

Monitoring Teams summary

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

CDFW notes that increasing OMRI to -2,500 cfs also increases exports, which is not supported by SaMT's 3/22 "advice regarding future project operations to minimize subsequent loss during the year" (as required by ITP COA 8.6.1) which was clear that "lowering exports would contribute to minimizing subsequent loss [of winter-run Chinook Salmon] this year." Therefore, CDFW recommends that OMRI should remain more positive than -500 cfs in order to minimize subsequent loss due to the 100% Annual Loss Threshold exceedance. Loss has decreased by nearly half since an OMRI of -500 cfs was targeted. Decreasing OMRI to -2500 cfs is likely to also increase loss according to previous week's loss data when OMRI was targeting -2500 cfs. See below section for the previous 5 weeks of loss data that occurred while operations were targeting an OMRI of -2500 cfs vs operating to an OMRI of -500 cfs that further supports that decreasing OMRI would increase loss.

Reclamation is elevating operational changes to OMRI of -500 cfs to -2,500 cfs to WOMT. Reclamation does not agree that the 3/22 SaMT meeting represents consensus of all the agencies in the Salmon 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 99.8% (one SD of 0.2%). By 3/24/2024, 1,110,528 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.
        - 84,994 Coleman NFH Complex brood year 2023 winter Chinook Salmon on March 11, 2024. The release took 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.
    - A release of 699,854 of spring-run Chinook salmon from the Feather River hatchery at Gridley Boat Launch and Boyd's Pump Boat Launch occurred on March 15, 2024. This group was 100% marked (with an adipose fin clip and CWT) and had an overall estimated average fork length of 74 mm.
    - Approximately 712,177 Coleman NFH brood year 2023 fall-run Chinook Salmon were released on March 21, 2024 into Battle Creek at Coleman NFH. This group is 25% marked (with an adipose-fin clip and CWT) and has an overall estimated average fork length of 75 mm.

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.
    - The majority of wild and hatchery steelhead observed at the salvage facilities are between 200 and 300 mm fork length (Figure 8). This is similar to the size distribution of age-1 clipped hatchery steelhead. However, wild steelhead in the 200-300 mm size range are likely to be comprised of both age-1 and age-2

individuals. While the size distribution of steelhead at salvage is similar to the sizes of age-1 O. mykiss at the American River, this is the typical size of age-2 steelhead from the Stanislaus River, Mokelumne River, Clear Creek, and Mill Creek (Satterthwaite et al. 2010, Eschenroeder et al. 2022, Lisa Elliott – unpublished data).

- Natural steelhead: No JPE has been established for steelhead. Data are limited.
- Hatchery steelhead: Reclamation's Proposed Action has no hatchery steelhead triggers, but see Table 7 for information on hatchery steelhead release and annual loss numbers.
- A release of 240 hatchery steelhead occurred on 3/15/24 at Lighthouse Marina from the Mokelumne hatchery. These fish will be acoustically tagged and tracked through CalFishTrack as the Mokelumne Hatchery Steelhead Export Effects Study. The goal of the release is to evaluate the effect of steelhead movement through the Delta at -500 cfs OMR.
- 6-year Steelhead study hatchery fish will be released on 3/20/24 into the Lower San Joaquin River.

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 3/16/2024, 14 genetic natural winter-run Chinook Salmon has been identified at the SWP facility. As of 3/13/2024, 6 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 6 times in the previous week (3/19/2024-3/24/2024).
- Acoustically tagged hatchery winter-run Chinook salmon have been observed passing receivers at Benicia Bridge.

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 seasonal timing. Based on historic trends in salvage winter-run Chinook salmon loss may increase over the next week.
- To date, there has been zero observation of genetic winter-run Chinook salmon within the Delta past May 1st (Sacramento trawl, Chipp Island trawl, collection at the salvage facilities) (see Brandes et al. 2021, Kevin Reece and Brian Mahardja unpublished data).

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 3/10/2024, 395 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.
- Loss of CCV Steelhead exceeded the ITL for the Dec. 1 to March 31 period on 3/20/2024
- 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-migration is occurring.
- Acoustically tagged steelhead from the Stanislaus, Mokelumne, and San Joaquin River have been observed passing receivers at Benicia Bridge.

Historical Trends

- At Red Bluff Diversion Dam, the estimated passage of BY 2023 steelhead is 57,255, which is the second highest in the last 10 brood years. (https://www.cbr.washington.edu/sacramento/tmp/hrt_1710862871_863.html).
- For historical CCV steelhead trends in salvage, see Table 3. The number of steelhead salvaged for water year 2024 is currently 1325 and the highest in the last 10 water years. 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	3/12-3/17	10	0	0	2	0
Tisdale RST	3/19-3/24	51	0	0	1	0

Locations	Reporting Period	SR Chinook	WR Chinook	LFR Chinook	Steelhead (Wild)	Green Sturgeon
Knights Landing RST	3/18-3/23	0	2	0	0	0
Lower Sacramento RST	3/17-3/24	18	1	0	0	0
Beach Seines	3/17-3/23	2	0	0	0	0
Sac. Trawl	3/17-3/23	0	2	0	1	0
Chipps Island Midwater Trawl	3/17-3/23	2	13	0	0	0
Mossdale Kodiak Trawl	3/17-3/23	N/A	0	0	1	0
EDSM	3/17-3/23	3	0	0	0	0
Feather River Herringer RST	3/6-3/17	2	0	0	0	0
Feather River Eye Side RST	3/10-3/17	0	0	0	94	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 Chipps Island (%)
Young-of-year (YOY) winter-run Chinook salmon	Current: 1-5% Last Week: 1-5%	Current: 55-69% Last Week: 65-79 %	Current: 30-40% Last Week: 20-30%
YOY spring-run Chinook salmon	Current: 20-30% Last Week: 29-40%	Current: 60-75 % Last Week: 55-70%	Current: 5-10% Last Week: 1-5%
YOY hatchery winter-run Chinook salmon	Current: 20-30% Last Week: 70-85%	Current: 40-60% Last Week: 10-20%	Current: 20-30% Last Week: 1-5%
Natural origin steelhead	Current: 20-35% Last Week: 25-40%	Current: 25-50% Last Week: 25-50%	Current: 30-40% Last Week: 25-35%

Table 3. Historic migration and salvage patterns. Last updated 03/25/2023.

Species	Red Bluff Diversion Dam	Tisdale Rst	Knights Landing Rst	SacTrawl Sherwood Catch Index	Chipps Island Trawl Catch Index	Salvage
Chinook, Winter-run, Unclipped	99.7% (99.4%,99.9 %) BY: 2014 - 2022	99.3%(98.7% ,99.9%) BY: 2014 - 2022	99.5%(98.8%,1 00.2%) BY: 2014 - 2022	74.8%(56.6%,93. 0%) BY: 2014 - 2022	41.5%(23.0%,60. 0%) BY: 2014 - 2022	77.2%(63.6%, 90.8%) WY: 2014 - 2023

Species	Red Bluff Diversion Dam	Tisdale Rst	Knights Landing Rst	SacTrawl Sherwood Catch Index	Chipps Island Trawl Catch Index	Salvage
Chinook, Spring-run, Unclipped	42.8%(17.0%,68.5%) BY: 2014 - 2022	32.6%(12.1%,53.1%) BY: 2014 - 2022	44.9%(22.4%,67.3%) BY: 2014 - 2022	15.9%(4.1%,27.8%) BY: 2014 - 2022	0.3%(-0.0%,0.6%) BY: 2014 - 2022	5.7%(-3.7%,15.1%) WY: 2014 - 2023
Steelhead, Unclipped (January-December)	4.2%(1.0%,7.3%) BY: 2014 - 2023	52.1%(32.4%,71.8%) BY: 2014 - 2023	52.8%(31.7%,73.9%) BY: 2014 - 2023	62.6%(36.2%,88.9%) BY: 2014 - 2023	54.4%(40.6%,68.1%) BY: 2014 - 2023	N/A
Steelhead, Unclipped (December-March)	N/A	N/A	N/A	N/A	N/A	84.7%(70.9%,98.4%) 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): flow percent change	Deer Creek (DCV): Alert	Wilkins Slough (WLK): mean daily flow (cfs)	Knights Landing RST: water tempe-rature (f)	Alert Triggered
3/24/2024	502.1	-7.6%	Flow>95cfs	726.2	-7.7%	Flow>95cfs	15,893.2	N/A	N/A
3/23/2024	543.5	20.4%	Flow>95cfs	786.8	46.6%	Flow>95cfs	15,591.0	N/A	N/A
3/22/2024	451.5	3.6%	Flow>95cfs	536.8	3.6%	Flow>95cfs	16,066.0	N/A	N/A
3/21/2024	435.8	4.0%	Flow>95cfs	518.2	2.1%	Flow>95cfs	16,907.7	N/A	N/A
3/20/2024	419.1	13.0%	Flow>95cfs	507.8	7.1%	Flow>95cfs	18,049.8	N/A	N/A
3/19/2024	370.9	9.1%	Flow>95cfs	474.1	3.4%	Flow>95cfs	19,521.2	N/A	N/A
3/18/2024	340.0	3.9%	Flow>95cfs	458.5	0.7%	Flow>95cfs	21,146.0	N/A	N/A

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

Stock	Date	Route	Median Travel Time	Survival	Routing Probability
Winter Chinook	2024-03-24	Overall	5.30	0.63	N/A
Winter Chinook	2024-03-24	Sacramento River	4.97	0.68	0.64
Winter Chinook	2024-03-24	Yolo Bypass	9.79	0.63	0.00
Winter Chinook	2024-03-24	Sutter Slough	5.01	0.57	0.13
Winter Chinook	2024-03-24	Steamboat Slough	4.84	0.67	0.11
Winter Chinook	2024-03-24	Interior Delta	7.89	0.40	0.12
Late-fall Chinook	2024-03-24	Overall	5.98	0.60	N/A
Late-fall Chinook	2024-03-24	Delta Cross Channel	N/A	N/A	0.00
Late-fall Chinook	2024-03-24	Georgiana Slough	8.92	0.32	0.19
Late-fall Chinook	2024-03-24	Sacramento River	5.20	0.68	0.48
Late-fall Chinook	2024-03-24	Sutter and Steamboat Slough	5.89	0.65	0.33

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 3/25/2024.

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 %	77	61
Predicted Steelhead, High %	284	172
Predicted Chinook Winter Run, Median %	46	14
Predicted Chinook Winter Run, High %	456	303

b) Environmental details, current and forecast

Parameter	Data	Forecast
Temperature (Mallard Island, C)	13.8	13.8
Precipitation (5-d running sum, inches)	0.05	0.05
Old and Middle River Flows (cfs)	-1113	-1113

Parameter	Data	Forecast
Sacramento River Flow (Freeport, cfs)	44553	44553
DCC Gates	closed	closed
San Joaquin River Flow (Vernalis, cfs)	5209	5209
Export	2925	2925

c) Salvage predictor estimates for natural origin Central Valley Steelhead from model developed in Tillotson et al. (2022)[1] across multiple OMR flow scenarios represented within a range of percentiles. The model with expected discharge values (Discharge Range) in the Sacramento and San Joaquin Rivers through 3/29.

OMR	Exports	San Joaquin Flow	Sacramento Flow	25th Percentile Weekly Loss	Median Weekly Loss	75th Percentile Weekly Loss	Median Daily Loss
1030	1500	5700	36800	31.42	83.38	155.88	11.91
0	2600	5700	36800	53.66	103.42	171.59	14.77
-500	3000	5700	36800	71.75	122.56	192.85	17.51
-1000	3700	5700	36800	81.95	131.12	198.68	18.73
-1500	4250	5700	36800	81.95	132.62	256.48	18.95
-2000	4800	5700	36800	82.81	134.56	266.46	19.22
-2500	5300	5700	36800	81.95	134.56	266.46	19.22
-3000	5900	5700	36800	77.44	141.28	284.57	20.18
-3500	6400	5700	36800	77.44	143.22	337.07	20.46
-4000	7000	5700	36800	79.66	162.54	389.03	23.22
-4500	7550	5700	37794	25.98	148.94	337.07	21.28
-5000	8000	5700	37794	52.47	161	354.06	30.71

[1] 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

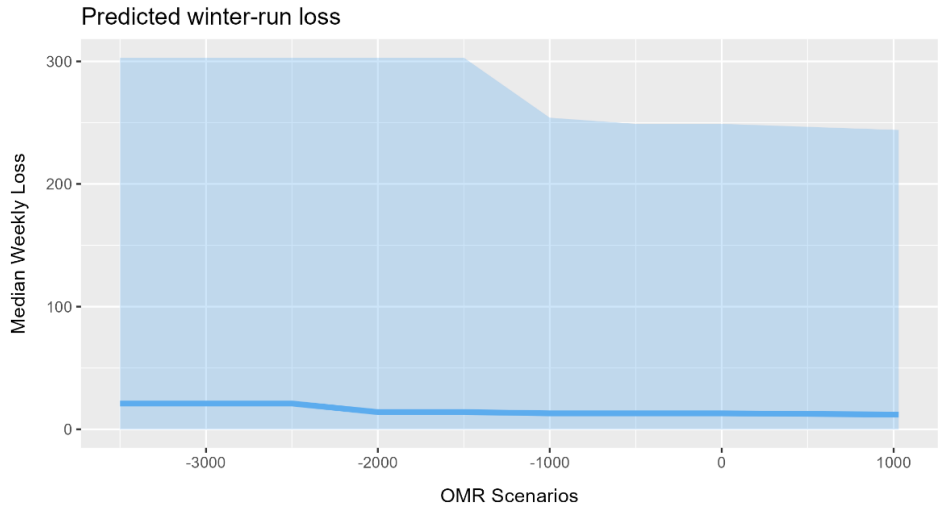


Figure 1. Summary of Tillotson et. al. (2022) model predictions for total weekly loss of LAD winter-run salmon at varying OMR scenarios. Solid blue line represents median weekly loss and shaded blue area represents 10th and 90th percentile weekly loss predictions.

Figure 1 is a line graph that shows a summary of Tillotson et. al. (2022) model predictions for the total weekly loss of LAD winter-run salmon at varying OMR scenarios. The shaded section shows 10^{th} and 90^{th} percentile weekly loss predictions exceeding 300 at the -3500 OMR scenario, decreasing to 250 at the -1000 OMR scenario, and reaching 240 at the 1000 OMR Scenario. Median weekly loss is shown to be at 45 at the -3500 OMR Scenario, and steadily decreases to 20 at the 1000 OMR Scenario.

Table 7. Annual loss of clipped juvenile steelhead at the salvage facilities and total hatchery juvenile steelhead release numbers for brood years 2016 to 2023*. From 2016 to 2024, average annual % lost to the facilities was 0.153%. Note that release locations and dates, which vary by year, were not considered for this calculation. Hatchery release numbers were acquired from: CDFW hatchery releases- Calfish.org and USFWS hatchery releases data provided by Kevin Offill, 3/13/2024. Water facility loss data acquired from: SacPAS and reflects Water Year 2017 - 3/12/2024. * BY23 includes all fish released prior to 3/14/2024 (data is preliminary)

Brood Year	Total Hatchery Steelhead Release Number (BY)	Loss of clipped steelhead at the facilities (WY)	% Total Hatchery Number Lost to the Facilities	Water Year
2016	1,019,501	164.29	0.016	2017
2017	811,379	2,462.90	0.304	2018
2018	1,264,939	5,777.70	0.457	2019
2019	1,084,899	659.44	0.061	2020
2020	1,853,751	341.69	0.018	2021
2021	1,676,701	639.79	0.038	2022
2022	1,623,483	3,650.30	0.225	2023
2023*	1,517,998	1,581.93	0.104	2024

"Today, the Central Valley O. mykiss population complex is dominated by hatchery-origin fish" (NMFS 2003; Lindley et al. 2007). Best available information indicates that natural-origin O. mykiss comprise only 6% to 16% of the O. mykiss in the northern Sacramento-San Joaquin Delta and San Francisco Estuary. While diversifying the portfolio of release practices is expected to benefit stock complex resiliency and stability, it is also important to consider the potential genetic and ecological impacts of releasing hatchery-origin pre-smolts on natural-origin O. mykiss and other life stages of hatchery-origin O. mykiss." See Eric R. Huber, Rachael E. Ryan, Rachel C. Johnson, Anna M. Sturrock, Robert A. Lusardi, and Stephanie M. Carlson. Seventy years of diminishing biocomplexity of California Central Valley hatchery steelhead, Oncorhynchus mykiss. Canadian Journal of Fisheries and Aquatic Sciences.

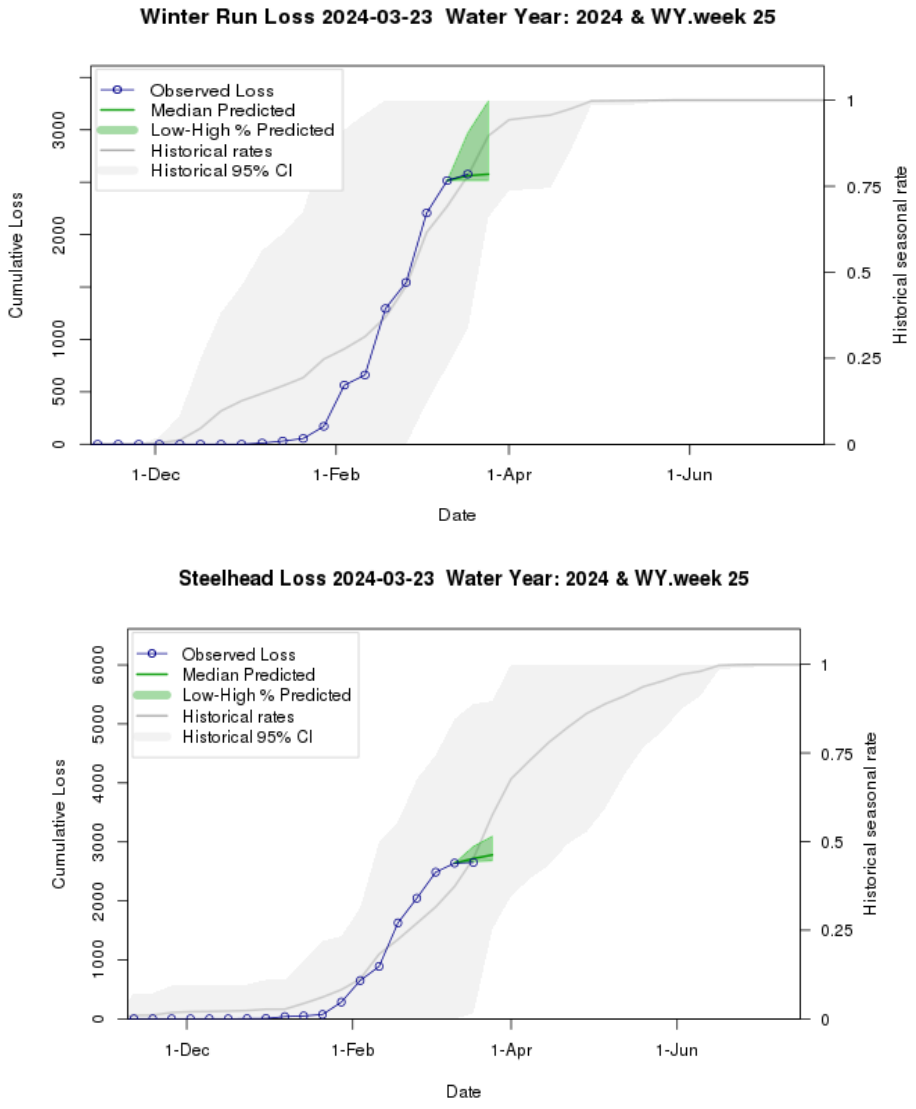
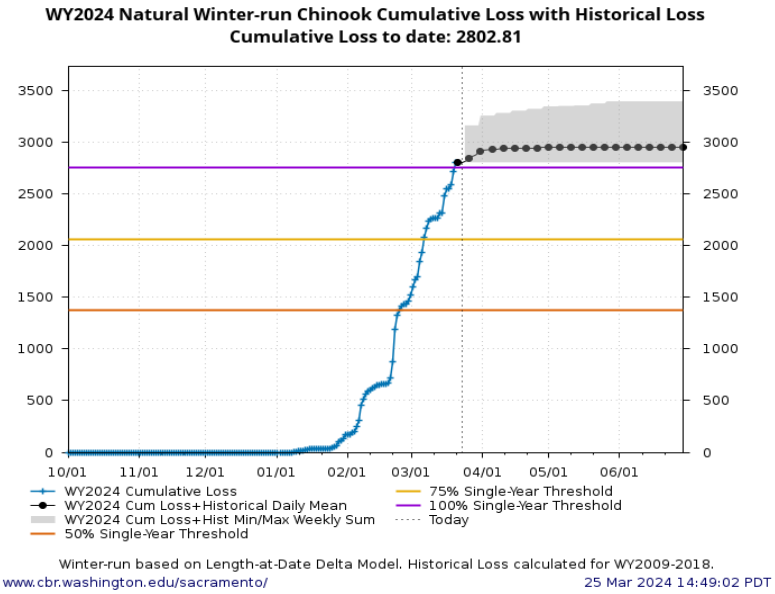


Figure 2. Predicted weekly loss of steelhead and winter-run Chinook at the CVP and SWP facilities based on historical loss

Figure 2 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 2700 and the observed loss of 2700. The second line graph shows the cumulative loss of Steelhead salmon comparing the median predicted loss of about 2800 and the observed loss of about 2700.



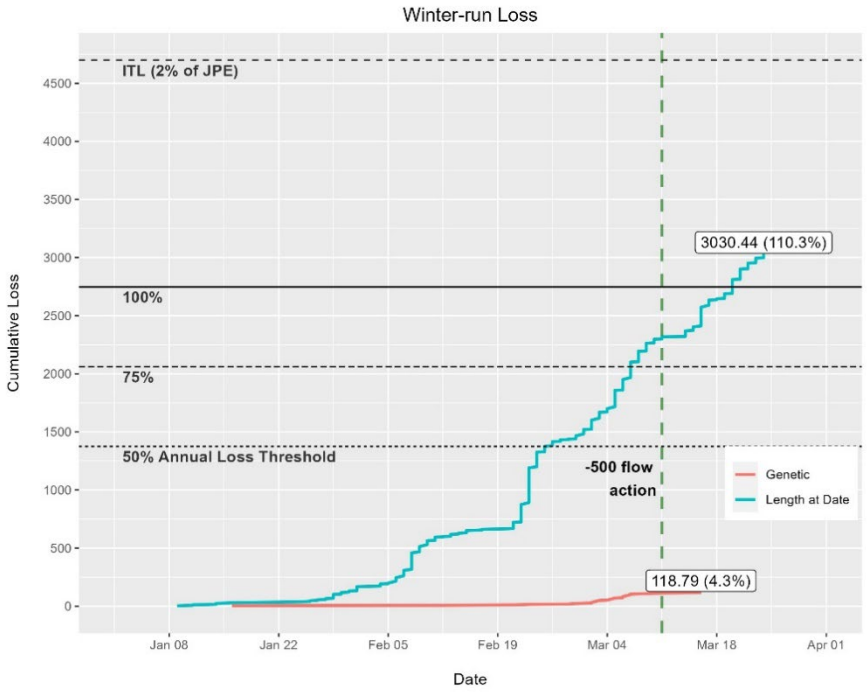


Figure 3. (Top) Cumulative natural winter-run Chinook salmon loss for the year (blue) and 2009 – 2018 historic cumulative loss (gray, different symbols). Historic daily mean plotted in black circles. (Bottom) Cumulative natural LAD winter-run loss in WY 2024 representing the most current LAD winter-run loss numbers

Figure 3 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, and the cumulative natural LAD winter-run loss in WY 2024 representing the most current LAD winter-run loss numbers.

The first line graph shows the water year 2024 cumulative loss to date. The water year 2024 cumulative loss passes the 50 percent single-year threshold on February 21, 2024, and the 100 percent single-year threshold on March 24, 2024. Cumulative loss to date is 2802.81.

The second graph shows the LAD winter-run loss at 3030.44 or 110.3% of the Annual Loss Threshold.

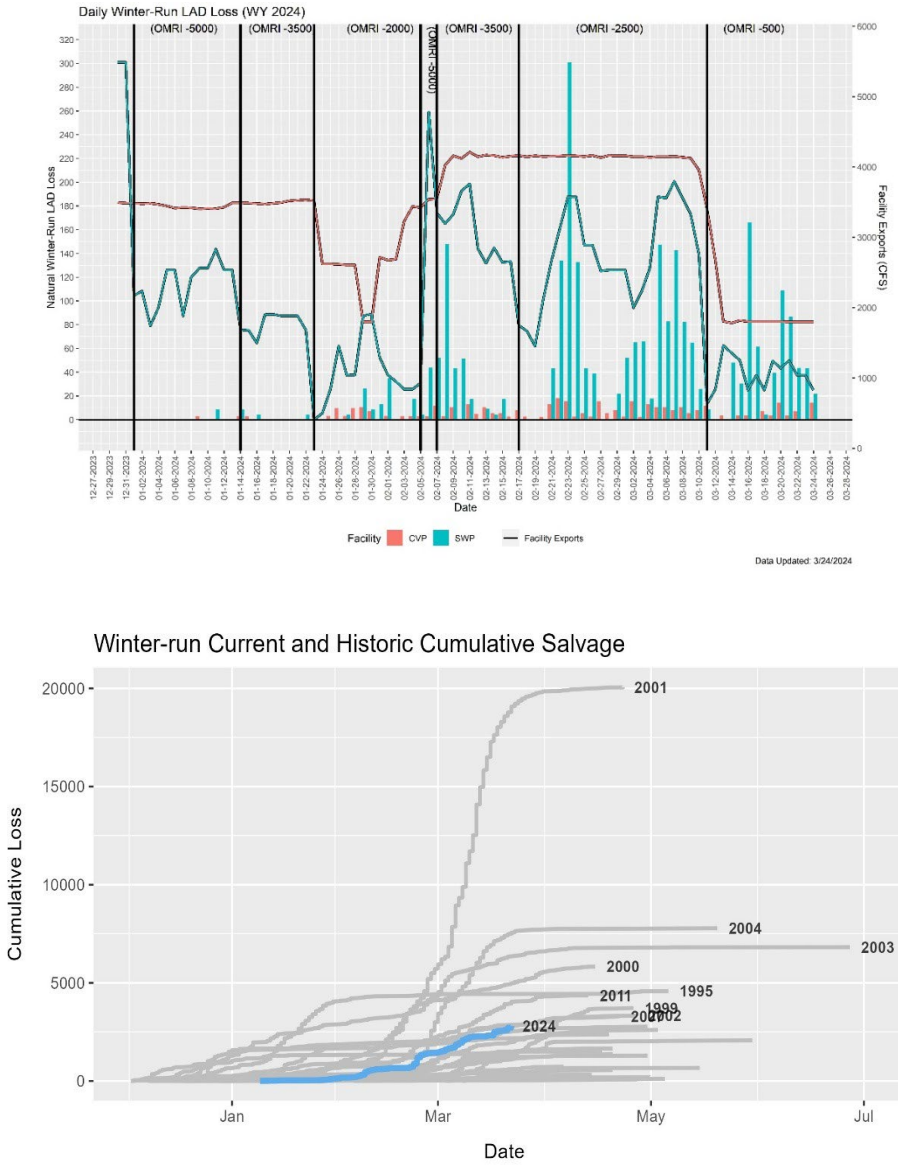


Figure 4. (Top) Daily LAD natural-origin winter-run Chinook salmon (CVP=red bars and SWP=blue bars) with daily exports at both the CVP (red line) and SWP (blue line). Vertical black bars are approximate dates when OMRI controlling factors change. (Bottom) LAD winter-run historic cumulative loss from salvage facilities from water year (WY) 1994-2024. The solid blue line represents 2024 and to ensure readability, only cumulative loss

curves that have exceeded current 2024 cumulative loss were labeled by WY (updated through 3/21). The 3 overlapping years are 1999, 2002, and 2007.

Figure 4 is two line graphs, the first of which shows daily LAD natural origin winter-run Chinook salmon loss for WY 2024, and the second shows LAD winter-run current and historic cumulative loss from salvage facilities from WY 1994-2024.

The first graph shows daily exports at the CVP and SWP facilities, and highlights the approximate dates when OMRI factors change.

The second graph shows 2024 cumulative loss at over 2500 and highlights years that have exceeded this number which include 1995, 2000, 2001, 2003, 2004, and 2011. The graph highlights the years that overlap with 2024 which include 1999,2002, and 2007.

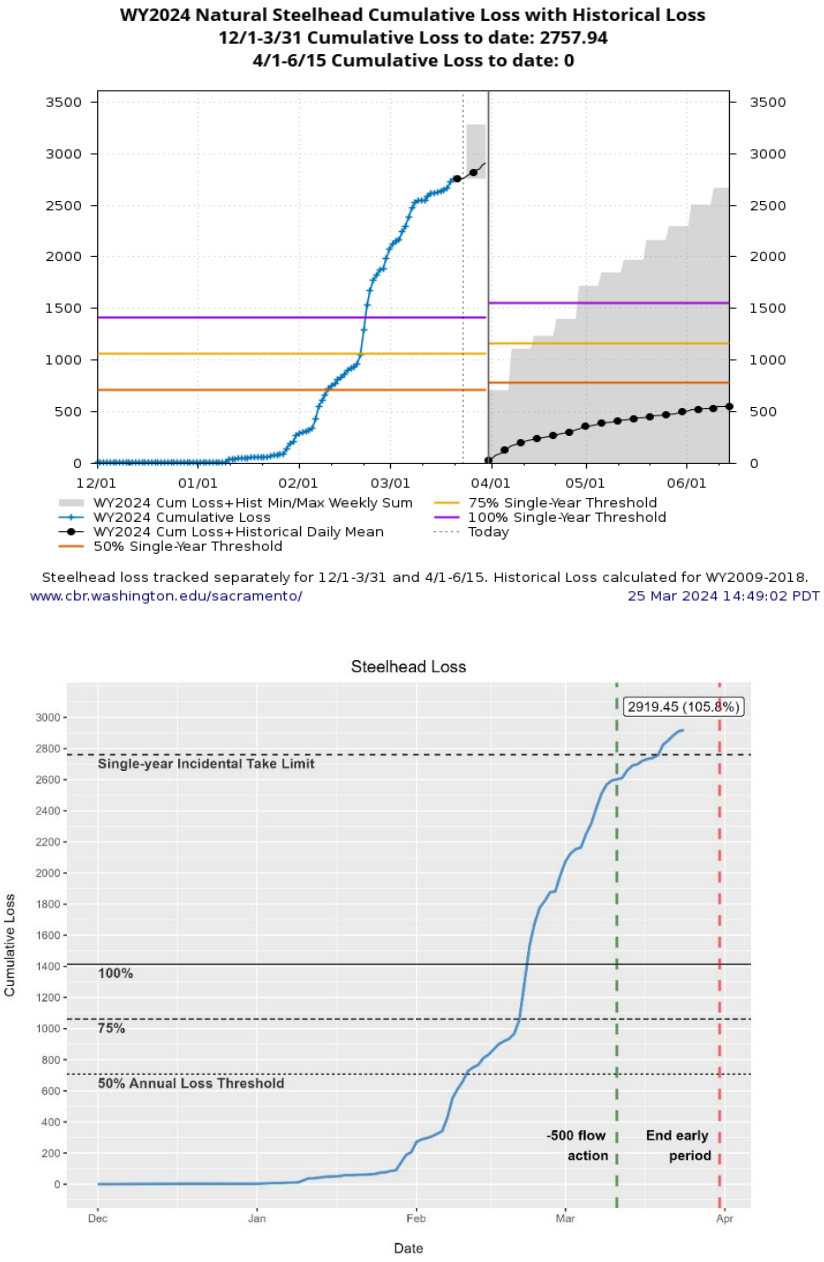


Figure 5. (Top) Cumulative natural steelhead loss overlaid with mean, minimum, and maximum historic salvage rates. (Bottom)Cumulative natural steelhead loss in WY 2024 representing the most current steelhead loss numbers.

Figure 5 is two line graphs, the first of which shows the cumulative natural steelhead loss of WY 2024 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 WY 2024.

The first line graph shows the WY 2024 cumulative loss and historical daily mean pass the 100% single-year threshold on February 21, 2024 and reach 2757.94 on March 25, 2024. The WY 2024 cumulative loss and historical daily mean begins to approach the 50% single-year threshold at the start of April 2023 and reached just above 500 on June 15, 2024.

The second line graph shows the WY 2024 cumulative loss at 2919.45 or 105.8 percent of the single-year incidental take limit.

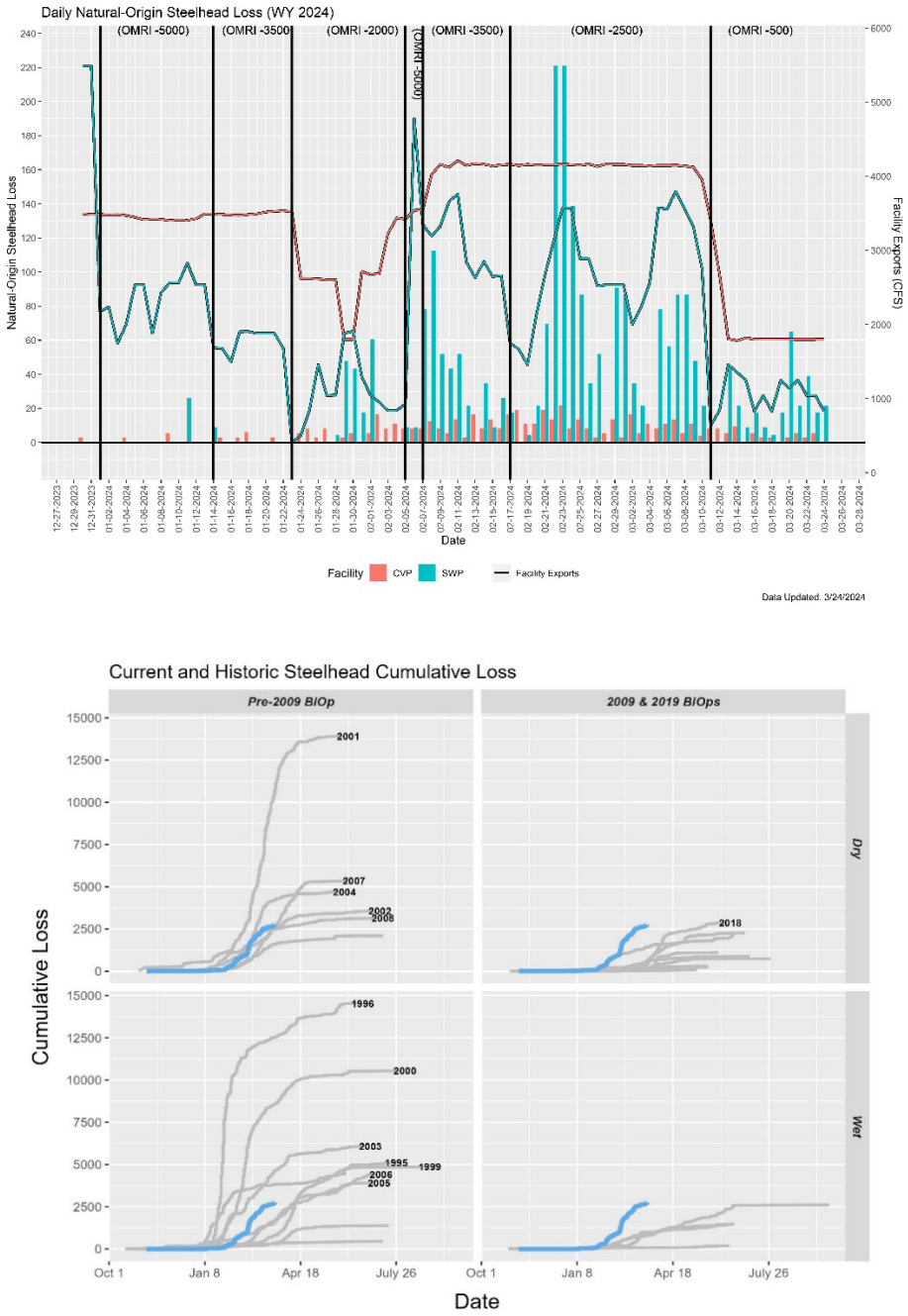


Figure 6. (Top) Daily natural-origin steelhead (CVP=red bars and SWP=blue bars) with daily exports at both the CVP (red line) and SWP (blue line). Vertical black bars are approximate dates when OMRI controlling factors change. (Bottom) Central Valley Steelhead historic cumulative loss from salvage facilities from water year (WY) 1994-2024. The solid blue line represents 2024 and to ensure readability, only cumulative loss

curves that have exceeded current 2024 cumulative loss were labeled by WY (updated through 3/21/24).

Figure 6 is two line graphs, the first of which shows the daily natural-origin steelhead exports at each facility, and the second shows current and historic cumulative steelhead loss.

The first graph shows the natural-origin steelhead exports at the CVP and SWP facilities by approximate dates when OMRI controlling factors change.

The second graph shows current and historic cumulative steelhead loss prior to the 2009 BiOP and following the 2009 and 2019 BiOPs, broken down by wet and dry.

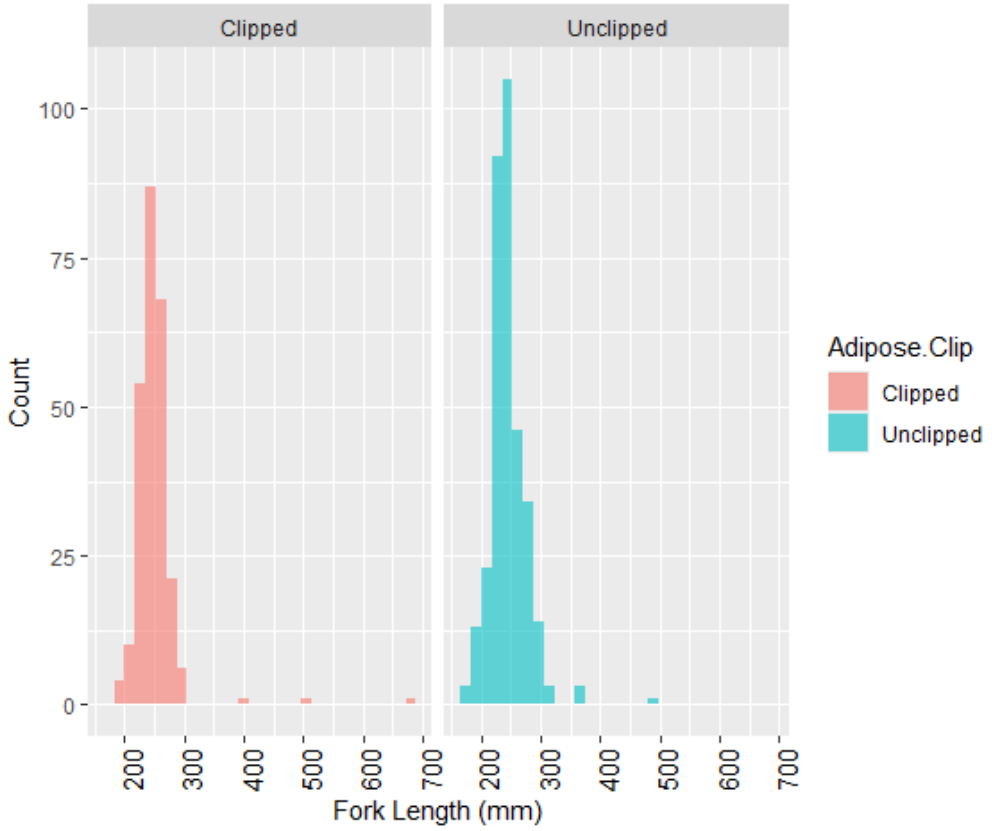


Figure 7. Fork length distribution of wild and hatchery steelhead collected at the CVP and SWP salvage facilities in WY 2024. Data included steelhead through 3/17/2024.

Figure 7 is a bar chart which shows the fork length distribution of wild and hatchery steelhead collected at the CVP and SWP facilities in WY 2024. The date is broken down into fish collected with 'clipped' and 'unclipped' adipose fins, with unclipped having a greater fork length and being collected in higher numbers.

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 be 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 3030.44 fish (as of 03/24/2024). 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 75% single-year loss threshold was exceeded on 3/7/2024, and the 100% single-year loss threshold was exceeded on 3/20/2024. It is possible that the ITL (4,698), which is based on length-at-date winter-run, will be exceeded this year.

The Delta Model length-at-date (LAD) criteria is used for tracking the 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 2 and 4 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 4 may be relevant this year. Genetic methods provide a more accurate measure of identifying winter-run Chinook salmon than length-at-date. According to the genetic data, peak outmigration of natural winter-run Chinook Salmon in the Delta typically occurs in March and ends sometime in mid- to late-April, with no detection of genetic winter-run in the Delta past May 1st (Brandes et al. 2021, Kevin Reece and Brian Mahardja unpublished data). DNA results through 3/16/2024 indicate a loss of 118.79 winter-run Chinook salmon so far this year, which is the highest genetic loss observed in the previous 4 years as well as the sixth's highest genetic loss in the previous 14 years. Relative to the JPE, genetic winter-run loss at the salvage facilities in WY 2024 so far is comparable to WY 2018 and 2019 (~0.05%), and remains lower than WY 2011 (0.44%) and WY 2012 (0.56%) (the two highest genetic winter-run annual loss at salvage facilities since 2008). Genetic analysis has prioritized older juvenile Chinook salmon (LAD winter-run, late fall-run, and yearling fall-run) so far and results on Chinook salmon from other runs (LAD young-of-year fall-run and spring-run) are being analyzed as capacity permits. All fish have been analyzed through February, however, fish smaller than older

juvenile Chinook salmon from March are still awaiting analyses, which would indicate the possibility of more genetic winter-run Chinook salmon.

The CVP and SWP may target an OMRI as negative as -2,500 cfs this week. SaMT acknowledges that while there does not seem to be any export level that would result in zero loss, this would likely result in an increase in loss per day based on the Tillotson Model and observed loss based on previous weeks operations targeting an OMRI no more negative than –2,500 cfs. Any increase in loss would not be beneficial to the winter-run population and would likely lead to an earlier exceedance of the incidental take limit.

Central Valley Steelhead

Total natural juvenile steelhead loss is 2919.45 fish (as of 03/24/2024). 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, the 100% loss threshold was exceeded on 2/23/2024, and the incidental take limit was exceeded on 3/20/2024.

A means of calculating a juvenile production estimate currently does not exist for steelhead, limiting the ability of SaMT to assess the impact of loss on the basin-wide or genetically distinct populations of *Oncorhynchus mykiss*. Information on steelhead abundance and distribution in the Delta is also limited, as the existing fish surveys do not target steelhead and may be ineffective at catching these larger-sized fish (yearling or older). Although the proportion of wild steelhead population lost at the salvage facilities is unknown due to lack of WY 2024 population size, the proportion of hatchery or tagged steelhead observed at the facilities relative to release or tagged fish numbers can potentially offer insight into the proportional entrainment of wild steelhead. Annual loss of clipped steelhead at the salvage facilities represent between 0.02 to 0.46% of total hatchery release numbers between water year 2017 and 2024 (Table 7). Meanwhile, acoustic tag study of wild steelhead from the Stanislaus River indicates that 9 out of 197 (~4.6%) tagged fish arrived nearby or at the salvage facilities (CalFish Track Stanislaus River wild steelhead, Fall Releases). For the six-year Steelhead study, so far about 25 out of 335 (~11%) tagged fish have been detected nearby or at the salvage facilities (CalFish Track 6-year Study San Joaquin River Steelhead – March Releases), while none of the 240 tagged Mokelumne River hatchery steelhead have been detected at the salvage facilities (CalFish Track Mokelumne Hatchery Steelhead Export Effects Study).

Salmonid species are expected to have increased survival when flows are high (Michel et al. 2021) and acoustic telemetry studies indicated that survival is correlated with increased flows at Vernalis for San-Joaquin origin Steelhead

(Buchanan et al. 2021), potentially influencing the number of fish observed at the salvage facilities.

However, SaMT recognizes that while there seems to be no export level that would lead to zero loss, reduction of export or a more positive OMR should generally lead to a reduction in salvage and loss of steelhead (Table 6c, Figure 7).

The CVP and SWP have been operating to OMRI of no more negative than –500 cfs beginning on 3/11/2024. Weekly loss of natural-origin steelhead has decreased significantly since OMRI of –500 cfs has been targeted. The CVP and SWP may target an OMRI as negative as -2,500 cfs this week. Below are data from the previous 5 weeks (including the most up to date week):

- 2/19/24-2/25/24: 1650.16
- 2/26/24-3/3/24: 530.81
- 3/4/24-3/10/24: 723.80
- 3/11/24-3/17/24: 139.03
- 3/18/24-3/24/24: 186.30

Steelhead loss is likely to remain lower when targeting a -500 cfs OMRI than when targeting a -2,500 cfs OMRI, which is based on the previous 5 weeks of salvage (see above).

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 was exceeded in WY 2024 on 3/20/2024. Because the 50% and 75% single year loss thresholds have been exceeded and export facilities would operate such that the fourteen-day average OMRI flow is no more negative than -2,500 cfs through the end of OMR management season or until the risk of entrainment is no longer present based on a SaMT risk assessment. Coordination between all agencies that are SaMT members is expected to address the operations after exceeding the 100% annual loss threshold.

Central Valley Steelhead

The 100% annual loss threshold for steelhead (December 1 – March 31) has been exceeded for WY 2024.

It is uncertain if additional OMR restrictions benefit fish movement and survival. Buchanan et al.'s (2021) study indicated that high flows increase through-Delta survival of steelhead, with little to no association between Delta export and survival. However, this study was conducted in 2011-2016 when OMR was restricted to be no more negative than -5,000 cfs, and therefore does not necessarily suggest that higher Delta export cannot be associated with lower survival.

STARS model output indicates higher survival for Sacramento River-origin salmon in the Delta relative to the past several years due to hydrological conditions (STARS Predicted Survival, Travel-Time and Routing for Winter Run). Steelhead appear to be outmigrating at a larger sizes than Chinook salmon based on salvage data (~200-300 mm fork length) and therefore may have even higher survival than Chinook salmon. Although the December-March period is expected to reflect the Delta outmigration timing of Sacramento-basin steelhead, real-time data from CalFish Track indicate that some steelhead from the Stanislaus River (San Joaquin basin) have been entrained at the salvage facilities and some have even migrated past Benicia.

Mokelumne hatchery steelhead were released on 3/15/2024 at the Lighthouse Resort in the Delta to evaluate the effects of export on steelhead. To date, the majority of detections after release have occurred downstream at Benicia.

The Tillotson Model results at OMRI of –500 cfs predicted a median daily loss of 23.43 per day last week, which is higher than what was observed over the previous week when a no more negative than -500 cfs OMRI was targeted. At -1500 cfs OMRI the latest range of model runs (Table 7) predicts a median daily loss of 11.06 and at -500 cfs OMRI the prediction for the median daily loss is 9.33. CVP and SWP may target an OMRI no more negative than –1,500 cfs. SaMT acknowledges that this would likely result in an increase in loss per day based on the Tillotson Model which would not be beneficial to the steelhead population. After exceeding the ITL any decrease in loss of steelhead would benefit the species.

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 OMRI flows are targeting between -500 and –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.

Salmonid References

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Eschenroeder J, Peterson M, Hellmair M, Pilger TJ, Demko D, Fuller A. 2022. Counting the Parts to Understand the Whole: Rethinking Monitoring of Steelhead in California's Central Valley. San Fr Estuary Watershed Sci. 20(1). https://doi.org/10.15447/sfews.2022v20iss1art2

Michel CJ, Notch JJ, Cordoleani F, Ammann AJ, Danner EM. 2021. Nonlinear survival of imperiled fish informs managed flows in a highly modified river. Ecosphere. 12(5). https://doi.org/10.1002/ecs2.3498

Tillotson M, Hassrick J, Collins A, Phillis C. 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 Fr Estuary Watershed Sci. 20(2):0–21. https://doi.org/10.15447/sfews.2022v20iss2art3

Satterthwaite WH, Beakes MP, Collins EM, Swank DR, Merz JE, Titus RG, Sogard SM, Mangel M. 2010. State-dependent life history models in a changing (and regulated) environment: Steelhead in the California Central Valley. Evol Appl. 3(3):221–243. https://doi.org/10.1111/j.1752-4571.2009.00103.x

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 3/26/2024). 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 March 11, 2024 and is 5,150 (95% CI: 1,426 to 13,412).
- Biological Conditions:
    - Adult Delta Smelt are expected to be present in Suisun Marsh and the lower Sacramento River. 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 20 mm Survey. Bay Study provides data as available.
- Fifty-one Delta Smelt have been detected this water year (surveys and salvage). Forty-six of these have been from experimental releases.
- Four marked adult Delta Smelt have been detected by surveys (excluding salvage) in Suisun Marsh and the lower Sacramento River since 3/12/2024.
- No Delta Smelt have been salvaged after 2/23/2024. Cumulative seasonal salvage is 56.
- Qualitative Larval sampling began on 2/20/2024 at 0400 at the Tracy Fish Collection Facility (TFCF) and began at 1100 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, however it was not triggered by SLS survey 6 on 3/18/2024.

Table 8. 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	0	3	0	0
Subadult	0	0	0	0	0
Larvae/Juvenile	0	0	0	0	0

Table 9. 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	3	N/A	36	N/A	36363	Phase 2 will begin on 4/1/2024
SKT	Monthly	0	N/A	N/A	N/A	0	not occurring this year
SLS	Biweekly	0	N/A	N/A	N/A	0	Complete
20-mm	Biweekly	0	N/A	N/A	N/A	0	Ongoing
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
Chipps 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
Skinner Fish Facility (SWP)	Daily	0	N/A	N/A	N/A	0	Ongoing

Sampling Method	Frequency	New Detections	Preliminary Detections	QA/QC Detections	Genetically Confirmed to Date	Total WY2024	Notes
Total	N/A	N/A	N/A	N/A	N/A	515148	Sum of all Delta Smelt observed during the water year

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: SacPAS: Central Valley Prediction & Assessment of Salmon

Table 10. 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
3/25/2024	EDSM	Lower Sacramento River	1	N/A	X	N/A
3/25/2024	EDSM	Suisun Marsh	2	N/A	X	N/A

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. (SacPAS: Central Valley Prediction & Assessment of Salmon)
- 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

- Sunny today with chance of showers Thursday through the rest of the week. In Stockton, light SW winds today and tomorrow, and light West winds on Thursday. In Antioch, light WNW winds today, increasing to SSW winds up to 16mph on Wednesday.
- Turbidity is below 12 FNU at OBI and at most other stations in the central and south Delta. Turbidity will likely remain stable or decrease this week. The SLS survey 6 mean Secchi depth for 11 of the 12 South Delta stations was 1.11 m as of 3/18/2024. The 20 mm survey 1 Secchi depth for 11 or the 12 South Delta stations was 1.24 m as of 3/19/2024.

Table 11. 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)	12-station average Secchi Depth (m) SLS 6/20mm 1 (3/18/2024-3/19/2024)
3/25/2024	5.5	14.9/58.8	1.11/1.24 (11 of 12 stations measured)

X2 Conditions

- As of 3/26/2024, X2 was estimated to be 57 km.

Other Environmental Conditions

- The Fish and Water Operation Outlook OMR Index values are expected to range between -400 to -2600 cfs this week.
- QWEST was +11,725 cfs as of 3/25/2024 and is estimated to range between +9,000 to +12,000 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 14.4°C at Rio Vista and 14.8°C at Antioch as of 3/25/2024.
- Anticipated Vernalis Flows: 4,500 to 6,000 cfs

Evaluation

USBR and DWR Proposed Operations:

- March: X2 at Port Chicago for 27 days in March; E/I <= 0.35.
- Effective 3/8, CVP and SWP project operations will be limited to a 14-day average OMRI flow no more negative than -2,500 cfs per the Proposed Action and ITP COA 8.6.1 with 75% of the annual loss threshold of natural-origin LAD winter-run exceeded on 3/7.
- Beginning 3/11, CVP and SWP project operations will be limited to an OMRI no more negative than –500 cfs to protect steelhead, based on the Director's decision of 3/7.
- Reclamation and DWR propose to operate within the range of OMRI no more negative than –500 cfs to –2,500 cfs this week, in accordance with the direction provided by the LTO Governance process.

Questions and Discussions:

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.

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

   OBI, Holland Cut, and Victoria Canal turbidities are < 12 NTU/FNU as of 3/25/2024. Clifton Court Forebay turbidity was 13.5 NTU as of 3/25/2024. The SLS survey 6 mean Secchi depth for 11 of the 12 South Delta stations was 1.11 m as of 3/18/2024 and the 20 mm survey 1 mean Secchi depth for 11 of the 12 South Delta stations was 1.24 m as of 3/18/2024-3/19/2024.

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 low turbidities in the OMR corridor, entrainment risk is low for adult DS.

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 2023 IOP, 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.

   Temperature 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 is > 1 m as of 3/18/2024-3/19/2024. Implementation of steelhead protections is expected to reduce the chance of entraining Delta Smelt.

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?

   No. Water temperatures became suitable for spawning on 1/31/2024, however mean Secchi depth for 11 of the 12 South Delta stations was >1 m as of 3/18/2024-3/19/2024 and no larval or juvenile Delta Smelt have been detected in the Central or South Delta, thus risk is low for larval DS. COA 8.5.2 was not triggered by the most recent SLS or 20mm surveys (SLS 6/20mm 1). Implementation of steelhead protections is expected to reduce the chance of entraining 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.

Delta Smelt References

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