



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

January 24, 2023

## Executive Summary

### Operational Conditions

See Weekly Fish and Water Operation Outlook document for –January 24 - January 30

### 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 (WY 2023 total loss = 47.31 fish, as of 1/24/2023). 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. 40-60% of juvenile natural winter-run Chinook Salmon from brood year (BY) 2022 are estimated to be present in the Delta. The Delta Cross Channel (DCC) gates closure for the season reduces exposure of winter-run Chinook Salmon juveniles that are present in the Sacramento River near the DCC gates into the interior Delta.

### Spring-run Chinook salmon

No loss of natural spring-run Chinook Salmon (by length at date, LAD) has occurred in the past week at the State or Federal fish salvage facilities. Loss of spring-run Chinook salmon at the CVP and SWP fish collection facilities may occur over the next week. 15-30 % of juvenile natural spring-run Chinook Salmon from brood year (BY) 2022 are estimated to be present in the Delta. The DCC gates closure for the season reduces exposure of spring-run Chinook Salmon juveniles that are present in the Sacramento River near the DCC gates into the interior Delta.

### Central Valley Steelhead

Loss of natural California Central Valley (CCV) steelhead has occurred in the past week at the State and Federal fish salvage facilities (WY 2023 December 1 - March 31 total loss = 71.50 fish, as of 1/24/2023). Loss of Central Valley steelhead at the CVP and SWP fish collection facilities may occur over the next week. 10-15% of juvenile natural CCV Steelhead from brood year (BY) 2022 are estimated to be present in the Delta. DCC closure for the season reduces exposure to Central Valley steelhead juveniles that are potentially present in the Sacramento River near the DCC gates.

## **Green Sturgeon**

Loss of green sturgeon has not occurred in the past week at the State and Federal fish salvage facilities (WY 2023 total loss = 0 fish, as of 1/24/2023). Loss of green sturgeon is unlikely to occur over the next week due to their rare presence in the South Delta.

## **Delta Smelt**

Based on recent detection data, distribution patterns over the past decade, recent first flush conditions and widespread turbidity in the Delta, Delta Smelt are migrating and distributing throughout the Delta. The last Delta Smelt observations were on 1/24/2023 by EDSM in Suisun Bay (preliminary), 1/19/2023 by the DJFMP Chipps Island trawl, 1/17/2023 by EDSM in the South Delta, and on 1/7/2023 at the CVP (salvage). The Turbidity Bridge Avoidance Action began on 1/17/2023, and has continued through present. Turbidity remains elevated throughout the Delta. Overall risk for entrainment is moderate for Delta Smelt outside of the OMR corridor and risk is high for fish within the OMR corridor. Changing to a more negative OMRI will increase risk of entrainment.

## **Delta Cross Channel Gates**

The DCC gates were closed on 11/28/2022 to meet LTO Proposed Action and are expected to remain closed until May. DCC gates may only be opened to maintain water quality under D-1641 between November and January.

## **Monitoring Teams summary**

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

Smelt Monitoring Team: CDFW, USFWS, DWR, and USBR did not reach consensus on what OMR target is deemed protective for Delta Smelt.

## **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 2022 Productivity:

- Natural winter-run Chinook salmon: Draft Juvenile production estimate (JPE) calculations have been established for brood year (BY) 2022 winter-run Chinook salmon. The agencies in the winter-run Chinook salmon JPE project work team (WR JPE PWT) have provided a draft JPE recommendation to the fish agencies. The final BY 2022 JPE is 49,924 natural origin juvenile winter run Chinook salmon.
- Mean cumulative weekly passage of winter-run Chinook salmon through 1/14/2023 at Red Bluff Diversion Dam (RBDD) for the last 20 years of passage data is 97.8% (one SD of 2.8%). By 1/14/2023, 221,452 winter-run Chinook salmon were estimated to have passed RBDD compared to the cumulative passage last year of 572,568 winter-run Chinook salmon.
- Hatchery winter-run Chinook salmon: No hatchery winter-run Chinook salmon have been released in WY 2023.

### ***Spring-run Chinook Salmon***

- Delta Life Stages:
  - Young-of-year (YOY) and Yearlings
- Brood Year 2022 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 71,057 late-fall Chinook salmon from Coleman National Fish Hatchery were released at Battle Creek on 12/5/2022. This group is 100% marked with adipose-fin clip and CWT and have an estimated average fork length of 145mm. This is the first spring-run Chinook salmon surrogates release group associated with the Proposed Action. There has been no loss this water year of fish associated with the first surrogate release group.
    - Approximately 66,735 late-fall Chinook salmon from Coleman National Fish Hatchery were released at Battle Creek on 12/23/2022. This group is 100% marked with adipose-fin clip and CWT and have an estimated average fork length of 145mm.
    - Approximately 60,712 Coleman NFH brood year 2022 late-fall Chinook Salmon on January 13, 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.

- There has been loss this water year of fish associated with the first and second surrogate release groups.
- The agencies in the SaMT discussed the thiamine vitamin deficiency that was observed in winter run Chinook salmon broodstock at the Livingston Stone National Fish Hatchery (LSNFH) in BY 2021. Last year the thiamine deficiency appeared to negatively affect survival of juvenile fish as they migrate downstream towards the Delta. The thiamine deficiency issue is also likely impacting spring-run Chinook salmon. Although the egg take goals have been met at the Feather River Fish Hatchery, they are still experiencing fertility issues that are impacting production.

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

- Delta Life Stages:
  - Spawning Adults, Kelts, Juveniles
- Brood Year 2022 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.
- Through 1/2/2023, the Glenn Colusa Irrigation District (GCID) rotary screw traps (RSTs) have observed winter-run Chinook Salmon juveniles (by length at date criteria) in their daily catches.
- Tisdale RST has observed winter-run length-at-date (LAD) Chinook Salmon to date this season.
- There is uncertainty in the identification of some untagged salmonids potentially due to either tag loss or poor quality adipose clipping from hatchery releases made in the South

Delta. Lower rates of tagging success were confirmed for by hatchery staff for some releases. Confirmation of origin of these fish will be through genetic identification.

- No fish observed in salvage and genetically analyzed through 1/2/2023 has been genetically identified as Winter-run Chinook Salmon (see attachment A).

#### **Historic 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 life history and detections in real-time monitoring locations in the Delta. If historic trends in salvage were to continue, winter-run Chinook salmon loss is expected to increase over the next week.

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

- Movement of winter-run Chinook salmon juveniles into the lower reaches of the Sacramento River and upper Delta may continue over the next week.
- 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). The DCC gates were closed 11/28/22 and are expected to remain closed through mid-May 2023. If little precipitation is forecasted there may be a need to open the DCC gates to meet D-1641 water quality standards.

#### ***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.
- Spring-run LAD Chinook Salmon have been observed in the Delta (Sac trawl).

##### **Historical Trends**

- For historical spring-run Chinook salmon trends in salvage, see Table 3. If historic trends in salvage were to continue YOY spring-run Chinook salmon loss is unlikely to increase over the next week.

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

- Mill and Deer creek flows exceeded 95 cfs indicating yearling spring-run Chinook salmon have begun to migrate into mainstem Sacramento River.

## 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.

### Historical Trends

- For historical CCV steelhead trends in salvage, see Table 2. If historic trends in salvage were to continue, juvenile CCV steelhead loss may occur over the next week.

### Forecasted Distribution within Central Valley and Delta regions

- CCV Steelhead were observed at Butte Creek RST.
- The entrainment tool estimates of CCV steelhead loss remain low (Table 6, Fig. 1).
- Closure of the DCC gates for the season will reduce exposure and possible entrainment of juvenile CCV steelhead from the Sacramento River into the interior Delta via the DCC gates.

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
GCID RST	N/A	N/A	N/A	N/A	N/A	N/A
Butte Creek RST	N/A	N/A	N/A	N/A	N/A	N/A
Tisdale RST	1/16-1/22	13	4	0	2	0
Knights Landing RST	1/14-1/20	41	13	0	8	0
Lower Sacramento RST	N/A	N/A	N/A	N/A	N/A	N/A
Beach Seines	1/17-1/20	0	0	0	0	0
Sac. Trawl	1/17, 1/19-1/20	1	0	0	0	0
Chippis Island Midwater Trawl	1/18-1/20	0	0	0	0	0
Mossdale Kodiak Trawl	1/17-1/18, 1/20	0	0	0	0	0
EDSM	1/17-1/20	0	0	0	1	0
Feather River Herrerger RST	1/17-1/23	11	0	0	0	0
Feather River Eye Side RST	1/17-1/23	21	0	0	1	0
Lower Feather River	1/17-1/23	41	3	0	0	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: 38-60% Last Week: 49-65%	Current: 40-60% Last Week: 35-50%	Current: 0-2% Last Week: 0-1%
YOY spring-run Chinook salmon	Current: 70-85 % Last Week: 75-90 %	Current: 15-30% Last Week: 10-25%	Current: 0 % Last Week: 0 %
YOY hatchery winter-run Chinook salmon	Current: NA Last Week: NA	Current: NA Last Week: NA	Current: NA Last Week: NA
Natural origin steelhead	Current: 83-89% Last Week: 88-94%	Current: 10-15% Last Week: 5-10%	Current: 1-2% Last Week: 1-2%

Table 3. Historic migration and salvage patterns. Last updated 01/23/2023.

Species	Red Bluff Diversion Dam	Tisdale Rst	Knights Landing Rst	Sac Trawl Sherwood Catch Index	Chipps Island Trawl Catch Index	Salvage
Chinook, Winter-run, Unclipped	97.7%(95.8%,99.6%) BY: 2013 - 2021	76.2%(51.9%,100.6%) BY: 2013 - 2021	73.5%(47.0%,100.1%) BY: 2013 - 2021	37.5%(9.1%,66.0%) BY: 2013 - 2021	5.3%(-2.2%,12.9%) BY: 2013 - 2021	25.8%(4.0%,47.6%) WY: 2013 - 2022
Chinook, Spring-run, Unclipped	14.5%(4.0%,25.0%) BY: 2013 - 2021	17.3%(1.1%,33.6%) BY: 2013 - 2021	26.5%(2.7%,50.2%) BY: 2013 - 2021	5.2%(-2.8%,13.3%) BY: 2013 - 2021	0.0%(0.0%,0.0%) BY: 2013 - 2021	0.0%(0.0%,0.0%) WY: 2013 - 2022
Steelhead, Unclipped (January-December)	0.8%(-0.4%,2.1%) BY: 2013 - 2022	13.0%(-0.6%,26.5%) BY: 2014 - 2022	18.9%(-0.8%,38.6%) BY: 2014 - 2022	3.8%(-5.1%,12.6%) BY: 2013 - 2022	3.2%(-0.8%,7.1%) BY: 2013 - 2022	N/A
Steelhead, Unclipped (December-March)	N/A	N/A	N/A	N/A	N/A	12.2%(-1.2%,25.5%) WY: 2013 - 2022
Steelhead, Unclipped (April-June)	N/A	N/A	N/A	N/A	N/A	0.0%(0.0%,0.0%) WY: 2013 - 2022

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 temperature (f)	Alert Triggered
1/22/2023	296.9	-10.2%	Flow > 95cfs	410.2	-10.9%	Flow > 95cfs	20,605.9	N/A	N/A
1/21/2023	330.5	-14.2%	Flow > 95cfs	460.6	-13.7%	Flow > 95cfs	22,805.2	N/A	N/A
1/20/2023	385.1	-21.0%	Flow > 95cfs	533.5	-18.8%	Flow > 95cfs	24,165.3	N/A	N/A
1/19/2023	487.7	-5.6%	Flow > 95cfs	657.0	-13.0%	Flow > 95cfs	24,996.5	N/A	N/A
1/18/2023	516.8	-23.7%	Flow > 95cfs	755.1	-24.3%	Flow > 95cfs	26,116.1	41.3	WLK > 750 cfs and KNL < 56.3 F
1/17/2023	677.2	-32.0%	Flow > 95cfs	996.9	-31.2%	Flow > 95cfs	27,127.8	41.9	WLK > 750 cfs and KNL < 56.3 F
1/16/2023	996.3	-32.6%	Flow > 95cfs	1,449.8	-31.5%	Flow > 95cfs	27,428.3	42.1	WLK > 750 cfs and KNL < 56.3 F

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	2023-01-22	Overall	4.93	0.67	
Winter Chinook	2023-01-22	Sacramento River	4.59	0.71	0.65
Winter Chinook	2023-01-22	Yolo Bypass	9.47	0.62	0.00
Winter Chinook	2023-01-22	Sutter Slough	4.93	0.58	0.13
Winter Chinook	2023-01-22	Steamboat Slough	4.49	0.72	0.11
Winter Chinook	2023-01-22	Interior Delta	7.26	0.45	0.11
Late-fall Chinook	2023-01-22	Overall	4.10	0.65	
Late-fall Chinook	2023-01-22	Delta Cross Channel	NA	NA	0.00
Late-fall Chinook	2023-01-22	Georgiana Slough	6.43	0.37	0.18
Late-fall Chinook	2023-01-22	Sacramento River	3.31	0.71	0.47



Stock	Date	Route	Median Travel Time	Survival	Routing Probability
Late-fall Chinook	2023-01-22	Sutter and Steamboat Slough	4.24	0.71	0.34

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

Table 6a-b. WY 2023 loss and salvage predictor data: Environmental details, current and forecast.

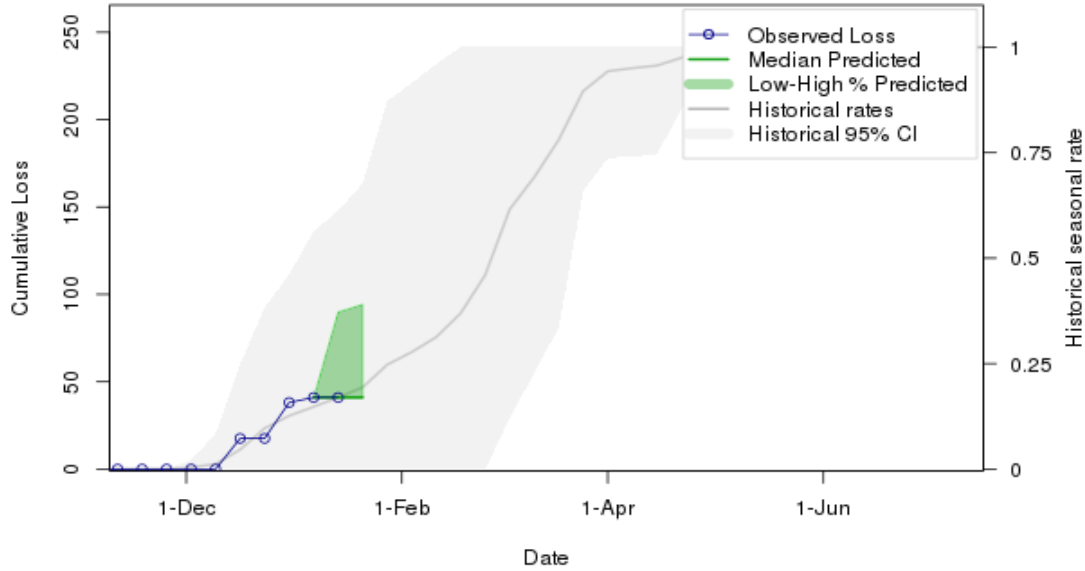
a.) WY 2022 loss and salvage predictor data: Predicted weekly loss of winter-run Chinook salmon and steelhead at CVP and SWP facilities.

Parameter	Modeled Current Week	Modeled Next Week
Predicted Steelhead, Median %	3	0
Predicted Steelhead, High %	29	17
Predicted Chinook Winter Run, Median %	0	0
Predicted Chinook Winter Run, High %	49	4

b.) Environmental details, current and forecast.

Parameter	Data	Forecast
Temperature (Mallard Island, C)	10.4	20
Precipitation (5-d running sum, inches)	0.14	0
Old and Middle River Flows (cfs)	-858	-3039
Sacramento River Flow (Freeport, cfs)	72953	6993
DCC Gates	closed	closed
San Joaquin River Flow (Vernalis, cfs)	19748	262
Export	11002	1887

**Winter Run Loss 2023-01-20 Water Year: 2023 & WY.week 16**



**Steelhead Loss 2023-01-20 Water Year: 2023 & WY.week 16**

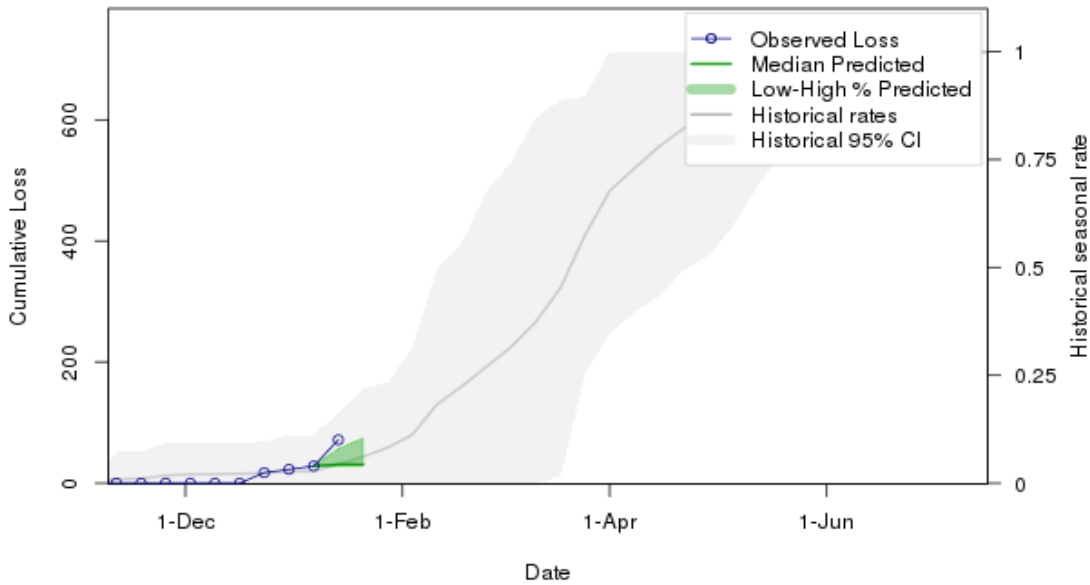


Figure 1. Predicted weekly loss of steelhead and winter-run Chinook salmon at the CVP and SWP facilities

## 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 juvenile salmonids are 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 minimal impact on movement and distribution of salmonids in the South Delta.

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 47.31 fish (as of 01/24/2023). Loss of juvenile winter-run Chinook salmon has occurred in the past week at the CVP and SWP fish salvage facilities. Final JPE calculations have been established for brood year (BY) 2022 winter-run Chinook salmon. The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believe that loss occurring in the next week is unlikely to lead to exceedance of the 50% single-year loss threshold.

### Spring-run Chinook salmon

Total natural juvenile spring-run Chinook salmon (LAD) loss is 0 fish (as of 01/23/2023). No loss of natural juvenile spring-run Chinook salmon has occurred in the past week at the CVP and SWP fish salvage facilities. The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believes that loss occurring in the next week is unlikely to lead to exceedance of the 50% single-year loss threshold.

### Central Valley Steelhead

Total natural juvenile steelhead loss (December 1 through March 31) is 71.5 fish (as of 1/23/2023). Loss of natural juvenile has occurred in the past week at the CVP and SWP fish salvage facilities. The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believe that loss occurring in the next week is unlikely to lead to exceedance of the 50% single-year loss threshold.

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 annual loss threshold for winter-run Chinook salmon has not been exceeded in WY 2023.

### Spring-run Chinook salmon

The annual loss threshold for spring-run Chinook salmon has not been exceeded in WY 2023.

### Central Valley Steelhead

The annual loss threshold for steelhead (December 1 – March 31) has not been exceeded in WY 2023.

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 -3,000 to -5,000 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.
- A dead adult Green Sturgeon was collected from the trashrack at the SWP facility on 1/4/23. It measured 64.25 inches FL (ca. 1.63 m FL). A living adult Green Sturgeon was collected from the trashrack at the CVP facility at around 3:00 am on 1/7/2023. It was reported as around 5 feet long. The sturgeon is being held and monitored at the federal facility since it was injured, but not dead. A second dead adult Green Sturgeon was collected from the trashrack at the SWP facility on 1/20/23. Sturgeon found on the either trashrack do not count toward salvage.
- 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 but likely.

### *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 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 1/23/2023). 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 and subadults
- Brood Year 2022:
- Abundance estimate:
  - The abundance estimate as of January 23, 2023, was 3,401 (95% CI: 159-17,359).
- Biological Conditions:
  - Adult and subadult Delta Smelt are expected to be present in Suisun Bay and the South Delta based on the most recent survey detections. One unmarked adult Delta Smelt was preliminarily reported captured in Suisun Bay by EDSM during the 1/24/2023 meeting; one unmarked Delta Smelt was caught in the South Delta by EDSM on 1/17/2023 and one cultured adult Delta Smelt was salvaged at the CVP on 1/7/2023. Delta Smelt are likely migrating and distributed widely in the Delta in response to increases in turbidity and flow from “first flush” conditions, which were met on 12/31/2022 (Sommer et al. 2011). The Smelt Monitoring Team discussed the most recent monitoring data (Table 4) and considered professional judgement on the historical trends in regional distribution.

## Distribution

### *Current Distribution*

- Real time detection data is currently limited to EDSM, Chipps Island Trawl and SLS; Bay Study and SKT provide data as available.
- Since there are few recent detections of Delta Smelt, the Smelt Monitoring Team’s capacity to estimate where they are within the Delta is limited.
- The most recent Delta Smelt detections were one unmarked preliminary Delta Smelt in Suisun Bay, one cultured adult at Chipps Island reported by DJFMP on 1/19/23, one adult in the South Delta reported by EDSM on 1/17/23, and one cultured adult in CVP salvage on 1/7/23.
- Experimental release of hatchery Delta Smelt occurred at Rio Vista on November 30, 2022, and January 18-19, 2023. Three fish from the experimental release were caught on 12/14/22, 1/7/23, and 1/19/23.
- Larval sampling at the Skinner Fish Facility (SFF) and the Tracy Fish Collection Facility (TFCF) will be initiated by the SMT in February.

- COA 8.5.2: No larval or juvenile Delta Smelt have been salvaged at the SFF or TFCF as of 1/3/2023 (Table 7).

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.

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

\* 1 Adult preliminarily reported during 1/24/2023 meeting

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 detections that have undergone preliminary ID, QA/QC, and genetic confirmation. Numbers are updated as QA/QC and genetic confirmation become available.

Sampling Method	Frequency	New Preliminary Detections	Preliminary to Date	QA/QC to Date	Genetically Confirmed to Date	Total WY2023	Notes
EDSM	Weekly	1	N/A	2	1	4	Phase 1 began 12/5/22
SKT	Monthly	0	N/A	N/A	N/A	0	Began 1/9/23
SLS	Biweekly	0	N/A	N/A	N/A	0	Ongoing
20-mm	Biweekly	0	N/A	N/A	N/A	0	Begins: 3/13/23
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

Sampling Method	Frequency	New Preliminary Detections	Preliminary to Date	QA/QC to Date	Genetically Confirmed to Date	Total WY2023	Notes
Chipps Island Trawl	Weekly	1	N/A	N/A	N/A	1	Ongoing
FCCL Brood Stock Collections	Weekly	N/A	N/A	2	N/A	2	Ongoing
LEPS	As available	0	N/A	N/A	N/A	0	Ongoing
TFCF	Daily	0	N/A	1	N/A	1	Ongoing
FRP	Daily	0	N/A	N/A	N/A	0	Ongoing
Skinner Fish Facility	Daily	0	N/A	N/A	N/A	0	Ongoing
Total	N/A	N/A	N/A	N/A	N/A	8	Sum of all Delta Smelt observed during the OMR Management Season

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

- Experimental releases include: 13,140 fish on November 30, 2022, and 17,570 fish on January 18-19, 2023, both at Rio Vista.
- The final release is planned for the week of January 23 (~ 13,750 in the Sacramento Deep Water Ship Channel).
- A total of approximately 42,000 fish is expected to be released this water year.
- Details of Delta Smelt releases are available at: [SacPAS: Central Valley Prediction & Assessment of Salmon](#)



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
1/19/2023	Chippis Island Trawl	West	1	N/A	X	N/A
1/24/2023	EDSM	West	1*	N/A	N/A	X

\* 1 Adult preliminarily reported during 1/24/2023 meeting

### ***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 can last as long as four weeks after flow and turbidity increases, based on salvage data (Sommer et al. 2011).
- Historically, the highest peak in salvage is in May and the second highest is in June (Grimaldo et al 2009; figure 5).

### ***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 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.

### **Abiotic Conditions**

#### ***Turbidity***

- Turbidity continues to be high throughout the Delta and is expected to remain elevated due to continued high flows from precipitation events that occurred in the past month. Forecast for this week includes below normal temperatures, sunny and clear with east-northeast winds 3-9 mph near Antioch and light and northwest winds 3-6 mph near Stockton and a slight chance of rain on Sunday.
- Turbidity is greater than 12 FNU at OBI and at other central and south Delta stations.

- South Delta Turbidity is expected to remain high in continued response to this month’s rains and high flows.

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

Date Reported	FPT 3-day Running Average Flow (cfs)	FPT 3-day Running Average Turbidity (FNU)	OBI Daily Average Turbidity (FNU)
1/23/2023	61241	88.5	26.0

### ***X2 Conditions***

- As of 1/23/2023, the X2 estimation was less than 55 km (west of Martinez).
- When X2 is above 81 km, the SMT uses the X2\_EC\_Graph.xlsx tool to estimate the position of X2 for both the Sacramento and San Joaquin Rivers and assumes the average of the two is representative of an approximate X2 position.

### ***Other Environmental Conditions***

- The Fish and Water Operation Outlook OMR Index values are expected to range between -3000 to -5000 cfs from 1/24/2023 to 1/30/2023.
- QWEST was estimated at 26,000 cfs on 1/24/2023 and will remain above 14,000 cfs this week.
- Real time tracking of environmental conditions, relevant thresholds and Delta Smelt catch data are updated daily at:  
[http://www.cbr.washington.edu/sacramento/workgroups/delta\\_smelt.html](http://www.cbr.washington.edu/sacramento/workgroups/delta_smelt.html).

## **Evaluation**

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

First flush conditions based on running 3-day average flow and running 3-day average turbidity at Freeport were met on December 31, 2022, triggering IEWPP regulations. The CVP and SWP reduced exports beginning on 1/3/2023 through 1/16/2023.

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

Based on distribution patterns over the past decade and recent detection data, Delta Smelt are towards the end of their migration period. Delta Smelt are present in the South Delta based on the report of one unmarked adult captured by EDSM in the South Delta on 1/17/2023 and one cultured adult Delta Smelt that was salvaged at the CVP on 1/7/2023. IEWPP protections ended on 1/16/2023 and Turbidity Bridge

Avoidance protections began on 1/17/2023 and are ongoing. The continued presence of a turbidity bridge presents an increased risk of entrainment to fish in the OMR Corridor. Based on a migration window of approximately one to four weeks after “first flush” conditions (Sommer et al. 2011) and the initial increase in flows and turbidities around 1/1/23, Delta smelt migration could continue through this week. Overall risk is moderate for fish with the potential to disperse into areas of high entrainment.

3. Has a spent female been collected?

A spent female has not 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?

Biological Information: Delta smelt are still migrating to spawning grounds (Sommer et al. 2011) and two Delta smelt have been detected in the South Delta in the past three weeks.

Environmental Information: An OMR of -2000 cfs did not reduce OBI turbidity after five days and was extended through present with a change to operating to an OMRI no more negative than -3500 starting 1/22/23. Elevated turbidity is expected to continue at OBI and throughout the Delta.

Hydrologic Information: USBR considered evaluating flow and velocity effects of OMRI at -2000 cfs, -3500 cfs, and -5000 cfs. DSM2 output indicated strongly positive flows near Jersey Point (Channel 49), leading to lower hydrologic risk (Table 12, Table 13, Figure 3). DSM2 output indicated negative flows in the OMR Corridor (Channel 94) with differences between -2000, -3500 and -5000 OMRI (Table 12, Table 13). Thus hydrologic risk is high in the OMR Corridor.

Literature: Smith et al. (2021) used a life cycle model to evaluate proportional death due to entrainment at both high and low levels of turbidity across a range of Old and Middle River flows. Results indicated that monthly risk of proportional entrainment mortality increases with more negative OMRI and is more pronounced at higher levels of turbidity (Figure 16). Credible intervals overlap with the threshold that characterizes certain harm to the population.

Summary: Biological and environmental conditions have generally been unchanged from last week. High turbidities (above 12 FNU) and ongoing migration lead to moderate risk outside of the OMR Corridor. More negative flows and proximity to exports, in addition to high turbidities and ongoing migration, lead to high risk in the OMR Corridor. Modeling from Smith et al. (2021) indicates changing to a more negative OMRI will increase risk of entrainment.

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

OBI turbidity is currently above 12 FNU (Average of 26.0 FNU on 1/23/2023). The daily average turbidities on 1/23/2023 at Prisoners Point (27.4 NTU), Holland Cut (44.3 FNU) and Victoria Canal (37.5 NTU) may remain elevated over the next seven days.

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

The Turbidity Bridge Avoidance Action has been in effect from 1/17/2023 – present as warranted by turbidity conditions (OBI Daily Average > 12 FNU).

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?

This question is not applicable until March 15th.

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?

This question is not applicable until March 15th.

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?

This question is not applicable until March 15th.

## Delta Smelt References

- Damon, L. J., S. B. Slater, R. D. Baxter, and R. W. Fujimura. 2016. Fecundity and reproductive potential of wild female Delta smelt in the upper San Francisco Estuary, California. *California Fish and Game* 102(4):188–210.
- Hobbs, J. A., Lewis, L. S., Willmes, M., Denney, C., & Bush, E. (2019). Complex life histories discovered in a critically endangered fish. *Scientific Reports*, 9(1). <https://doi.org/10.1038/s41598-019-52273-8>
- Grimaldo, L. F., T. Sommer, N. Van Ark, G. Jones, E. Holland, P. B. Moyle, B. Herbold & P. Smith (2009) Factors Affecting Fish Entrainment into Massive Water Diversions in a Tidal Freshwater Estuary: Can Fish Losses be Managed? *North American Journal of Fisheries Management*, 29:5, 1253-1270, DOI: 10.1577/M08-062.1

Polansky, L., Newman, K.B., Nobriga, M.L. et al. Spatiotemporal Models of an Estuarine Fish Species to Identify Patterns and Factors Impacting Their Distribution and Abundance. *Estuaries and Coasts* 41, 572–581 (2018). <https://doi.org/10.1007/s12237-017-0277-3>

Sommer, T., F. Mejia, M. Nobriga, and L. Grimaldo. 2011. The Spawning Migration of Delta Smelt in the Upper San Francisco Estuary. *San Francisco Estuary and Watershed Science* 9(2).

## Attachment A.

Table 11. Salmonid Genetic testing results for WY 2023 as of this assessment. Genetic identification of salmon is not used in calculating loss.

ID	Sample Date	FL	Julian	ots28	sexid	Assign.	Pos Prob1	Group	PosPr ob2	Mode l	Facility	Orig. ID
C220127CVP	12/17/2022 22:00	185	171	late	male	Non-winter	1.000	Spring	1.000	Fall	CVP	C220127CVP
C220098SWP	12/18/2022 13:00	137	172	late	female	Non-winter	1.000	Spring	1.000	Winter	SWP	C220098SWP
C220099SWP	12/28/2022 5:00	154	181	late	male	Non-winter	1.000	Spring	0.607	Late Fall	SWP	C220099SWP
C220128CVP	12/30/2022 23:59	163	184	late	female	Non-winter	1.000	Fall	0.981	Late Fall	CVP	C220128CVP
C220180SWP	12/31/2022 3:00	180	184	late	male	Non-winter	1.000	Fall	1.000	Late Fall	SWP	C220180SWP
C230082SWP	1/1/2023 10:00	150	185	late	male	Non-winter	1.000	Fall	0.982	Winter	SWP	C230082SWP
C230083SWP	1/1/2023 11:00	113	185	late	female	Non-winter	1.000	Fall	0.988	Winter	SWP	C230083SWP
C230082CVP	1/2/2023 14:00	212	187	early	male	Non-winter	1.000	Fall	0.988	Fall	CVP	C230082CVP
C230001CVP	1/3/2023 10:00	35	187	late	female	Non-winter	1.000	Fall	0.982	Fall	CVP	C230001CVP
C230002CVP	1/3/2023 10:00	34	187	late	male	Non-winter	1.000	Fall	0.769	Fall	CVP	C230002CVP
C230003CVP	1/3/2023 10:00	33	187	late	female	Non-winter	1.000	Fall	0.930	Fall	CVP	C230003CVP
C230004CVP	1/3/2023 10:00	34	187	late	male	Non-winter	1.000	Fall	0.984	Fall	CVP	C230004CVP
C230005CVP	1/3/2023 12:00	35	188	late	male	Non-winter	1.000	Unassigned	0.627	Fall	CVP	C230005CVP

ID	Sample Date	FL	Julian	ots28	sexid	Assign.	Pos Prob1	Group	PosPr ob2	Mode I	Facility	Orig. ID
C230006CVP	1/4/2023 8:00	38	188	late	female	Non-winter	1.000	Fall	0.996	Fall	CVP	C230006CVP
C230007CVP	1/4/2023 12:00	36	189	late	female	Non-winter	1.000	Fall	0.922	Fall	CVP	C230007CVP
C230008CVP	1/4/2023 12:00	38	189	late	female	Non-winter	1.000	Fall	0.999	Fall	CVP	C230008CVP
C230009CVP	1/4/2023 12:00	36	189	late	female	Non-winter	1.000	Spring	0.661	Fall	CVP	C230009CVP
C230010CVP	1/4/2023 14:00	38	189	late	male	Non-winter	1.000	Fall	0.645	Fall	CVP	C230010CVP
C230084SWP	1/4/2023 15:00	162	189	late	male	Non-winter	1.000	Fall	0.877	Late Fall	SWP	C230084SWP
C230012CVP	1/4/2023 22:00	148	189	late	male	Non-winter	1.000	Spring	0.836	Winter	CVP	C230012CVP
C230011CVP	1/5/2023 10:00	37	189	late	female	Non-winter	1.000	Fall	0.696	Fall	CVP	C230011CVP
C230013CVP	1/5/2023 14:00	163	190	late	female	Non-winter	1.000	Fall	1.000	Late Fall	CVP	C230013CVP
C230015CVP	1/11/2023 6:00	38	195	late	male	Non-winter	1.000	Fall	0.970	Fall	CVP	C230015CVP
C230016CVP	1/12/2023 8:00	166	196	late	female	Non-winter	1.000	Spring	0.870	Winter	CVP	C230016CVP
C230019CVP	1/12/2023 10:00	42	196	late	male	Non-winter	1.000	Spring	0.870	Fall	CVP	C230019CVP
C230018CVP	1/12/2023 12:00	34	197	late	female	Non-winter	1.000	Fall	0.986	Fall	CVP	C230018CVP
C230020CVP	1/12/2023 23:59	31	197	late	male	Non-winter	1.000	Fall	0.998	Fall	CVP	C230020CVP
C230021CVP	1/13/2023 6:00	35	197	late	male	Non-winter	1.000	Fall	0.981	Fall	CVP	C230021CVP
C230022CVP	1/13/2023 10:00	35	197	late	male	Non-winter	1.000	Spring	0.917	Fall	CVP	C230022CVP

ID	Sample Date	FL	Julian	ots28	sexid	Assign.	Pos Prob1	Group	PosPr ob2	Mode I	Facility	Orig. ID
C230023CVP	1/13/2023 23:59	38	198	late	male	Non-winter	1.000	Fall	0.966	Fall	CVP	C230023CVP
C230024CVP	1/14/2023 2:00	38	198	late	female	Non-winter	1.000	Fall	0.999	Fall	CVP	C230024CVP
C230025CVP	1/14/2023 6:00	35	198	late	male	Non-winter	1.000	Fall	0.994	Fall	CVP	C230025CVP
C230026CVP	1/14/2023 6:00	195	198	late	male	Non-winter	1.000	Fall	1.000	Late Fall	CVP	C230026CVP
C230027CVP	1/14/2023 14:00	36	199	late	female	Non-winter	1.000	Fall	0.991	Fall	CVP	C230027CVP
C230086SWP	1/17/2023 7:45	149	201	late	female	Non-winter	1.000	Fall	0.950	Winter	SWP	C230086SWP
C230029CVP	1/17/2023 8:00	36	201	late	female	Non-winter	1.000	Fall	0.998	Fall	CVP	C230029CVP



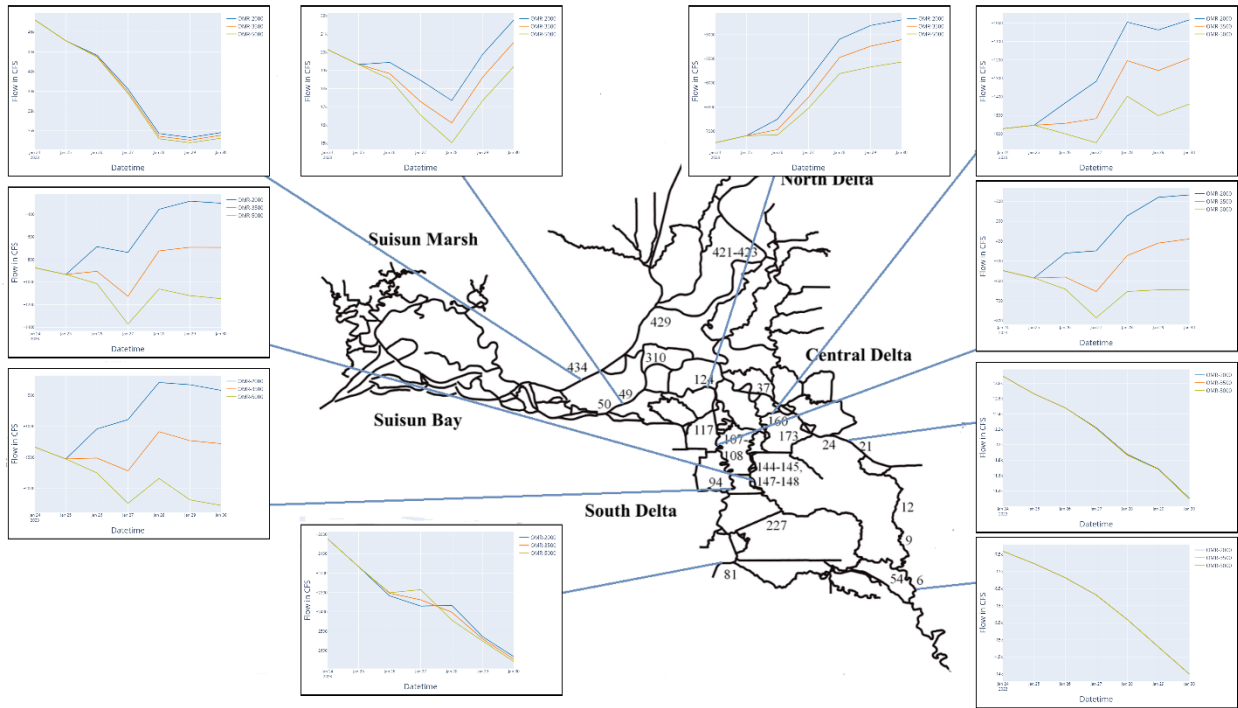


Figure 2. DSM2 Flow Results Across Stations

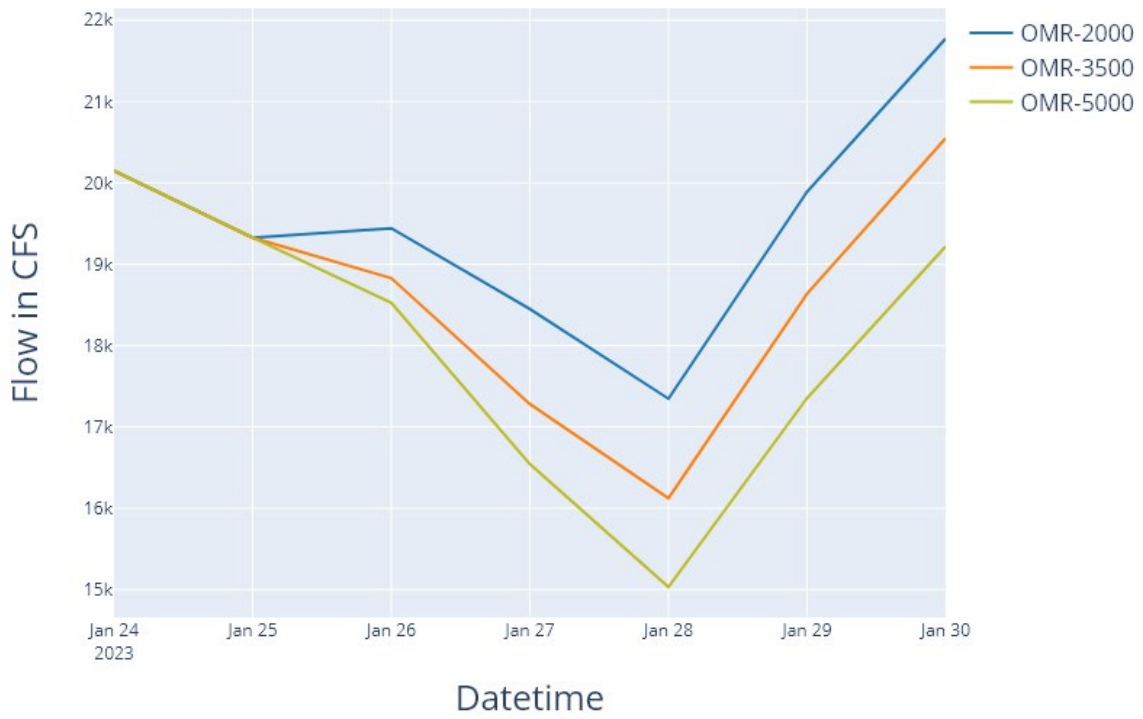


Figure 3. Comparison of OMRI Flow Scenarios at 49 (San Joaquin River near Jersey Point).

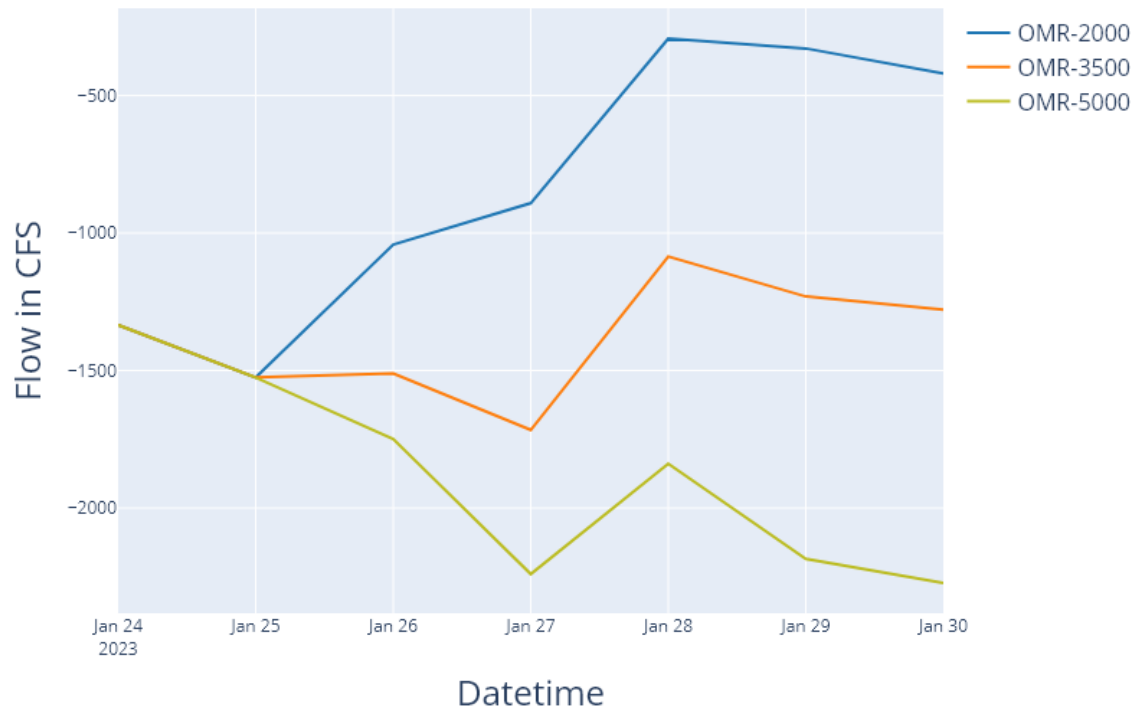


Figure 4. Comparison of OMRI Flow Scenarios at 94.

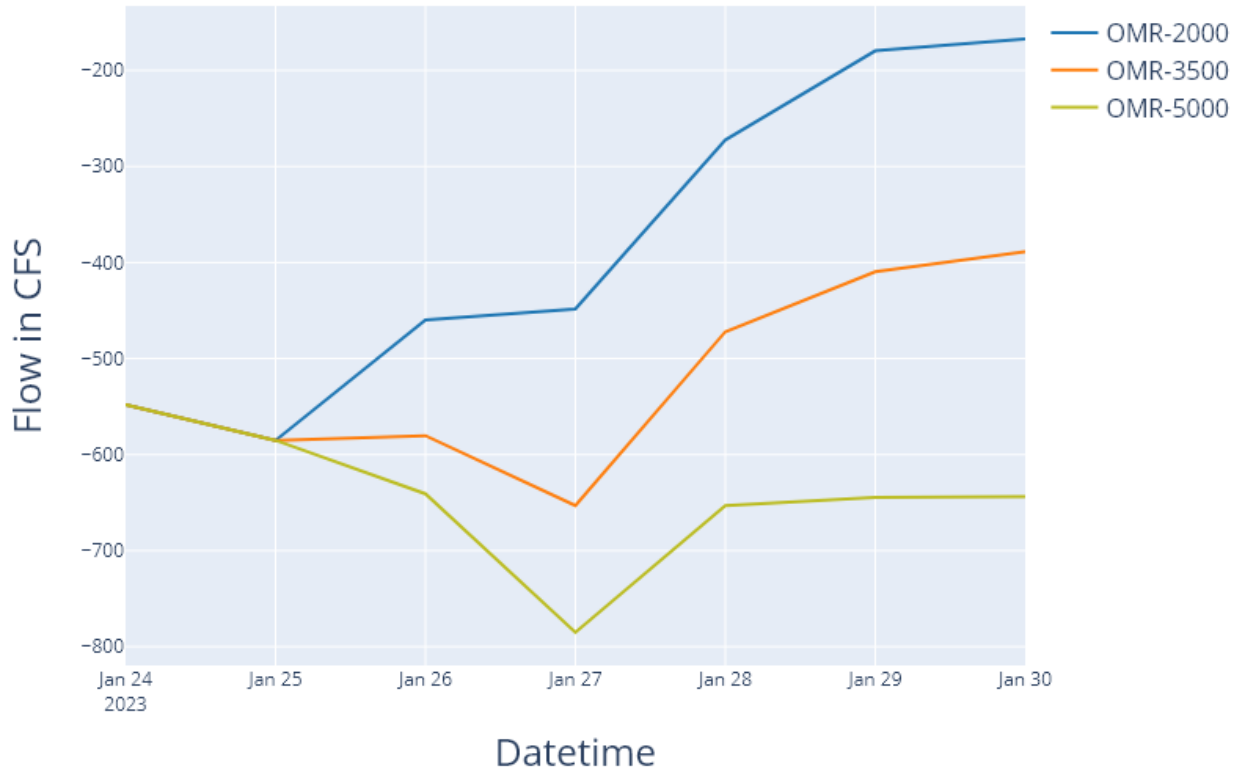


Figure 5. Comparison of OMRI Flow Scenarios at 107.

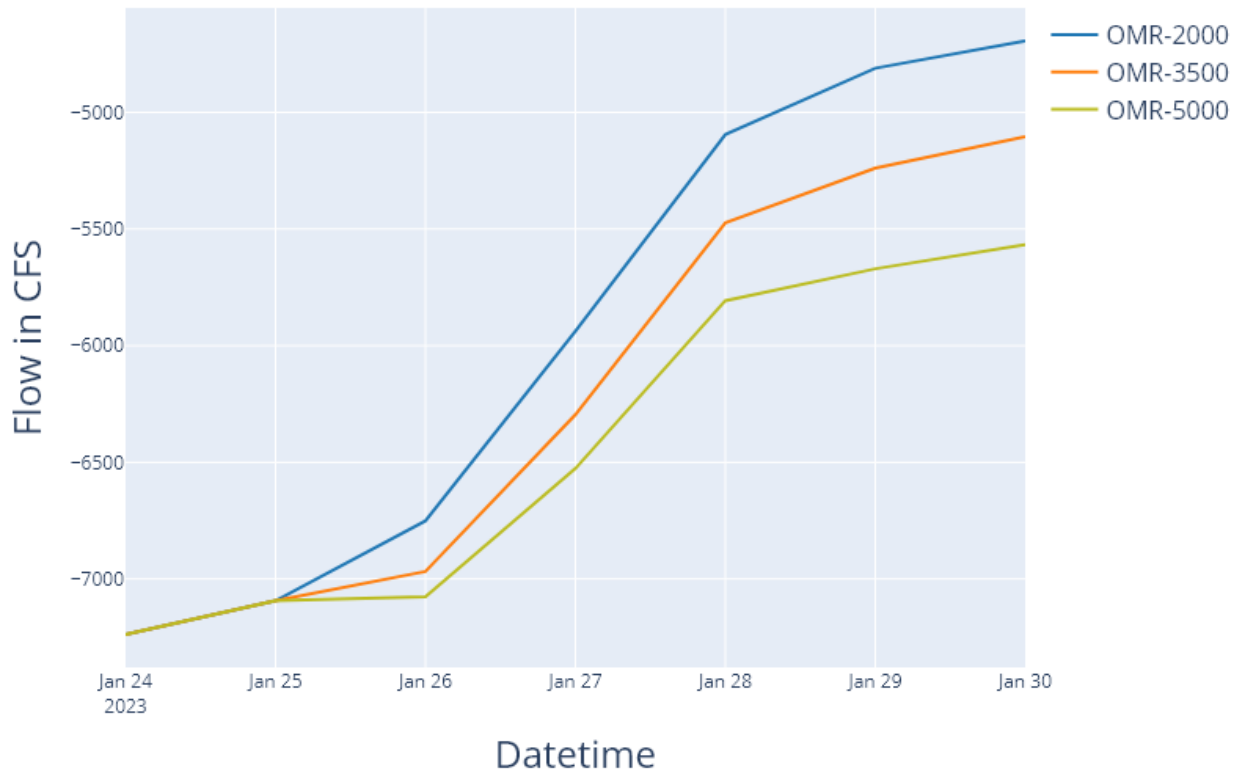


Figure 6. Comparison of OMRI Flow Scenarios at 124 (Old River between Franks Tract and San Joaquin River).

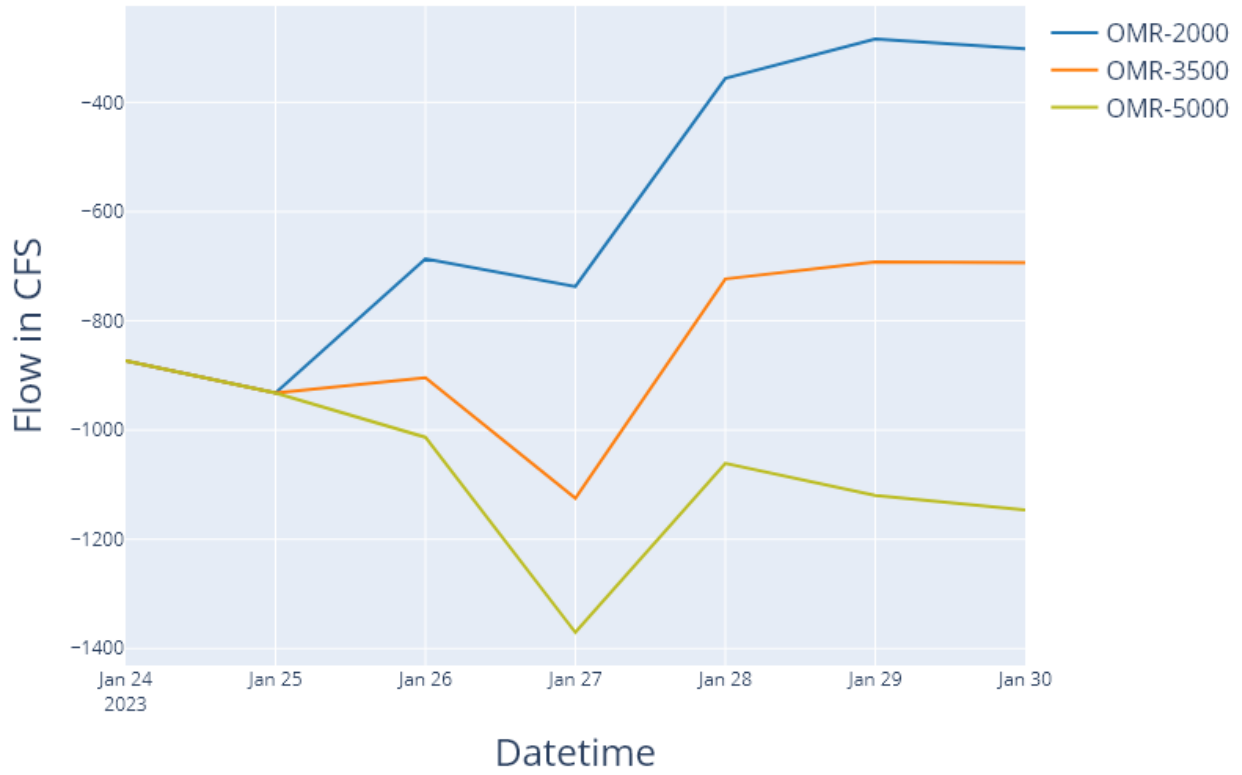


Figure 7. Comparison of OMRI Flow Scenarios at 148.

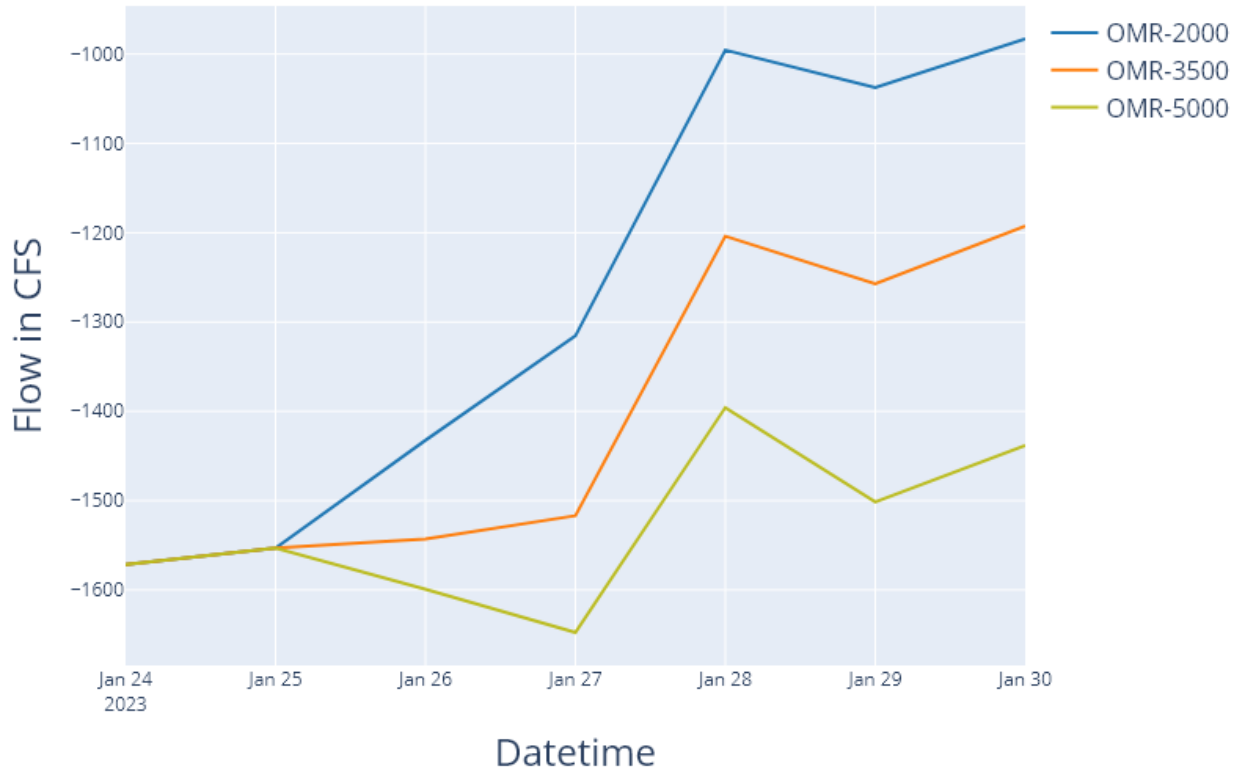


Figure 8. Comparison of OMRI Flow Scenarios at 160.

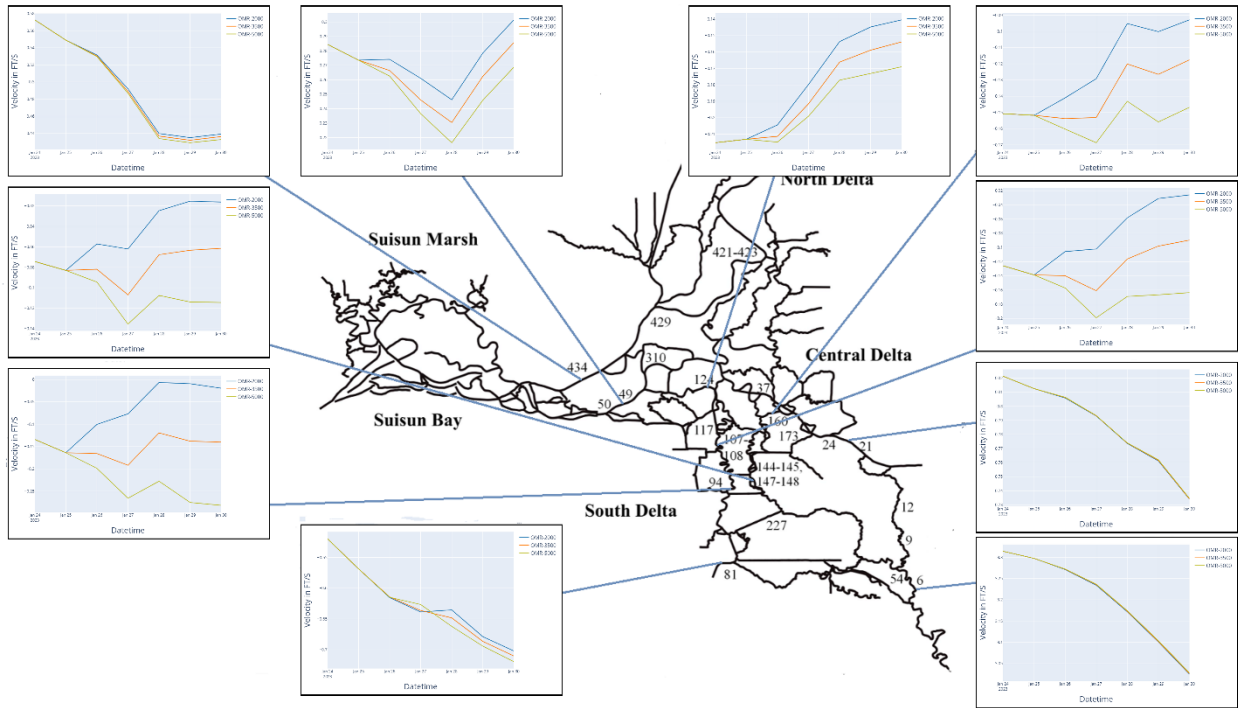


Figure 9. DSM2 Velocity Results Across Station.



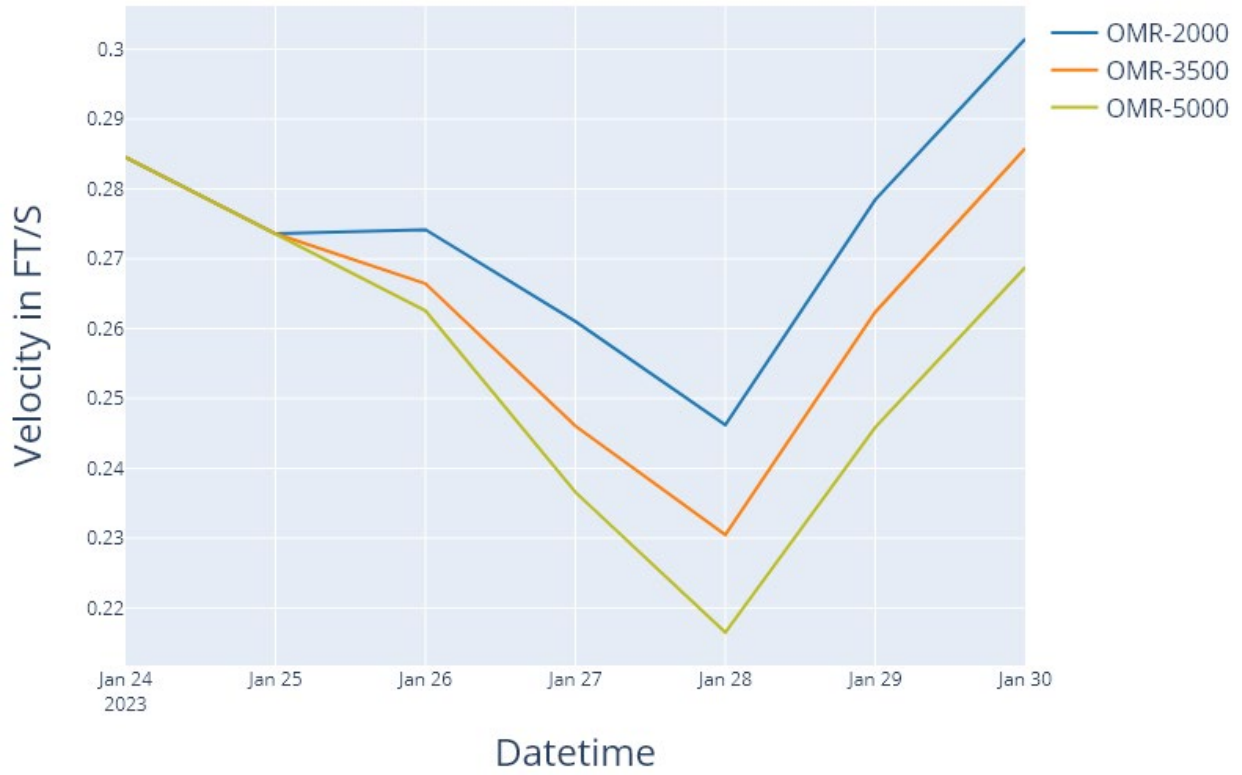


Figure 10. Comparison of OMRI Velocity Scenarios at 49.

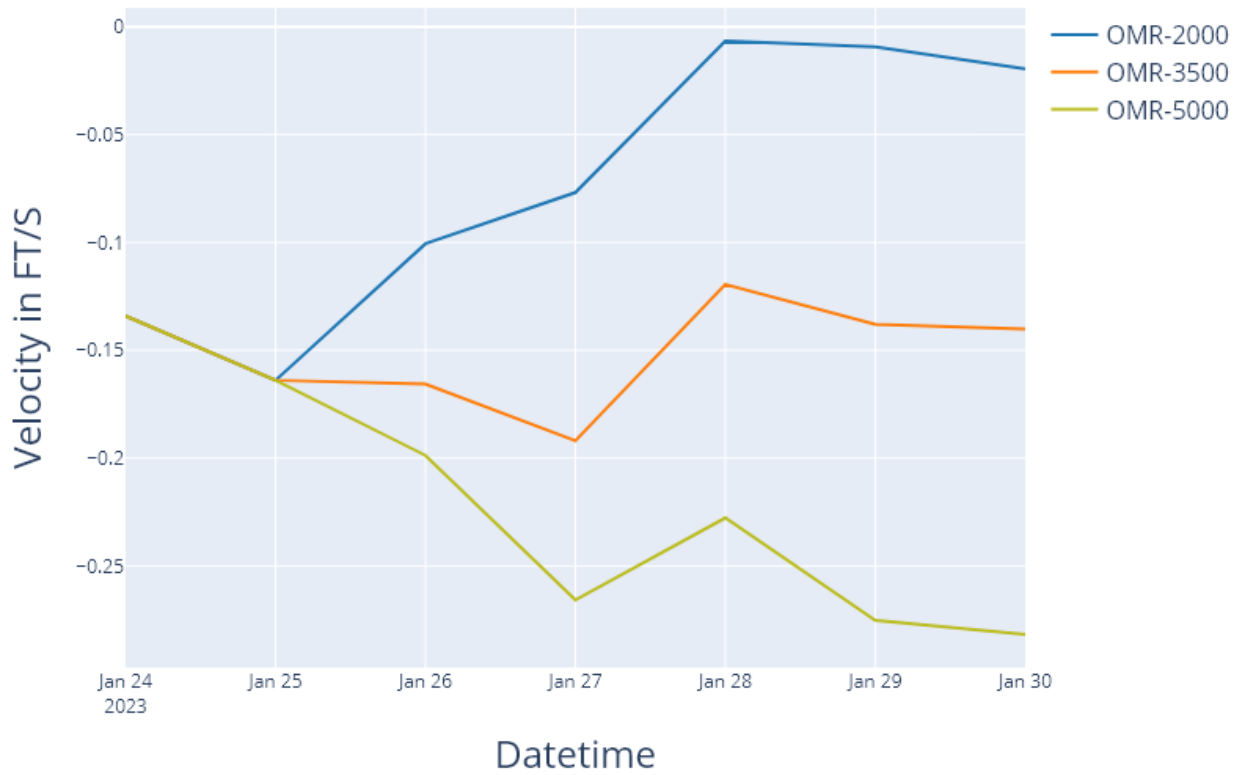


Figure 11. Comparison of OMRI Velocity Scenarios at 94.

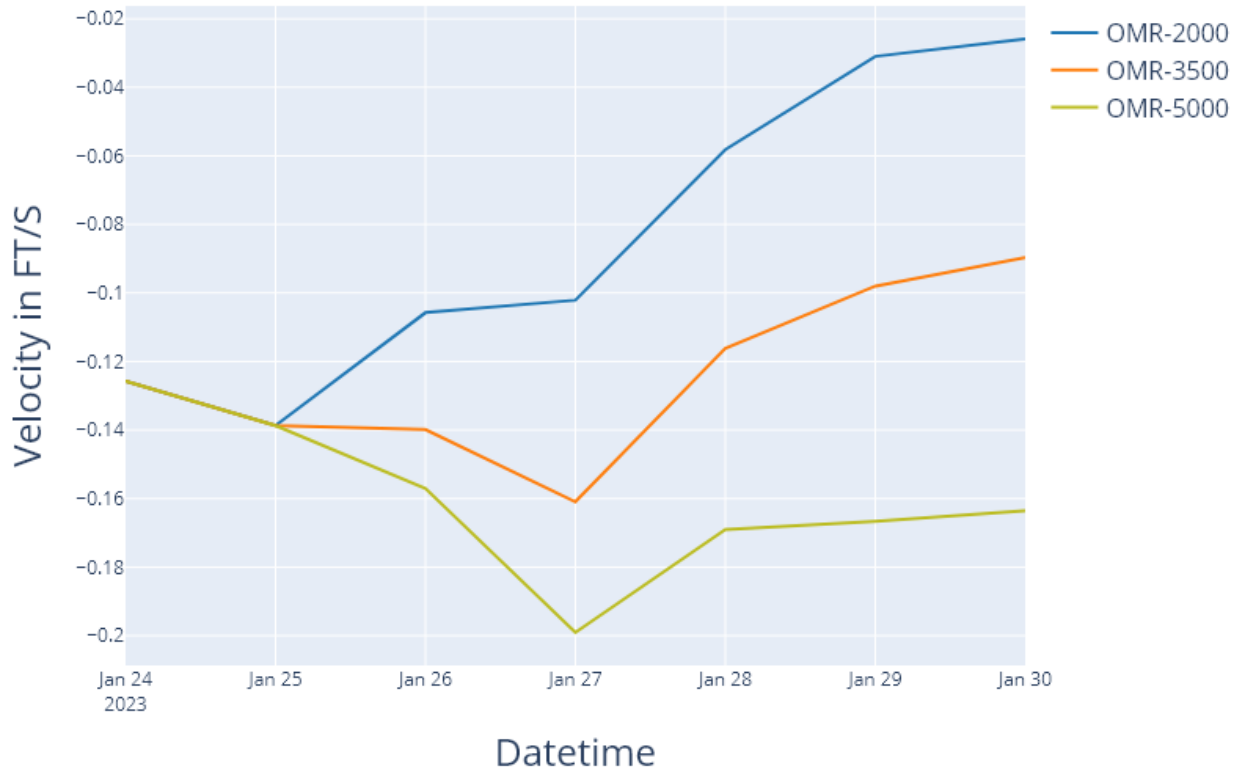


Figure 12. Comparison of OMRI Velocity Scenarios at 107.

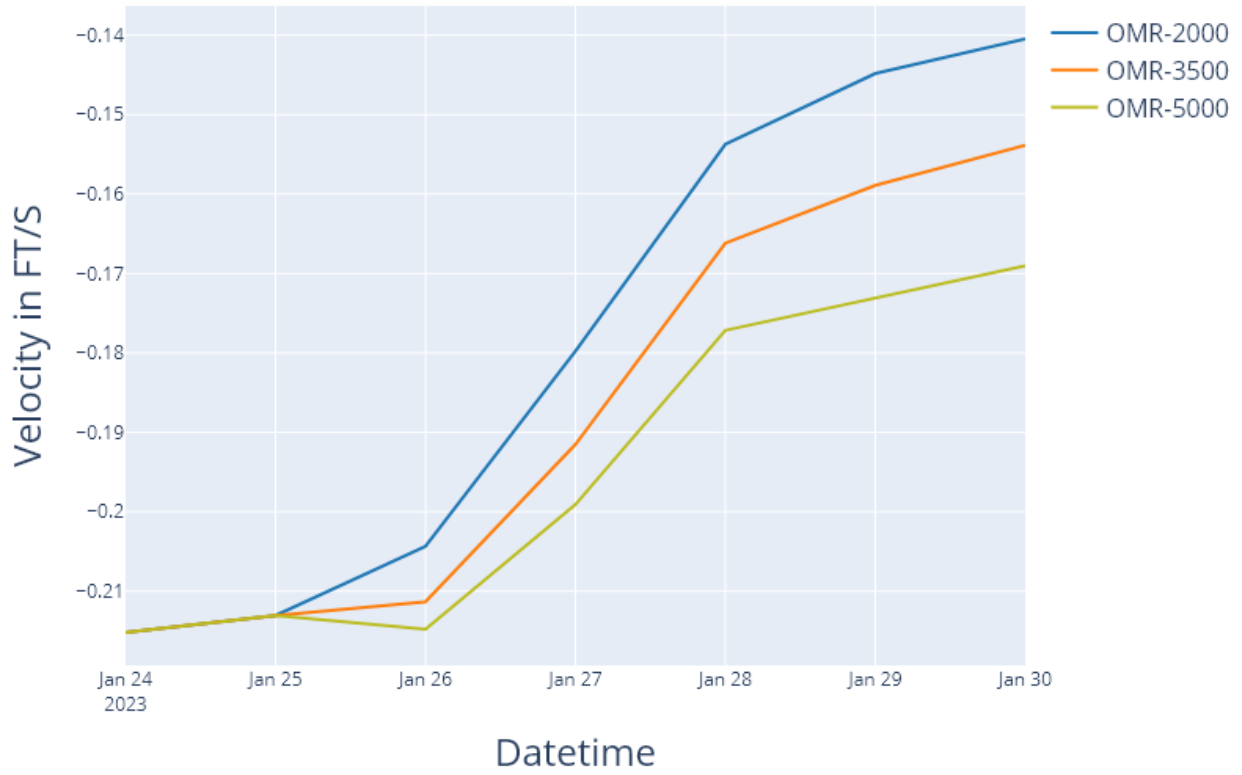


Figure 13. Comparison of OMRI Velocity Scenarios at 124.

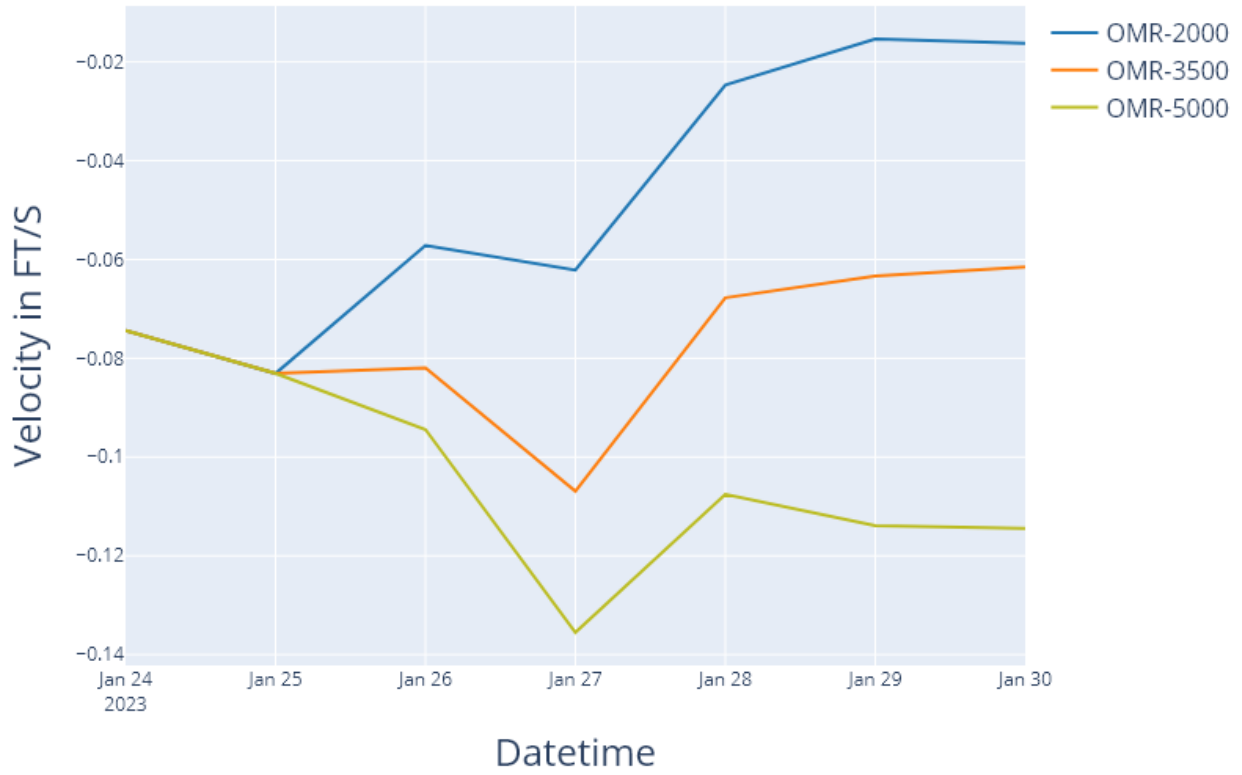


Figure 14. Comparison of OMRI Velocity Scenarios at 148.

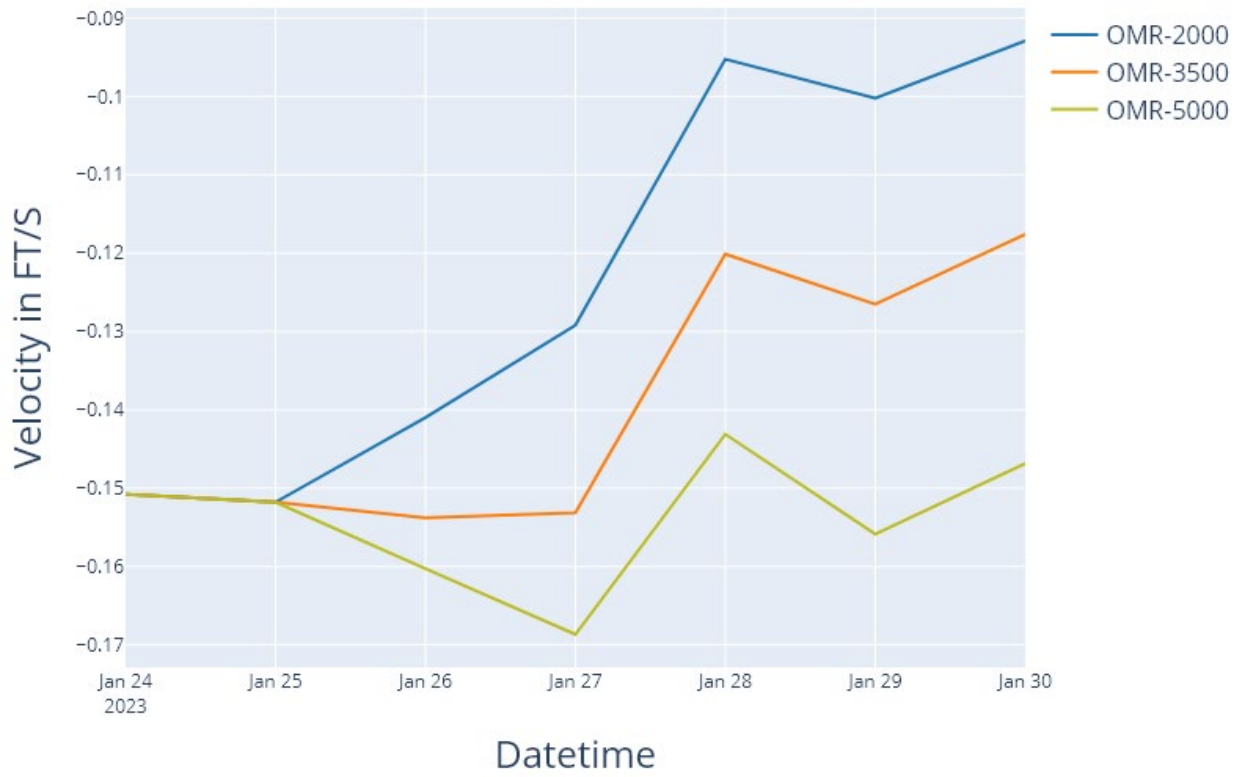


Figure 15. Comparison of OMRI Velocity Scenarios at 160.

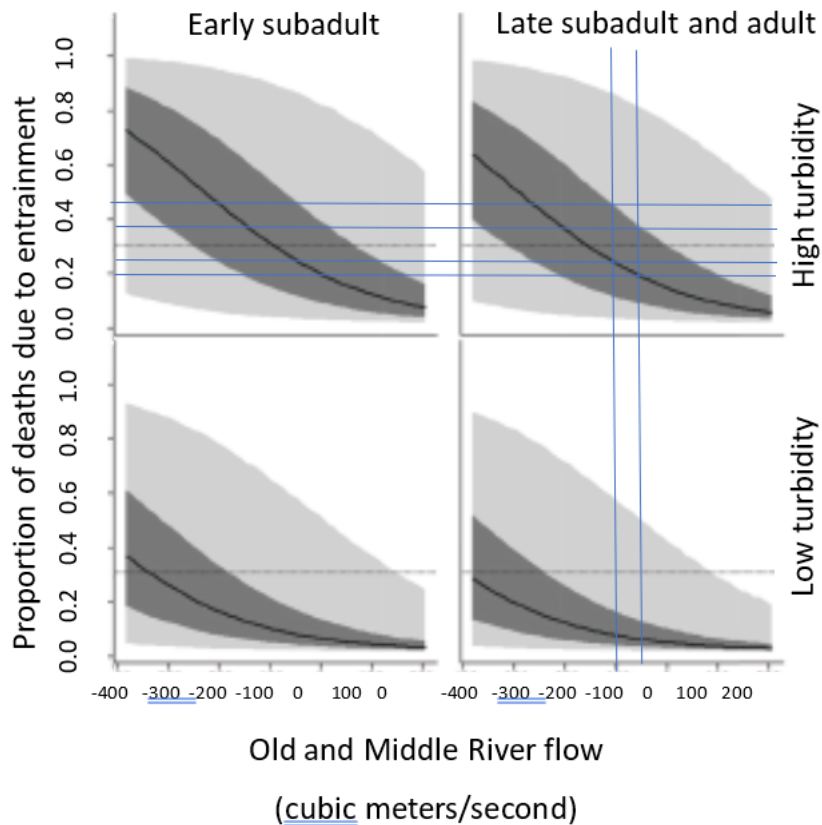


Figure 16. Posterior distributions of predicted entrainment mortality at two levels of water clarity (2007–2015 interquartile range) and a range of Old and Middle river flows. The dark shaded regions indicate the interquartile range of posterior predictions, and the light shaded regions indicate the 95% credible intervals. The dotted horizontal lines indicate the reference point  $0.41 \times$  natural mortality, or  $0.29 \times$  total mortality (following Zhou et al. 2012). This image is modified from Figure 3 of Smith et al. 2021. The blue vertical and horizontal lines were added to aid in comparing modeled proportion of deaths due to entrainment at an OMRI of -2000 cfs (56.6 cubic meters/second) and an OMRI of -3500 cfs (99.1 cubic meters/second) in the upper right panel (late subadult and adult; high turbidity). The bottom horizontal lines are for the average and the upper horizontal lines are for the upper interquartile range.

Table 12. Approximate Flows and Flow Differences at Stations in the Delta Between OMRIs of -2000 and -5000 cfs on 1/30/2023. Flows on 1/30/2023 generally represented maximum differences in flows. Flow values are approximated from Figures 3-8.

OMRI	Flows at 49 (cfs)	Flows at 94 (South Delta) (cfs)	Flows at 107 (cfs)	Flows at 124 (cfs)	Flows at 148 (cfs)	Flows at 160 (cfs)
-2000	21750	-400	-175	-4700	-300	-1000
-3500	20500	-1250	-400	-5200	-700	-1200
-5000	19250	-2750	-640	-5600	-1150	-1450
Difference -3500/-2000	-1250	-850	-225	-500	-400	-200
Difference -5000/-3500	-1250	-1500	-240	-400	-450	-250
Difference -5000/-2000	-2500	-2350	-465	-900	-850	-450

Table 13. Approximate Velocities and Velocity Differences at Stations in the Delta Between OMRIs of -2000 and -5000 cfs on 1/30/2023. Velocities on 1/30/2023 generally represented maximum differences in velocities. Velocity values are approximated from Figures 10-15.

OMRI	Velocities at 49 (ft/s)	Velocities at 94 (ft/s)	Velocities at 107 (ft/s)	Velocities at 124 (ft/s)	Velocities at 148 (ft/s)	Velocities at 160 (ft/s)
-2000	0.31	-0.02	-0.025	-0.14	-0.015	-0.095
-3500	0.285	-0.14	-0.09	-0.155	-0.06	-0.118
-5000	0.268	-0.26	-0.165	-0.17	-0.115	-0.148
Difference -3500/-2000	-0.025	-0.12	-0.065	-0.015	-0.045	-0.023
Difference -5000/-3500	-0.017	-0.12	-0.075	-0.015	-0.055	-0.03
Difference -5000/-2000	-0.042	-0.24	-0.14	-0.03	-0.1	-0.053