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

1. Executive Summary

a. Operations anticipated during the week

See Weekly Fish and Water Operation Outlook document for January 26 – February 1

b. Winter-run Chinook Salmon summary

No loss of natural winter-run Chinook salmon (LAD) has occurred in the past week at the State or Federal fish salvage facilities (Figure 1, Figure 2). Loss of natural winter-run Chinook salmon at the Central Valley Project (CVP) and State Water Project (SWP) fish collection facilities is unlikely to occur over the next week. 35-65% of juvenile natural winter-run Chinook salmon from brood year (BY) 2020 are estimated to be present in the Delta. This percentage is likely to increase due to anticipated precipitation this week and the maturation of juveniles for this time of year. In addition, releases of hatchery late fall-run Chinook salmon may encourage movement of fish downstream in conjunction with hatchery fish movements. Adult winter-run Chinook salmon are entering the Delta based on historical information.

c. Spring-run Chinook salmon summary

No loss of natural Central Valley (CV) YOY spring-run Chinook salmon has occurred in the past week at the State and Federal fish salvage facilities. Loss of young of year Central Valley spring-run Chinook salmon at the CVP and SWP fish collection facilities is unlikely to occur over the next week. 15-25% of spring-run Chinook salmon are estimated to be in the Delta. This percentage is likely to increase due to anticipated precipitation this week. There is a low likelihood that juvenile natural spring-run Chinook salmon from BY 20 are near the DCC gates based on regional monitoring data. YOY spring-run Chinook salmon are nearing the end of emergence from the gravel and are rearing and beginning to move downstream. Yearling spring-run are being detected in the Butte Creek rotary screw trap (RST) and the fyke trap at Parrot Phelan Dam and flow conditions are suitable based on tributary flows in Mill and Deer creeks to stimulate the movement in Sacramento River tributaries. Yearling spring-run Chinook salmon were released on 12/3/2020 from the SCARF facility. The production release of late fall-run Chinook salmon occurred on 1/4/21, with the first group of spring-run Chinook salmon surrogates released four days later, on 1/8/2021 from the Coleman National Fish Hatchery (NFH) facility in Battle Creek. The second group of spring-run Chinook salmon surrogates were released on 1/22/2021 from the Coleman NFH facility in Battle Creek. One clipped Chinook salmon was observed at the CVP on 1/18/2021.

d. **Central Valley Steelhead summary**

No loss of natural California CV (CCV) steelhead occurred last week through 1/24/2021 at the State and Federal fish salvage facilities (last loss was 2.72 fish on 1/11/2021, the first steelhead of WY 2021; Figure 3, Figure 4). Loss of CCV steelhead at the Central Valley Project (CVP) and State Water Project (SWP) fish collection facilities may occur over the next week. 10-25% of juvenile CCV Steelhead are estimated to be present in the Delta. An estimated 0-5% have exited the Delta. This percentage is likely to increase due to anticipated precipitation this week. Approximately 415,000 hatchery fish were released at Red Bluff since middle of December and an additional 216,500 were released between 12/28/2020 and 12/29/2020. This is expected to

stimulate natural origin fish movement as well. Spawning of adult steelhead is likely occurring in the tributaries.

e. **Green Sturgeon summary**
A dead green sturgeon (550 mm) was observed on the trash rack of the SWP last week. The body was retained, and identification was confirmed. Loss of green sturgeon at the Central Valley Project (CVP) and State Water Project (SWP) fish collection facilities is unlikely to occur over the next week. Green sturgeon are more likely to be salvaged during the summer although salvage may occur at any time of year.

f. **Delta Smelt summary**
Based on distribution patterns over the past decade and recent detections, Delta Smelt are unlikely to be prevalent in the South Delta. Limited detection data support Delta Smelt being present in Suisun Marsh, west of the Sacramento-San Joaquin confluence, and in the Sacramento Deep Water Ship Channel. The distribution of Delta Smelt is expected to extend upstream of the confluence which is supported by historical Spring Kodiak Trawl data analysis. Precipitation is anticipated, and changes to the Freeport flows and turbidity are not expected to reach "First Flush" conditions within the next seven days. The likelihood of Delta Smelt adult entrainment is slightly elevated relative to the previous seven days due seasonal timing. The overall probability of Delta Smelt moving into the south Delta is low. The projected OMR Index limits are at a level that is sufficiently protective. Both precipitation and wind could push turbidity in the central delta to potentially reach Old River at Bacon Island (OBI) by 2/1/2021. On 1/26/2021, a Delta Smelt was collected in the Sacramento Deep Water Ship Channel by EDSM.

g. **Monitoring Teams summary**
There were no non-consensus issues to report from the Salmon Monitoring Team.
There were no non-consensus issues to report from the Smelt Monitoring Team.

2. Operational and Regulatory Conditions

See Weekly Fish and Water Operation Outlook document for January 26 – February 1.

3. 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 2020 Productivity:**
  - Natural winter-run Chinook salmon: Preliminary interim juvenile production estimate (JPE) calculations were established for brood year (BY) 2020 winter-run Chinook salmon. The finalized estimate from the Winter-run JPE PWT for total natural production entering the Delta (JPE) is 330,130 winter-run Chinook salmon individuals. NMFS issued a final winter-run JPE letter on 1/25/21. The agencies in the SaMT have previously discussed the thiamine vitamin deficiency that is being observed again in broodstock at the Livingston Stone National Fish Hatchery (NFH) similar to last year's observations. Last year the thiamine deficiency appeared

to negatively affect survival of juvenile fish as they migrate downstream towards the Delta. Estimated winter-run Chinook salmon passage at Red Bluff Diversion dam (RBDD) is greater than recent years (BY 2014 – 2018) with the exception of BY 2019. By 1/14/2021, 1,972,734 winter-run Chinook salmon were estimated to have passed RBDD compared to a cumulative passage of 3,781,229 winter-run Chinook salmon RBDD on 1/14/2020.

- Few observations of natural winter-run Chinook salmon from brood year 20 (BY 2020) have been observed downstream of the Glenn-Colusa Irrigation District's (GCID) monitoring location this water year.
- Hatchery winter-run Chinook salmon: No hatchery winter-run Chinook salmon have been released in WY 2021 to date. Preliminary estimate for the hatchery JPE released into the Sacramento River from Livingston Stone NFH is 97,888 fish.

<u>Spring-run Chinook salmon</u>

- **Delta Life Stages:**
  - Young-of-year (YOY) and Yearlings
  - First hatchery releases of yearling spring-run Chinook salmon from the SCARF facility occurred on 12/3/2020
  - First hatchery releases of yearling spring-run Chinook salmon surrogates from Coleman NFH facility occurred on 1/8/2021, second hatchery releases occurred on 1/22/2021.
- **Brood Year 2020 Productivity:**
  - Natural spring-run Chinook salmon: No JPE has been established for spring-run Chinook salmon. Approximately 21.0% of the juvenile spring-run sized Chinook salmon population for BY 20 is expected to have passed passing Red Bluff Diversion dam as of 1/24 (see Ops Outlook) based on historical data.
  - Hatchery spring-run Chinook salmon surrogates: First hatchery releases of yearling spring-run Chinook salmon surrogates in WY 2021 from Coleman NFH facility occurred on 1/8/2021, second hatchery releases occurred on 1/22/2021.
  - The agencies in the SaMT discussed the thiamine vitamin deficiency that is also currently being observed again in winter-run Chinook salmon broodstock at the Livingston Stone NFH similar to last year's observations. 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. The Feather River Fish Hatchery experienced issues with infertile males. It is expected that the Feather River Hatchery will only meet about half of their production goals. On the Feather River, a larger than historical number of spring-run adults that entered the system and were tagged appear to be spawning in-river instead of returning to the hatchery. This is one reason that low returns are being observed at the hatcheries.

<u>Central Valley Steelhead</u>

- **Delta Life Stages**:
  - Spawning Adults, Kelts, Juveniles
- **Brood Year 2020 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.
- Approximately 415,000 steelhead from Coleman NFH were released at Red Bluff in the first half of December, part of the CCV Steelhead DPS.
- Approximately 216,500 steelhead from Coleman NFH were released into the Sacramento River from December 28-29, 2020, which are part of the CCV Steelhead DPS.

DISTRIBUTION

Winter-run Chinook Salmon

- **Current Distribution:**
  - On 1/26/2021, SaMT estimated 35-65% of juvenile winter-run Chinook salmon were present in the Delta (Table 1). In October, the GCID RSTs observed 583 winter-run Chinook salmon juveniles (by length at date criteria) in their daily catches. In November, the GCID RSTs observed 138 winter-run Chinook salmon juveniles (by length at date criteria) in daily catches. In December, the GCID RSTs have observed 246 winter-run Chinook salmon juveniles (by length at date criteria) in daily catches. In January (through 1/25/2021), the GCID RSTs have observed 36 winter-run Chinook salmon juveniles (by length at date criteria) in daily catches. Since few winter-run Chinook salmon have been observed in RST monitoring locations farther downstream (1 at Tisdale 1/19/2021 – 1/21/2021; 0 at Knights Landing 1/19/2021 – 1/24/2021), the fish appear to still be holding in the middle reaches of the Sacramento River.
  - Catch indices are calculated daily for juvenile winter-run Chinook salmon observed in RSTs at Knights Landing (Knights Landing Catch Index, KLCI) and Sacramento Trawl and Beach Seine (Sacramento Seine Catch Index, SCI Trawl and SCI Beach Seine) monitoring locations (Table 2). No catch indices for juvenile salmonid migration were triggered during the past week.
  - Mean daily flow and percent change (Wilkins Slough (WLK), Deer Creek (DCV), Mill Creek (MLM); cfs from CDEC) and temperature and percent change (Knights Landing RST (KL); °F from RST) are monitored as alerts for juvenile salmonid migration (Table 3). Mill Creek and Deer Creek alerts for juvenile salmonid migration were triggered 7 of the 7 days during the past week.
- **Historic Trends**
  - Based on historical trends in salvage, 23.8% of winter-run Chinook salmon should have been observed in salvage by this time of the water year (Table 4). If historic trends in salvage were to continue winter-run Chinook salmon loss is expected to remain the same over the next week (Figure 1, Figure 2). Hatchery winter-run Chinook salmon have not been released into the Sacramento River in WY 2021.
- **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 are likely to increase with precipitation events and increasing river flows and turbidity. Significant precipitation is anticipated to occur this week (see Ops Outlook) and given the seasonal timing (mid-January) any precipitation during a very dry period may stimulate fish movement. Furthermore, based on the time of year, and the maturation of juvenile fish, downstream migration is expected to continue even without any substantial precipitation events occurring. 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 12/1/20 and are expected to

remain closed through mid-May 2021. There may be a need to open the DCC gates to meet D-1641 water quality standards (see Operations Outlook document).
    - Anticipated precipitation this week in the Central Valley should stimulate fish movement.
    - The entrainment tool estimates a median loss of 0 fish and a maximum loss of 3 fish during this week (SacPAS last updated on 1/20/21).
    - For results of entrainment into Delta strata regions from DSM2 model runs (North Delta into Interior and Central Delta, San Joaquin River and Central Delta into South Delta, and South Delta into fish facilities) refer to Attachment A.

Spring-run Chinook salmon

- **Current Distribution**
    - On 1/26/2021 SaMT estimated 15-25% of juvenile CV spring-run Chinook salmon were present in the Delta (Table 1). Mill Creek and Deer Creek flows were recorded higher than 95 cfs seven times over the past week (1/18/2021 – 1/24/2021; Table 3). This is indicative that yearling spring-run Chinook salmon may begin to move out of tributaries into the mainstem Sacramento River, yearling spring-run Chinook salmon have also been detected in the Butte Creek monitoring locations. No unmarked spring-run Chinook salmon were observed at the Knights Landing RST or Tisdale RST in the past week.
    - No juvenile young-of-year CV spring-run Chinook salmon (LAD) have been observed near the DCC gates. Yearling CV spring run Chinook salmon may be migrating downstream based on increased flows in the Sacramento River tributaries and have been observed at the Butte Creek monitoring locations. Historical monitoring indicates that approximately 5% of YOY spring-run Chinook salmon are in the Delta at this time. Mill Creek and Deer Creek flows were greater than 95 cfs seven days during the past week indicating that downstream migration of yearling spring-run Chinook salmon may occur soon.
    - One clipped Chinook salmon was observed at the CVP on 1/18/2021.
- **Historical Trends**
    - Based on historical trends in salvage, 0% of spring-run Chinook salmon should have been observed in salvage by this time of the water year (Table 4). If historic trends in salvage were to continue spring-run Chinook salmon loss is expected to remain the same over the next week. The first and second spring-run surrogate Chinook salmon groups were released into the Sacramento River at Battle Creek on 1/8/2021 and 1/22/2021, respectively. Release Group 3 may be held at Coleman NFH facility through 2/12/2021.
- **Forecasted Distribution within Central Valley and Delta regions**
    - Movement of juvenile spring-run Chinook salmon into the lower reaches of the Sacramento River and upper Delta are likely to occur with precipitation events and increasing river flows and turbidity (see Weekly Fish and Water Operation Outlook document).
    - Anticipated precipitation this week in the Central Valley should stimulate fish movement.
    - For results of entrainment into Delta strata regions from DSM2 model runs (North Delta into Interior and Central Delta, San Joaquin River and Central Delta into South Delta, and South Delta into fish facilities) refer to Attachment A.

Central Valley Steelhead

- **Current Distribution**

- On 1/26/2021 SaMT estimated 10-25% of juvenile CCV steelhead were present in the Delta (Table 1).

- **Historical Trends**
  - Based on historical trends in salvage, 8.2% of juvenile CCV steelhead should have been observed in salvage by this time of the water year. If historic trends in salvage were to continue juvenile CCV steelhead loss is expected that it may increase over the next week.
- **Forecasted Distribution within Central Valley and Delta regions**
  - No juvenile Central Valley steelhead have been observed near the DCC gates in regional monitoring efforts and historical monitoring data does not detect juvenile steelhead in the Delta at this time. One hatchery steelhead was observed at Knights Landing this past week (1/19/2021 – 1/24/2021). SaMT estimated that 10-25% of the population of CCV steelhead may be present in the Delta at this time and 0-5% have exited the Delta past Chipps Island. Closure of the DCC gates would reduce exposure and possible entrainment of juvenile CCV steelhead into the interior Delta via the DCC gates. The first natural steelhead in salvage for WY 2021 occurred 1/11/2021 at the CVP (Figure 3, Figure 4). The first marked steelhead in salvage for WY 2021 occurred 1/20/2021 at the CVP.
  - Anticipated precipitation this week in the Central Valley stimulate fish movement.
  - The entrainment tool predicts a median loss of 0 fish will occur with a maximum loss of 0 fish (SacPAS last updated on 1/20/21).
  - For results of entrainment into Delta strata regions from DSM2 model runs (North Delta into Interior and Central Delta, San Joaquin River and Central Delta into South Delta, and South Delta into fish facilities) refer to Attachment A.

TABLE 1. Distribution estimates

Location	**Yet to Enter Delta**	**In the Delta**	**Exited the Delta (Past Chipps Island)**
Young-of-year (YOY) winter-run Chinook salmon	35-65%	35-65%	0%
YOY spring-run Chinook salmon	75-85%	15-25%	0%
YOY hatchery winter-run Chinook salmon	N/A	N/A	N/A
Natural origin steelhead	75-85%	10-25%	0-5%

TABLE 2. Catch indices for juvenile winter-run Chinook salmon observed in RSTs at Knights Landing (Knights Landing Catch Index, KLCI) and Sacramento Trawl and Beach Seine (Sacramento Seine Catch Index, SCI Trawl and SCI Beach Seine) monitoring locations

Date	**KLCI Winter Chinook**	**KLCI Older Chinook**	**SCI Trawl**	**SCI Beach Seines**	**Trigger Exceeded: Catch Index > 5**	**Trigger Exceeded: Catch Index 3 < X ≤ 5**
1/24/2021	0	0	0			
1/23/2021	0	0				
1/22/2021	0	0	0			
1/21/2021	0	0	0	0		

Date	KLCI Winter Chinook	KLCI Older Chinook	SCI Trawl	SCI Beach Seines	Trigger Exceeded: Catch Index > 5	Trigger Exceeded: Catch Index 3 < X ≤ 5
1/20/2021	0	0	0			
1/19/2021	0	0	0			
1/18/2021	0	0				

TABLE 3. Mean daily flow and percent change (Wilkins Slough (WLK), Deer Creek (DCV), Mill Creek (MLM); cfs from CDEC) and temperature and percent change (Knights Landing RST (KL); °F from RST)

Date	MLM mean daily flow (cfs)	MLM flow % change	MLM Alert	DCV mean daily flow (cfs)	DCV flow % change	DCV Alert	WLK mean daily flow (cfs)	KL water temp (°F)	WLK-KNL: Alert
1/24/2021	109.0	-0.2%	Flow>95cfs	105.5	-1.1%	Flow>95cfs	4430.8		
1/23/2021	109.3	-0.9%	Flow>95cfs	106.7	0.7%	Flow>95cfs	4419.8	49.9	
1/22/2021	110.2	-0.5%	Flow>95cfs	105.9	-0.1%	Flow>95cfs	4419.0	49.6	
1/21/2021	110.8	-1.3%	Flow>95cfs	106.0	-2.2%	Flow>95cfs	4440.2	49.7	
1/20/2021	112.3	-3.7%	Flow>95cfs	108.4	-5.1%	Flow>95cfs	4474.1	49.7	
1/19/2021	116.7	-2.0%	Flow>95cfs	114.2	-2.8%	Flow>95cfs	4546.8	50.3	
1/18/2021	119.1	-0.3%	Flow>95cfs	117.5	-1.2%	Flow>95cfs	4692.9	51	

TABLE 4. Historic migration and salvage patterns.

Date (1/24)	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% (95.9%,99.5%) BY: 2011 - 2019	77.8% (53.3%,102.4%) BY: 2011 - 2019	76.2% (51.8%,100.5%) BY: 2011 - 2019	38.0% (8.9%,67.2%) BY: 2011 - 2019	3.2% (-0.4%,6.8%) BY: 2011 - 2019	23.8% (3.8%,43.9%)
Chinook, Spring-run, Unclipped	21.0% (5.7%,36.4%) BY: 2011 - 2019	34.7% (2.2%,67.3%) BY: 2011 - 2019	23.7% (-2.9%,50.2%) BY: 2011 - 2019	4.6% (-3.3%,12.5%) BY: 2011 - 2019	0.0% (0.0%,0.0%) BY: 2011 - 2019	0.0% (-0.0%,0.0%)

Date (1/24)	Red Bluff Diversion Dam	Tisdale RST	Knights Landing RST	Sac Trawl (Sherwood) Catch Index	Chipps Island Trawl Catch Index	Salvage
Steelhead, Unclipped (Dec – March)						8.2% (-2.5%,19.0%)

TABLE 5. STARS model output

Date (1/23)	DCC	Georgiana Slough	Sacramento River	Sutter and Steamboat
Proportion of Entrainment	NA	31%	44%	24%
Survival	NA	16%	48%	34%
Travel Time	NA	19.0 d	11.9 d	12.3 d

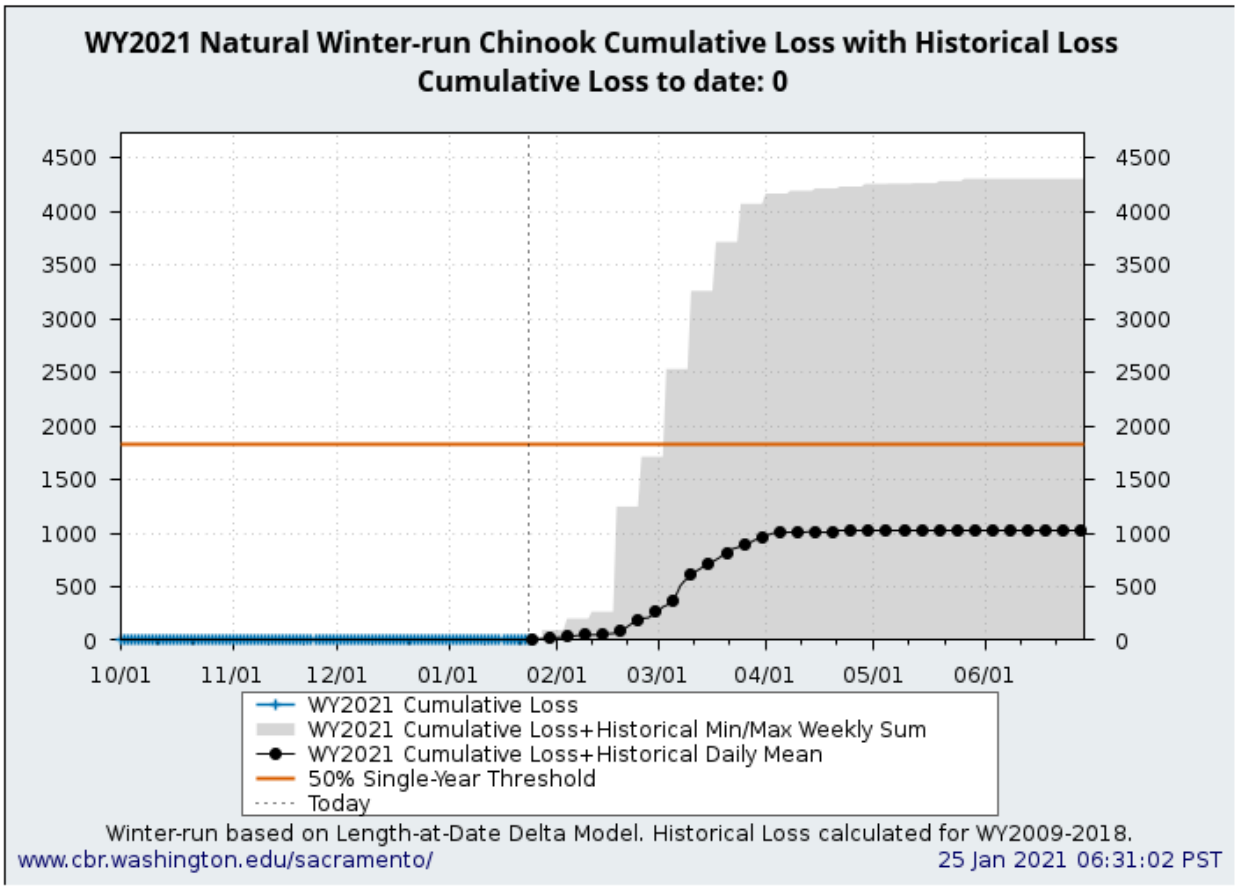


FIGURE 1. WY2021 natural winter-run Chinook salmon cumulative loss values through salvage season. Values depicted are not genetically corrected. No loss has occurred in WY2021. Based on historical cumulative loss values from 2009 – 2018, WY2021 observed loss (and potential future loss) are not likely to exceed the 50% loss threshold this week.

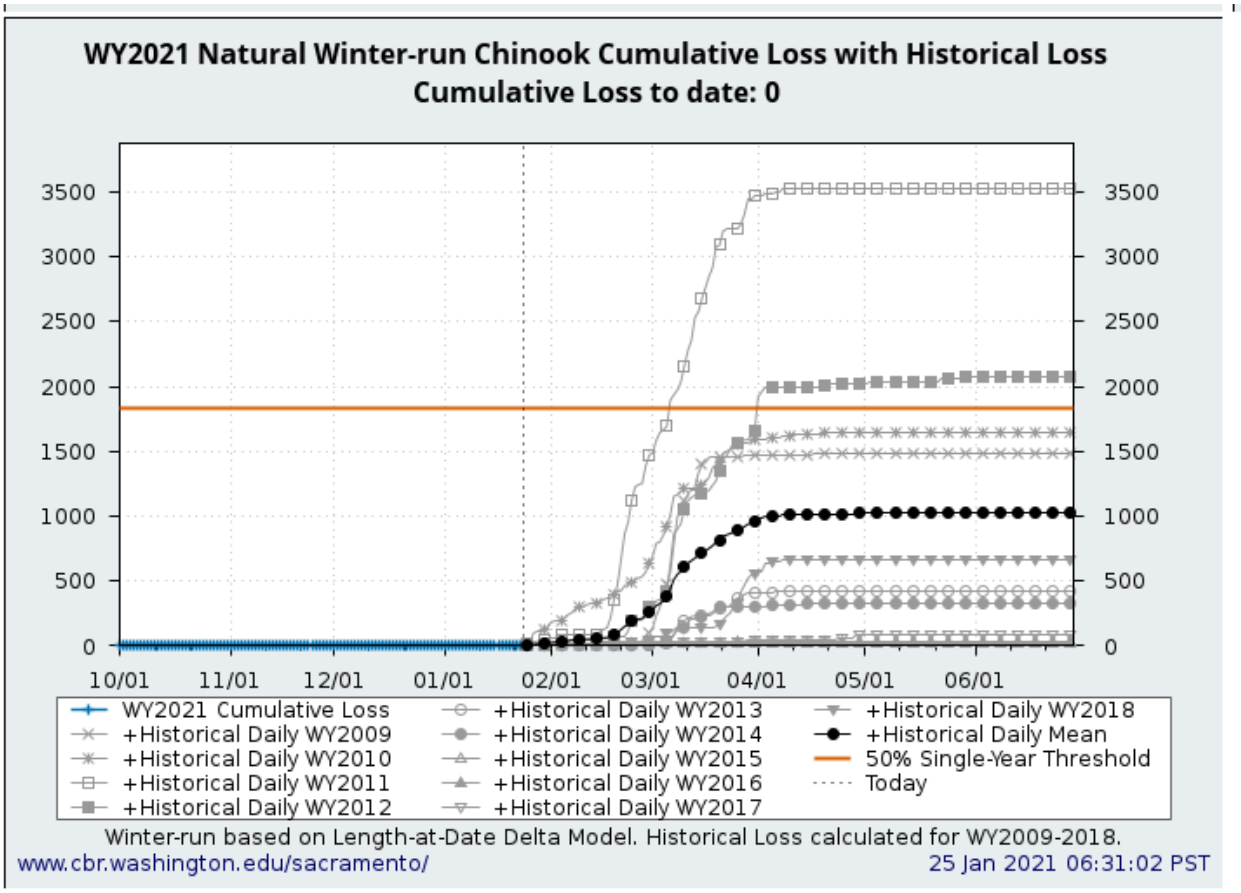


FIGURE 2. Daily natural winter-run Chinook salmon loss accumulates towards single-year loss threshold. Based on historical cumulative loss values from 2009 – 2018, WY2021 observed loss (and potential future loss) are not likely to exceed the 50% loss threshold this week.

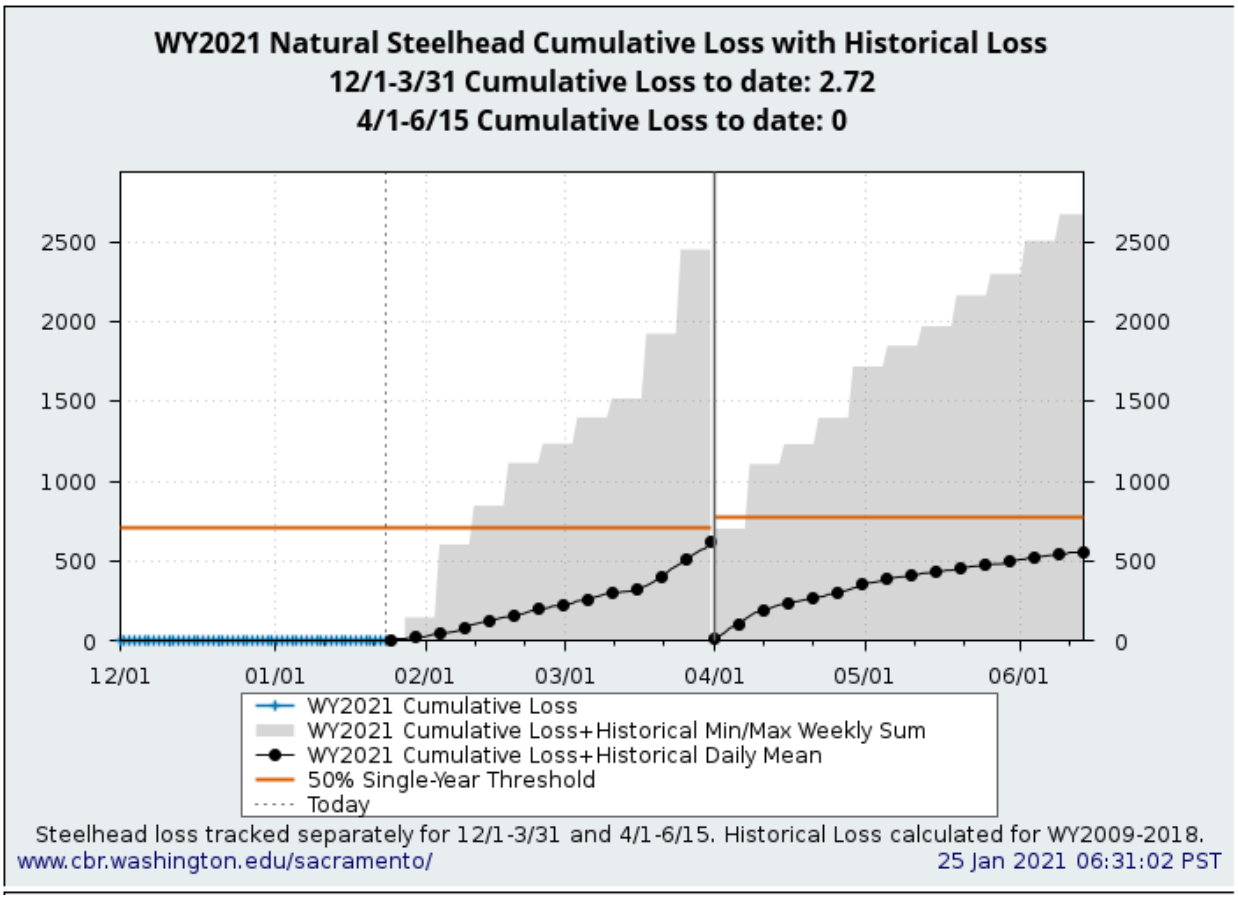


FIGURE 3. WY2021 natural steelhead cumulative loss values through salvage season: December 1 – March 31, April 1 – June 15. Based on historical cumulative loss values from 2009 – 2018, WY2021 observed loss (and potential future loss) are not likely to exceed the 50% loss threshold this week. The first steelhead loss occurred 1/18/2021.

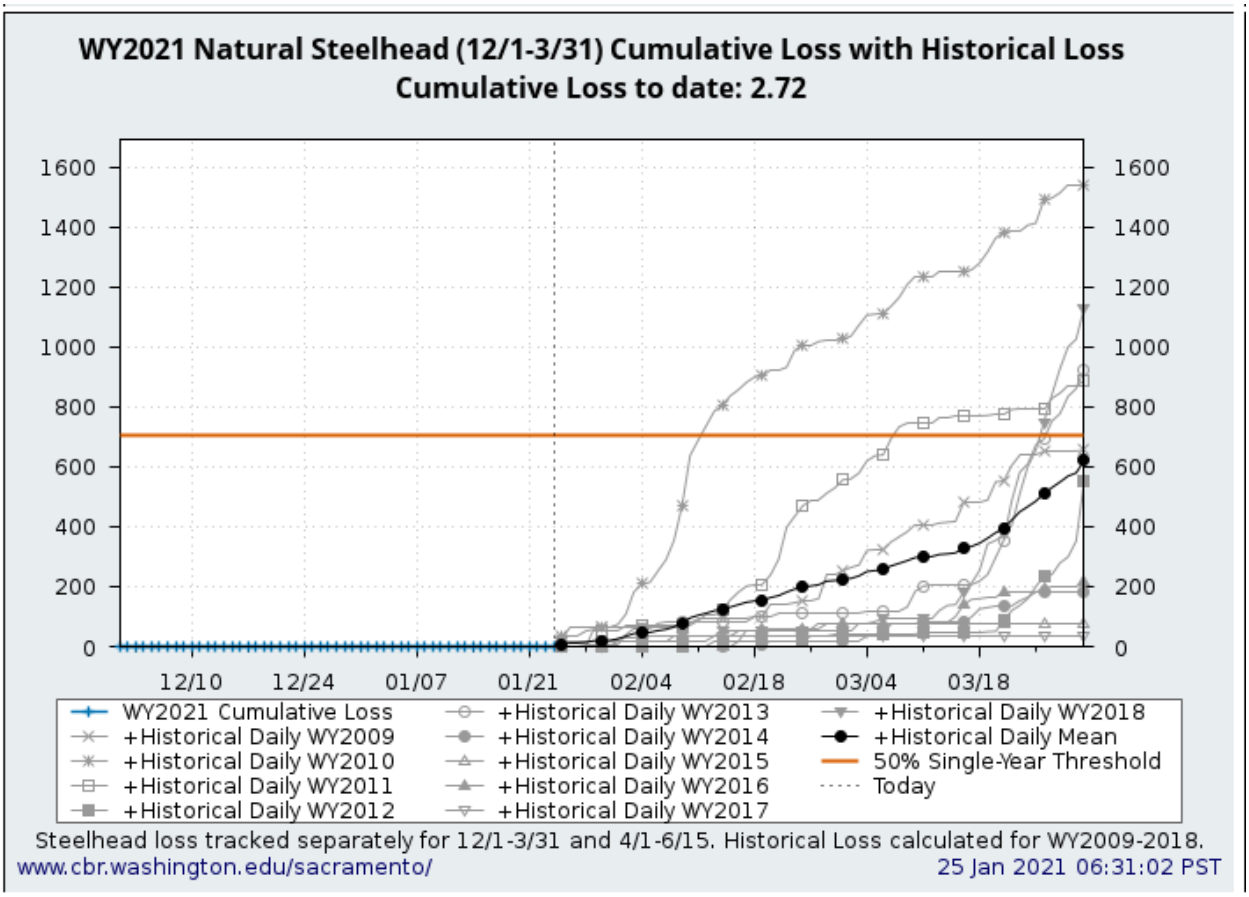


FIGURE 4. Daily natural steelhead loss accumulates towards single-year loss threshold: December 1 – March 31. Based on historical cumulative loss values from 2009 – 2018, WY2021 observed loss (and potential future loss) are not likely to exceed the 50% loss threshold this week.

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 juvenile winter-run Chinook salmon, spring-run Chinook salmon, and steelhead are present in the Delta.
2. **Does the operational outlook's ranges impact fish movement and change the potential distribution of fish?**
   i. **Potential effects within the 7 days (near-term) in the operations outlook.**
   It appears that there is an increased risk of salmonids being exposed to export facilities and OMR flow is expected to remain at or below -5,000 cfs this upcoming week. The SaMT anticipates an increased number of salmonids entering the Delta currently due to hatchery steelhead and yearling spring-run Chinook salmon surrogate releases and the forecast for precipitation occurring this week.
   For DSM2 model run results refer to Attachment A.
   ii. **Potential effects longer than the 7 days (longer-term) in the operations outlook.**

The members of SaMT are not confident in projecting beyond 7 days due to uncertainty regarding weather forecasting. Precipitation is forecasted for this week. Furthermore, if current trends were to continue then it is anticipated that more fish may appear at export facilities as fish begin to outmigrate based on historical trends.

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?**
   Reduced exports at the facilities reduces risk of entraining ESA-listed species.
   Winter-run Chinook salmon
   Total juvenile winter-run Chinook salmon (LAD) loss is 0 fish (as of 1/24/2021). 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 juvenile spring-run Chinook salmon (LAD) loss is 0 fish (as of 1/24/2021). The first and second groups of yearling spring-run surrogate Chinook salmon hatchery fish were released 1/8/2021 and 1/22/2021, respectively, in Battle Creek.
   Central Valley Steelhead
   Total juvenile steelhead loss is 2.72 fish (as of 1/24/2021). The first steelhead of the season was salvaged 1/11/2021. 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 2021.
   Spring-run Chinook salmon
   The annual loss threshold for spring-run Chinook salmon has not been exceeded in WY 2021.
   Central Valley Steelhead
   The annual loss threshold for steelhead (December 1 – March 31) has not been exceeded in WY 2021.
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?**
   OMR index levels in the upcoming week are not anticipated to be more negative than -5,000 cfs.

Green Sturgeon

POPULATION STATUS

- **Delta Life Stages:**
  - Adults and Juveniles
- **Juvenile Abundance:**
  - No empirical estimates of the juvenile population (ages 0 – 3) in the Delta are available. Information about their rearing and distribution patterns within the Delta is limited. In 2019, 73 larval green sturgeon and six juvenile green sturgeon were observed at the Red Bluff Diversion Dam fish monitoring RSTs in the upper Sacramento River. In WY 2019, no green sturgeon were observed at the Delta fish salvage facilities. In WY 2020, two green were caught at the Delta fish salvage facilities (salvage = 8).

DISTRIBUTION

- **Current Distribution**
    - Juvenile and adult green present in the San Joaquin and Sacramento rivers and Delta during the next week. Acoustically tagged green sturgeon have been detected and remain in the vicinity of Sherman Island.

- **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?**
   Currently, green sturgeon salvage is 0 fish (as of 1/24/2021). There may have been one green sturgeon salvaged this past week at the SWP fish salvage facility (refer to sturgeon section above for details). The agencies in the SaMT assessed the likelihood of salvage occurring in the next week is unlikely to occur.

Delta Smelt

POPULATION STATUS

- **Delta Smelt Life Stages:**
    - Adult
- **Brood Year 2020:**
    - **Abundance estimate**: The most recent population abundance estimate for Delta Smelt was 1,057. This estimate was calculated from the sampling between 1/04/2021-1/8/2021. The last Delta Smelt to contribute to the abundance estimate was collected on 1/6/2021. The most recent detection of a Delta Smelt was a 47 mm juvenile collected in the Sacramento Deep Water Ship Channel by EDSM on 1/26/2021. In addition, another Delta Smelt was collected on 1/21/2021 for FCCL broodstock. In order to reduce handling stress broodstock collections do not take additional data such as length or expression and are treated as adults in this assessment.
    - **Biological Conditions**: The Smelt Monitoring Team discussed the most recent monitoring data (Table 4) and considered professional opinion on the historical trends in regional distribution. Based on those discussions, the agency participants on SMT estimate Delta Smelt subadult/adults should be holding in the Suisun Marsh and west of the Sacramento-San Joaquin confluence in anticipation of migration but analysis of historic Spring Kodiak Trawl (SKT) supports Delta Smelt distribution being above the confluence and less tightly correlated to X2 position (available upon request from USFWS). They are also present in the Sacramento Deep Water Ship Channel.

DISTRIBUTION

- **Current Distribution**

- Real time detection data is currently limited to EDSM sampling, and SLS. Due to the low number of detections of Delta Smelt, the SMT is also closely monitoring FCCL Broodstock Collections to inform distribution estimates. Since there are only a few recent detections, the Smelt Monitoring Team's capacity to estimate where Delta Smelt are within the Delta is limited.
- The last Delta Smelt detection was on 1/26/2021 in the Sacramento Deep Water Ship Channel by EDSM. Larval sampling is not being conducted at the state or federal salvage facilities.

TABLE 6. Summary of recently reported detections of Delta Smelt by Region and Salvage Facilities between 1/19/2021 and 1/26/2021. Start and End dates reflect period of time between updates to SMT. Regional categories are determined from EDSM sampling. Delta Smelt >58mm FL are considered adults.

Life Stage	North	South	West	Far West	Salvage
Adult	1	0	0	NA	0
Larvae/Juvenile	1	0	0	NA	0

TABLE 7. 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.

Sampling Method	New Detections	WY2021	Notes
EDSM	1	2	Phase 1 begins 11/30/20 Last Detection: 1/26/2021
SKT	0		SKT Starts: 02/1/2021
SLS	0	0	Survey 1:Complete Survey 2 Started : 1/25/2021
20-mm	0	0	Begins: March
Bay Study	0	0	Suspended due to COVID-19 restrictions
FMWT	0	0	Ended 12/15/2020
Chipps Island Trawl	0	0	5 day per week sampling began 12/7/2020 Ends: mid-May.
Brood Stock Collections	1	2	Last Catch: 1/21/2021

- **Historical Trends**
  - Based on historical analysis of SKT, the centroid of Delta Smelt distribution is anticipated to be above the Sacramento-San Joaquin confluence, but less closely correlated to X2 which is currently estimated to be at 96 km.
  - The recent Delta Smelt detections in the Deep Water ship channel are upstream of the confluence, but may be freshwater residents and not representative of the migratory life history patterns in Delta Smelt (Hobbs 2019).

- **Forecasted Distribution within Central Valley and Delta regions**
  - Delta Smelt distribution is not expected to change in the next seven days since first flush conditions that would trigger migration are not anticipated. However, predicting the distribution

is currently difficult because detection data is limited to a few individuals and historic patterns may not be representative of the low population levels of Delta Smelt.

ABIOTIC CONDITIONS

- **Turbidity**
  - Precipitation is anticipated in the next seven days, and changes in Freeport flows and turbidity (Table 8) that would create "First Flush" conditions are not expected by the agency representatives of the SMT. High winds and precipitation are expected on the 26th and 27th which may increase turbidity at in Frank's Tract and Holland Cut which might reach OBI by 2/1/2021.The area of high turbidity will be monitored by the SMT.

TABLE 8. Relevant Environmental Factors to the current management actions for Delta Smelt.

Date Reported	FPT 3 Day Running Avg. of Daily Flows (cfs)	FPT 3 Day Running Avg. of Turbidity (FNU)	OBI Daily Average Turbidity (FNU)
1/26/2021	7303	3.93	3.13

- **X2 Conditions**
  - X2 is estimated to be greater than 10 km upstream of the confluence of San Joaquin and Sacramento Rivers.
- **Other Environmental Conditions**
  - The Smelt Monitoring Team expects environmental conditions to change in the next seven days depending upon the amount of precipitation and the SMT will be prepared to meet if triggers are met.
  - The Fish and Water Operation Outlook OMR Index values are expected to range between -2,500 to -5,000 cfs between 1/26/2021 and 2/2/2021.This range reflects the high uncertainty due to potential precipitation during the next seven days.
  - 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

EVALUATION

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

   The running 3-day average flows and running 3-day average turbidity at Freeport (Table 8) have not exceeded the triggers for "First Flush" conditions. Based on the forecasted storm precipitation, "First Flush" conditions are not expected before February 1, 2021.

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 a few recent detections, Delta Smelt are unlikely to be prevalent in the South Delta. The detection on 11/9/2020 supported Delta Smelt being present in Suisun Marsh and west of the Sacramento-San Joaquin confluence. The most recent detections on the 6th, 15th , 21st and 26th of January support a presence of the species in the Sacramento Deep Water Ship Channel, but these fish may represent the freshwater resident population and not be representative of the migratory life history pattern. Based on historical analysis of SKT, the centroid of Delta Smelt distribution is anticipated to be above the confluence of the Sacramento-San Joaquin confluence, and less tightly correlated to the X2 which is currently estimated to be at 96 km (Polansky et al 2018). Since "First Flush" conditions are not expected to be met within the next seven days, it is unlikely that Delta Smelt will migrate into areas with a high risk of entrainment. The range of

OMR values is expected to be -2,500 to -5,000 cfs and QWEST is expected to be positive after precipitation. As the season progresses, the risk that Delta Smelt may migrate even if "First Flush" conditions are not met will increase.

3. **Has a spent female been collected?**
   Turbidity Bridge Avoidance will begin on 2/1/2021 and as of 1/26/2021 no spent female Delta Smelt have been observed.
4. **If OMR of -2000 does not reduce OBI turbidity below 12NTU/FNU, what OMR target is deemed protective between -2000 and -5000?**
   Turbidity bridge avoidance begins on 2/1/2021.
5. **If OBI is 12 NTU/FNU, what do other station locations show?**
   This question is not applicable until Turbidity Bridge Avoidance begins.
6. **If OBI is 12 NTU/FNU, is a turbidity bridge avoidance action not warranted? What is the supporting information?**
   This question is not applicable until Turbidity Bridge Avoidance begins.

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, what is the OMR level between -3,500 and -5,000 cfs that manages weekly entrainment in the context of annual larval and juvenile entrainment levels?**
   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

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

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

Attachment A: DSM2 modeling

Hydraulic footprint information

DWR baseline forecast	1/19/2021 to 2/8/2021
CVO updated baseline and Scenarios	1/25/2021
CVO OMR action taking place	1/27/2021 to 2/1/2021
DSM2 modeling results valid	1/27/2021 to 2/2/2021

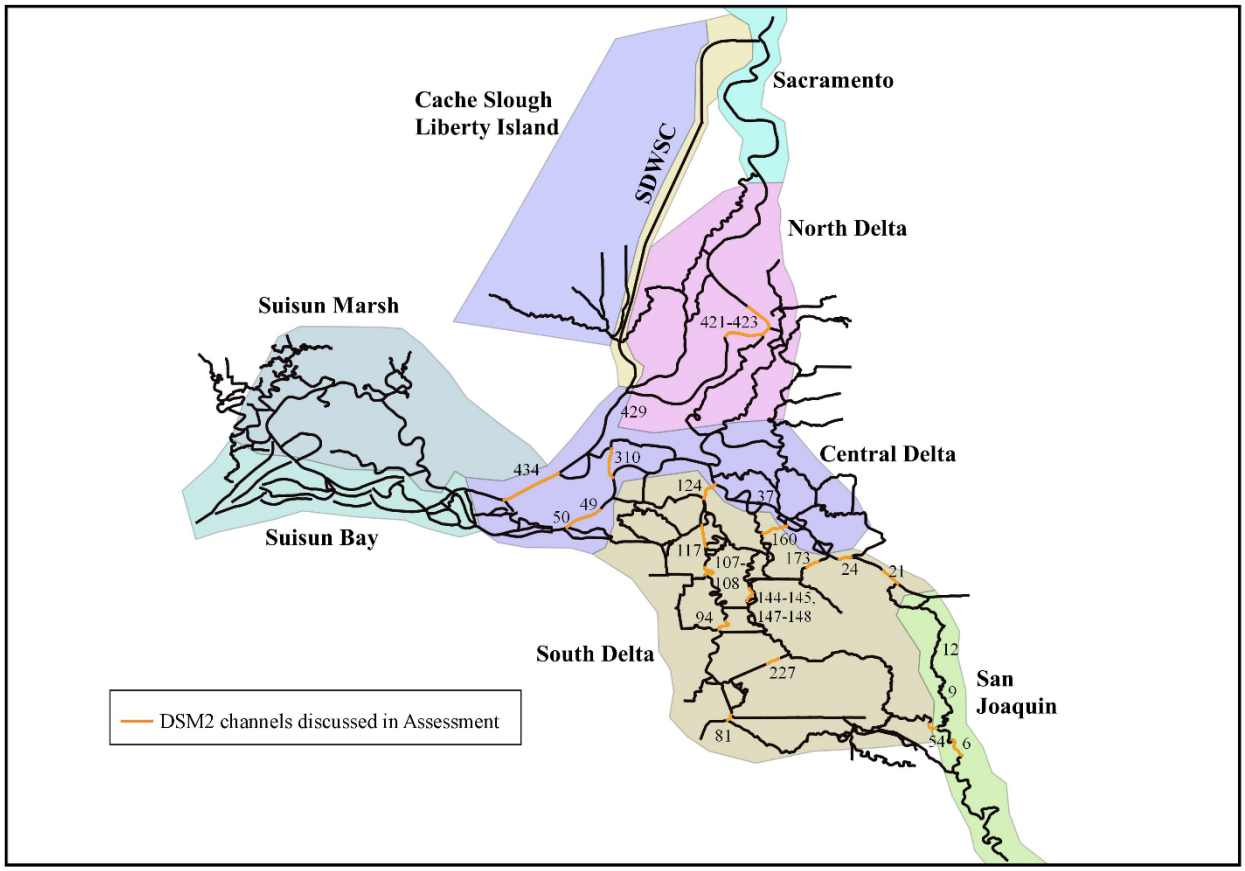
DSM2 modeling for January 27 through February 1 presents a challenge due to the expected storm events. This week the model runs represent configurations for two conditions: dry and wet. The dry scenario (-2,500 cfs) targets the low and the wet scenario (-5,000 cfs) targets the high range of OMR. Since the change in hydrology is expected to be significant, the hydrology is inconsistent between the two scenarios: Vernalis and Freeport flow are much drier in the dry scenario vs the wet scenario.

This week two scenario OMR operations were assessed, outlined here:

Baseline:	–2,600 cfs
Scenario 1:	–2,500 cfs (decreasing pumping from baseline, hereafter referred to as Scenario 1)
Scenario 2:	–5,000 cfs (increasing pumping from baseline, hereafter referred to as Scenario 2)

Each scenario's OMR value was compared with the baseline OMR value. A measure of similarity between scenarios were reported using the Kolmogorov-Smirnov (KS) statistic, test, or distance. This is a method to quantify how similar two empirical cumulative distribution functions (ECDFs) are to each other. The KS-statistic is bounded between 0 (very similar / equal) and 1 (very dissimilar / not equal), shown in ECDF plots for modeled flow and velocity. In the context of this analysis, a single parameter (daily OMR values) is modified between scenarios allowing for appropriate comparisons. The KS-statistic is an indicator of how much of an effect changing OMR via export diversion rates would have on hydrodynamics at that area in the Delta. Results from modeling efforts are examined at 28 Delta channel node locations.

Figure B1. Highlighted DSM2 channels by Delta Strata.



Description of channel location, by Delta Strata region. Not all listed channels have model results presented in every weekly Proposed Action Assessment.

DSM2 Channel	**Description**
North Delta into Interior and Central Delta	
CHAN049	San Joaquin River at Sherman Island
CHAN310	Three-Mile Slough
CHAN421	Sacramento River at Delta Cross Channel
CHAN422	Sacramento River at Delta Cross Channel
CHAN423	Sacramento River at Delta Cross Channel
CHAN434	Sacramento River at Sherman Island
San Joaquin River and Central Delta into South Delta	
CHAN006	San Joaquin River at Head of Old River (HOR)
CHAN021	San Joaquin River downstream from confluence with Calaveras River
CHAN024	San Joaquin River upstream of Turner Cut
CHAN054	Old River at confluence with San Joaquin River (HOR)
CHAN107	Old River north of Rock Slough
CHAN117	Old River south of Franks Tract
CHAN124	Old River between Franks Tract and San Joaquin River
CHAN160	Columbia Cut
CHAN173	Turner Cut
South Delta into Facilities	
CHAN148	Middle River
CHAN227	Victoria Canal
CHAN081	Grant Line Canal
CHAN094	Old River

Entrainment in Delta Strata Regions

North Delta into Interior and Central Delta

It is unlikely that listed salmonids will experience changes to rearing, foraging, sheltering or migrating related to modeled OMR conditions this week (Channels 49 and 434).

San Joaquin River and Central Delta into South Delta

Listed salmonids may be present, but recent surveys suggest that most are still holding upstream. Changes in velocity related to modeled OMR conditions this week may be undetectable by fish that are rearing or foraging but may increase transit rates for those that are present and migrating in the area (Channels 6, 21, 107, 124, and 160).

South Delta into facilities

Modeled hydrodynamic effects related to modeled OMR conditions this week suggest changes to migrating salmonid transit times (Channels 81, 94, and 148). For example, transit times would be delayed for salmonids

coming from the north; whereas, transit times would be faster for salmonids moving from the head of Old River to the export facilities.

DSM2 model results

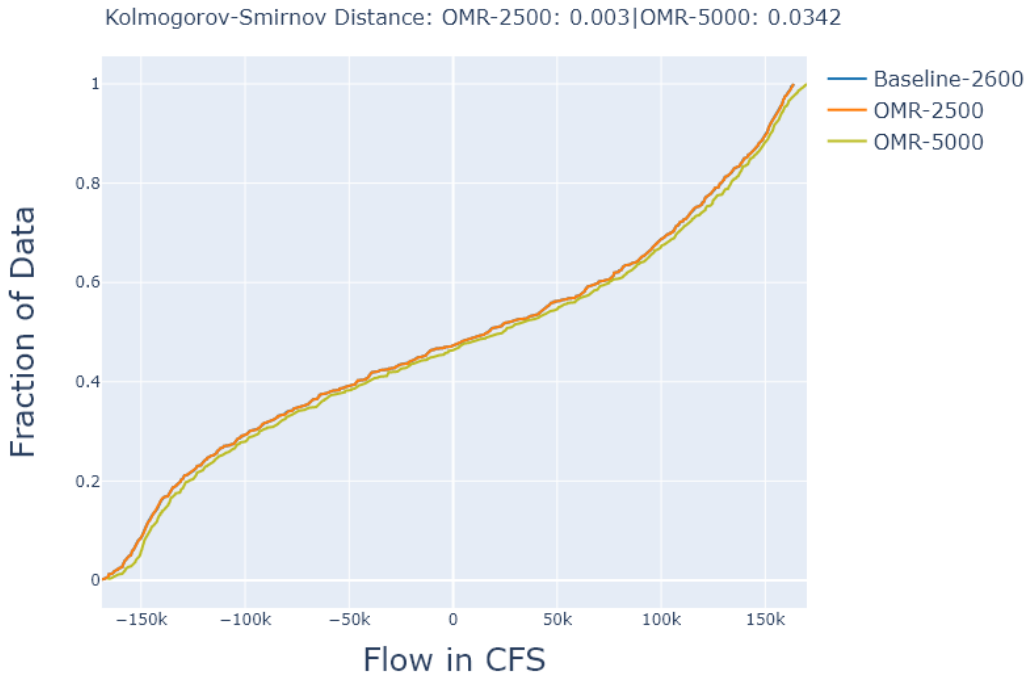
Figures

The following captions apply to the figures below:

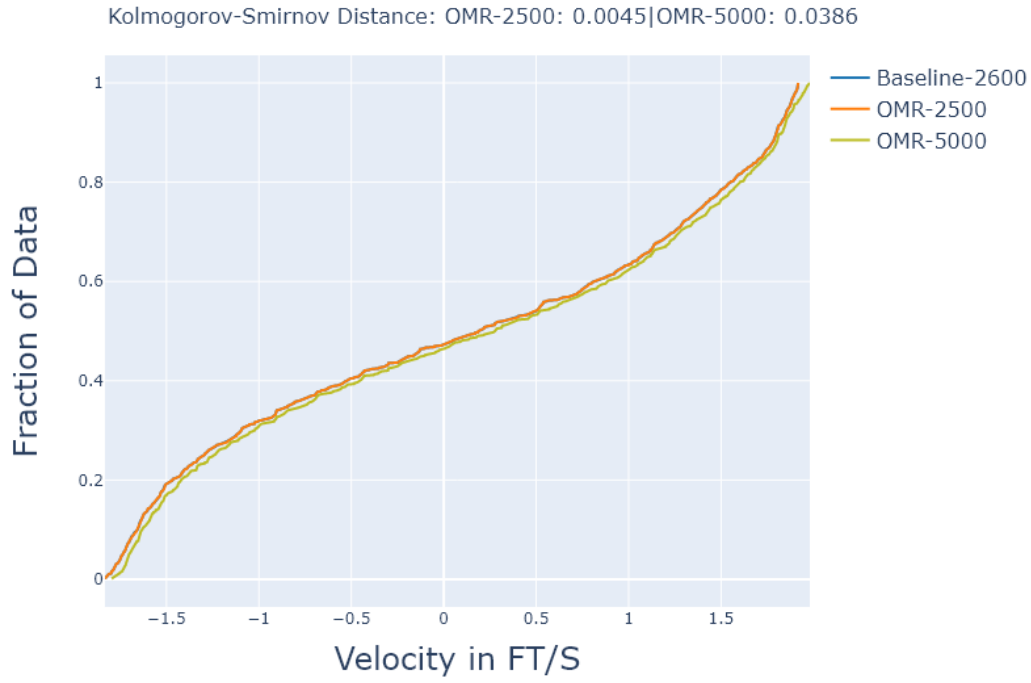
(a) Empirical Cumulative Distribution Function (ECDF) plot: Baseline vs Scenario 1 OMR and Scenario 2 OMR. X-axis represents flow (cfs) and y-axis represents percentage of 15-minute time-step flow values. For Baseline, Scenario 1, and Scenario 2 values refer to "Hydraulic Footprint Information" in the section above.

(b) ECDF plot: Baseline vs Scenario 1 OMR and Scenario 2 OMR. X-axis represents velocity (cfs) and y-axis represents percentage of 15-minute time-step velocity values. For Baseline, Scenario 1, and Scenario 2 values refer to "Hydraulic Footprint Information" in the section above.

Figure B2: Sacramento River at Sherman Island (CHAN434)

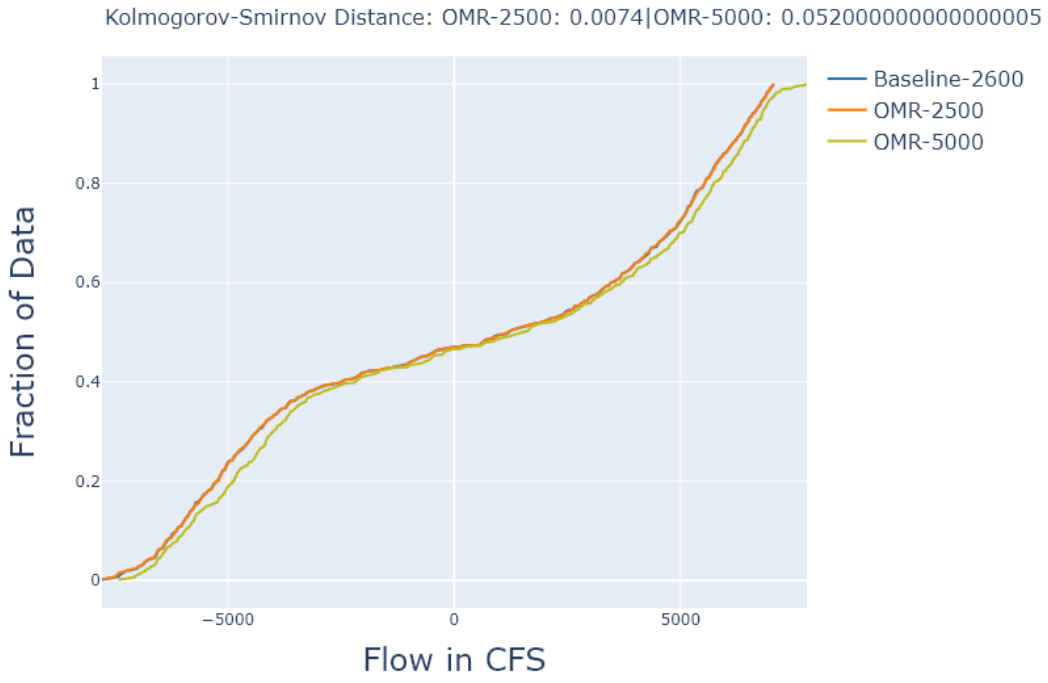


(a)



(b)

Figure B3: San Joaquin River downstream of confluence with Calaveras River (CHAN021)



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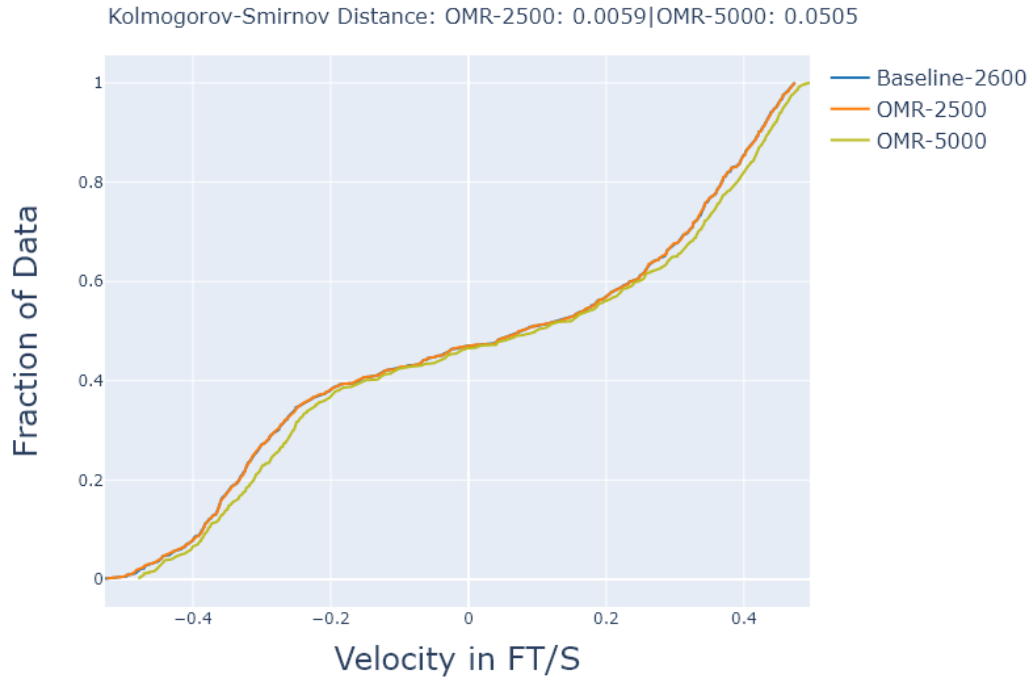
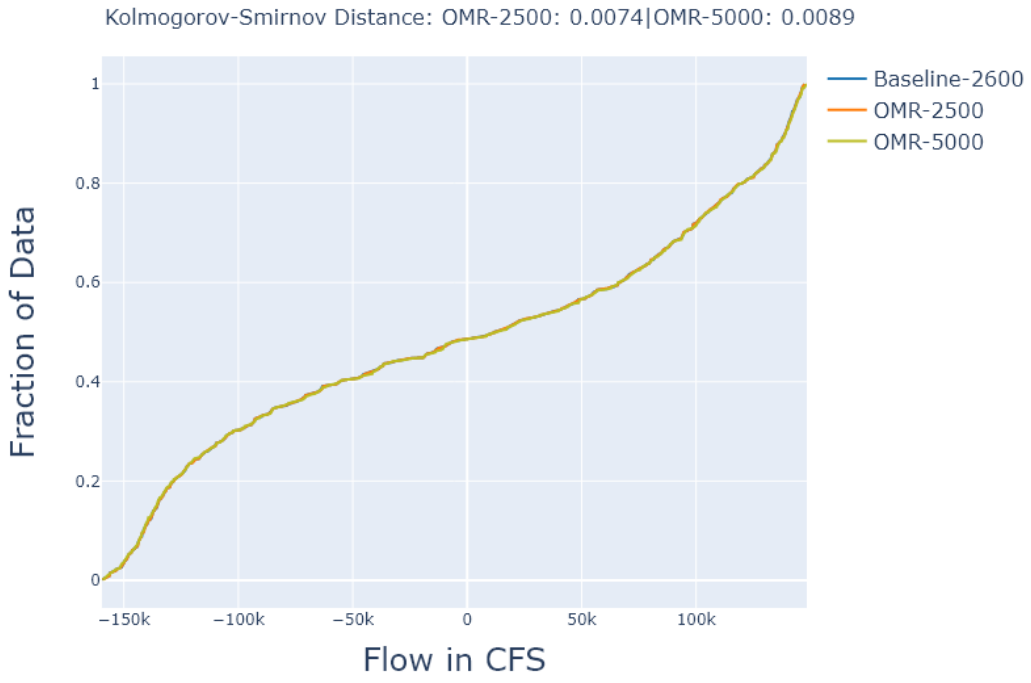


(b)

Figure B4: San Joaquin River at Sherman Island (CHAN049)



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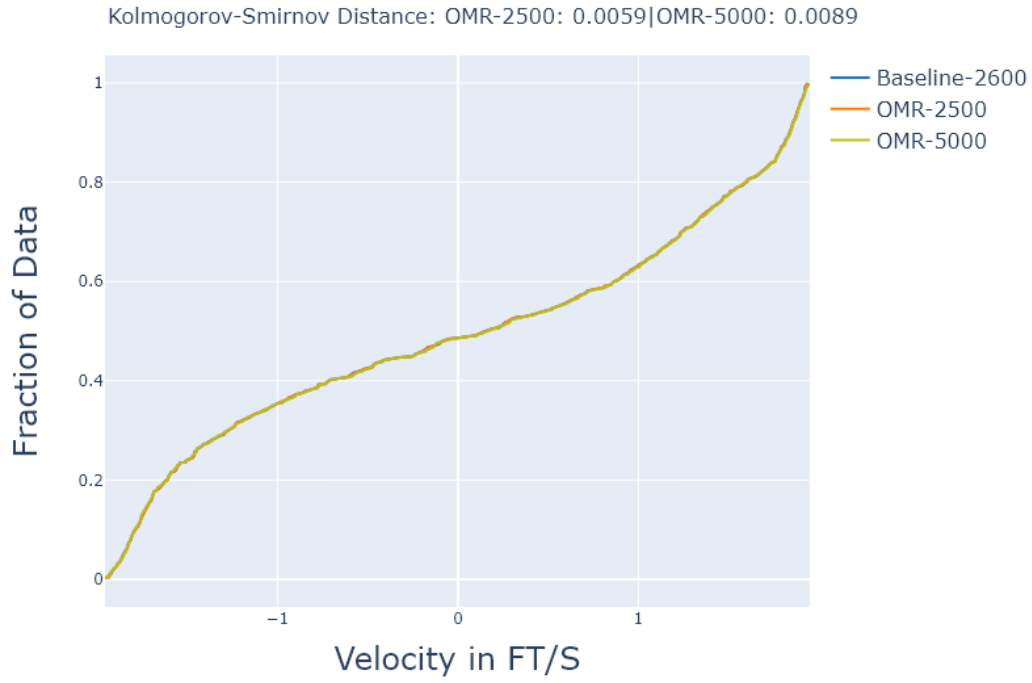
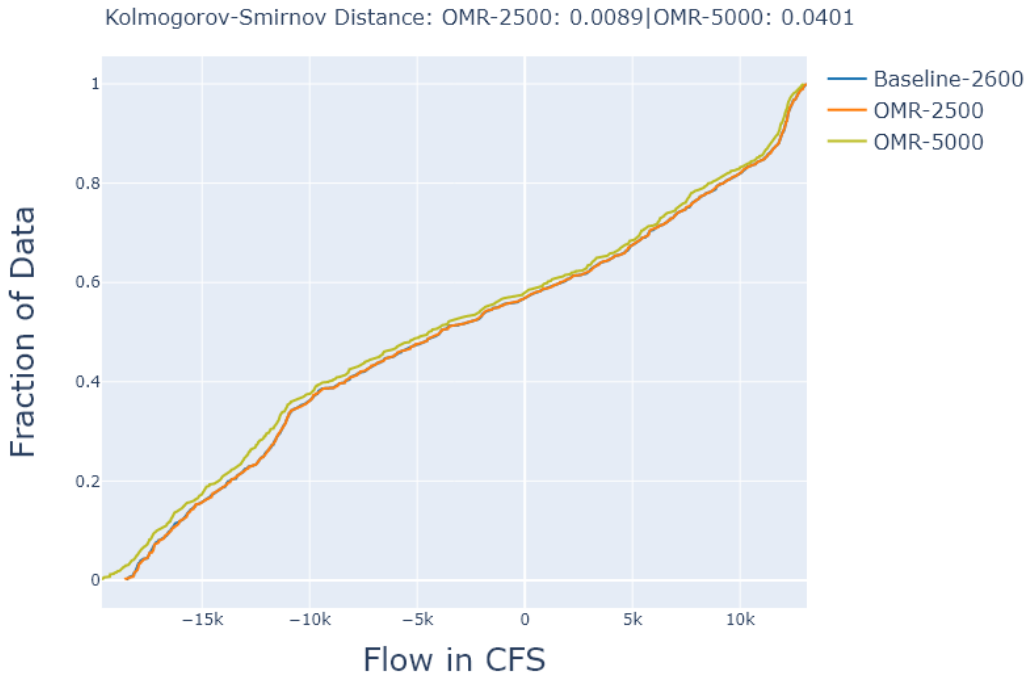


(b)

Figure B5: Old River between Franks Tract and San Joaquin River (CHAN124)



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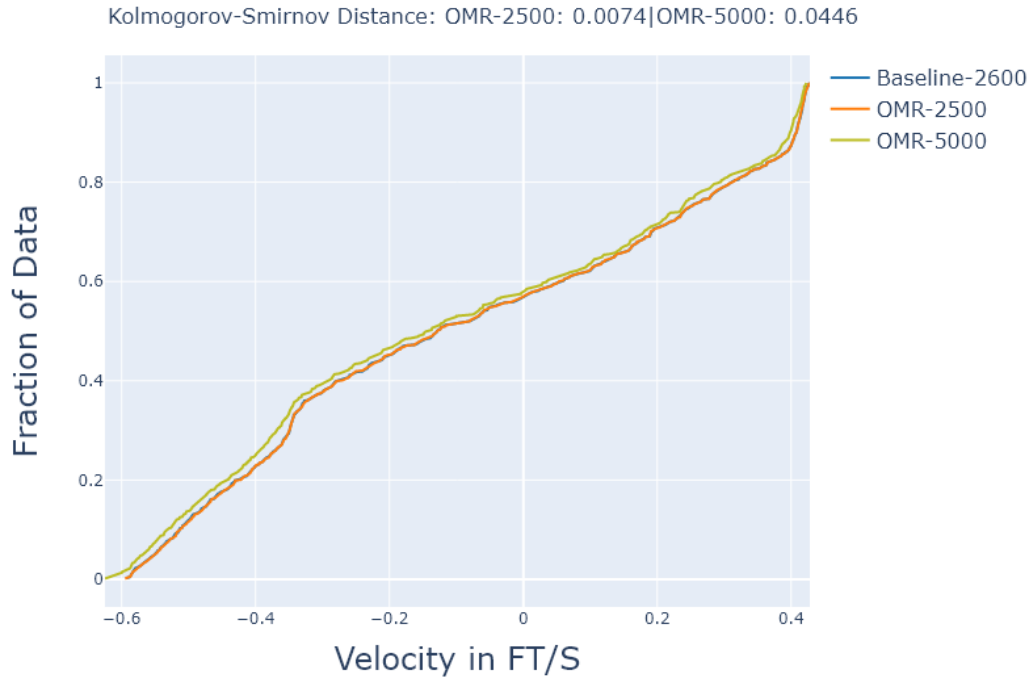
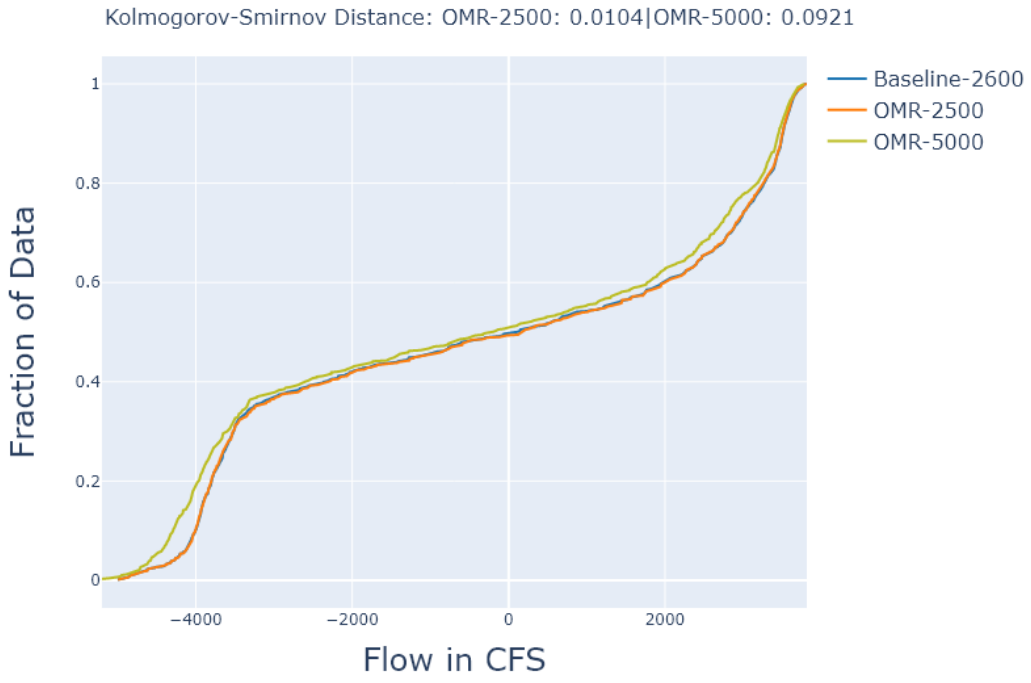


(b)

Figure B6: Lower San Joaquin River at Columbia Cut (CHAN160)



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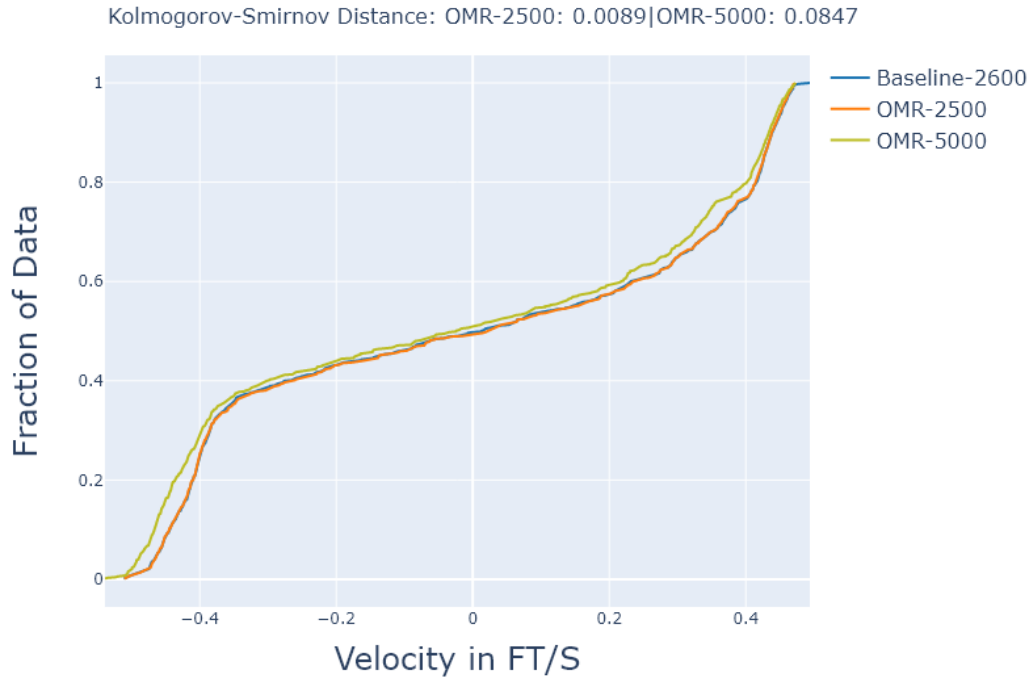
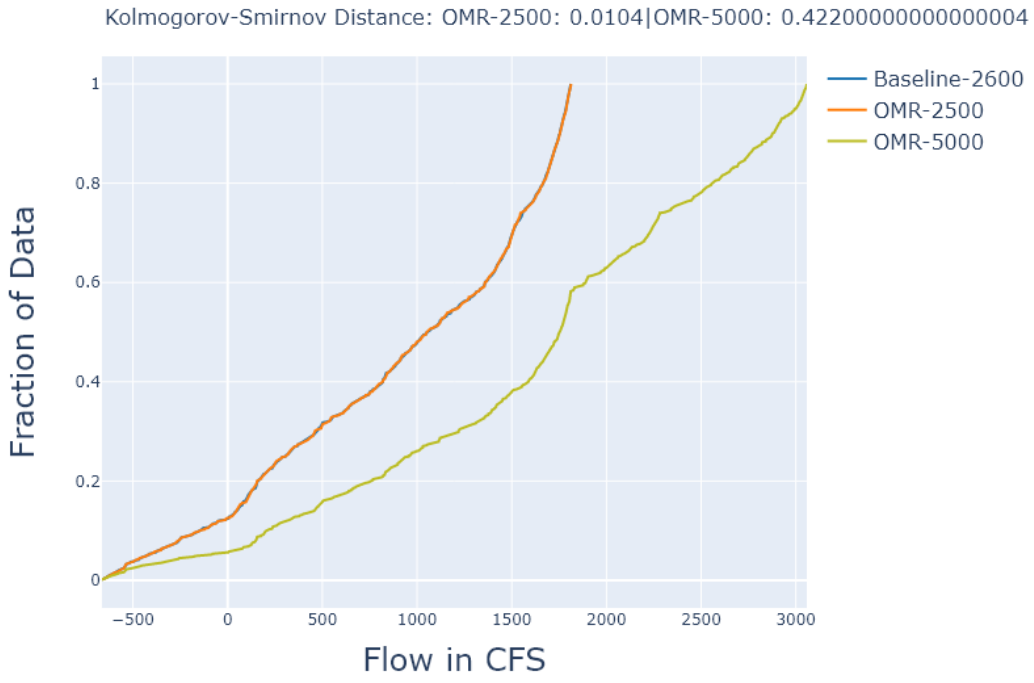


(b)

Figure B7: Slightly upstream of Head of Old River (CHAN006)



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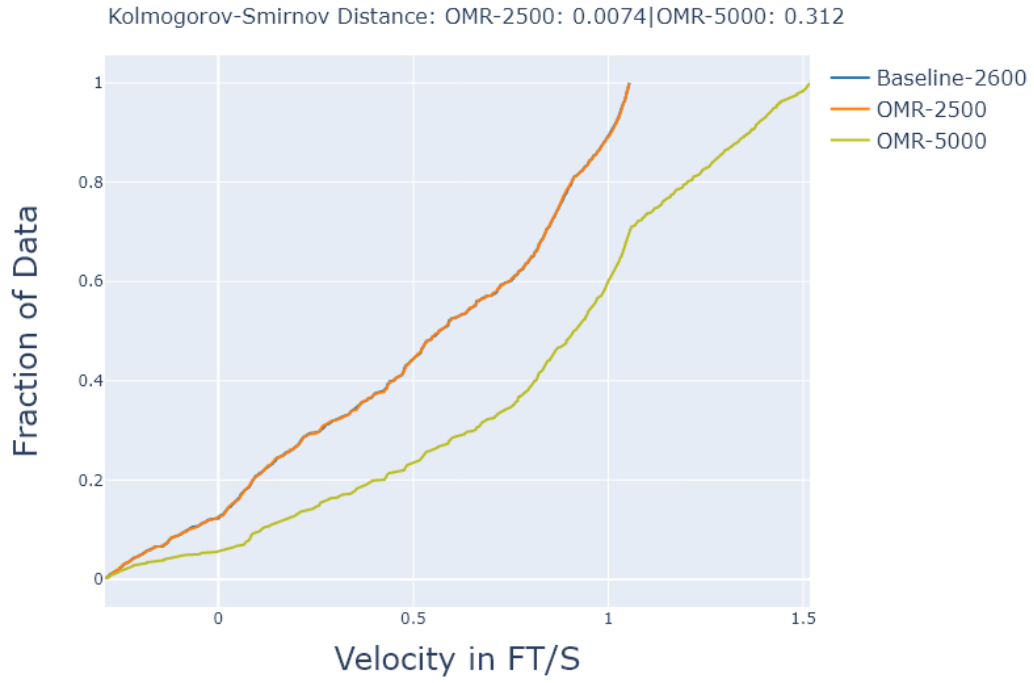
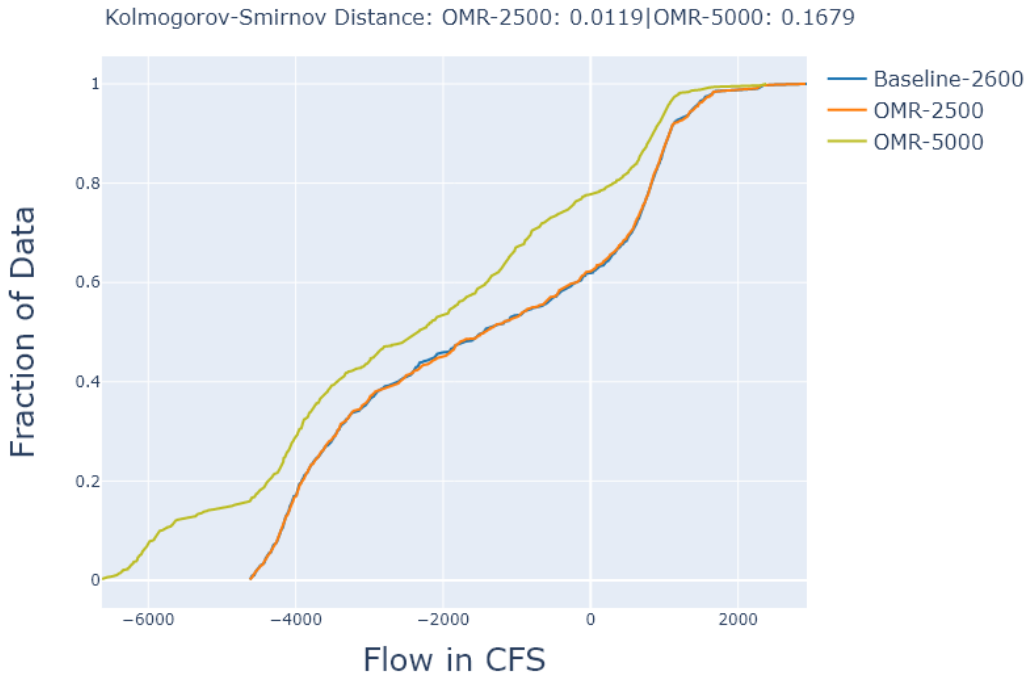


(b)

Figure B8: Old River adjacent to Grant Line Canal (CHAN081)



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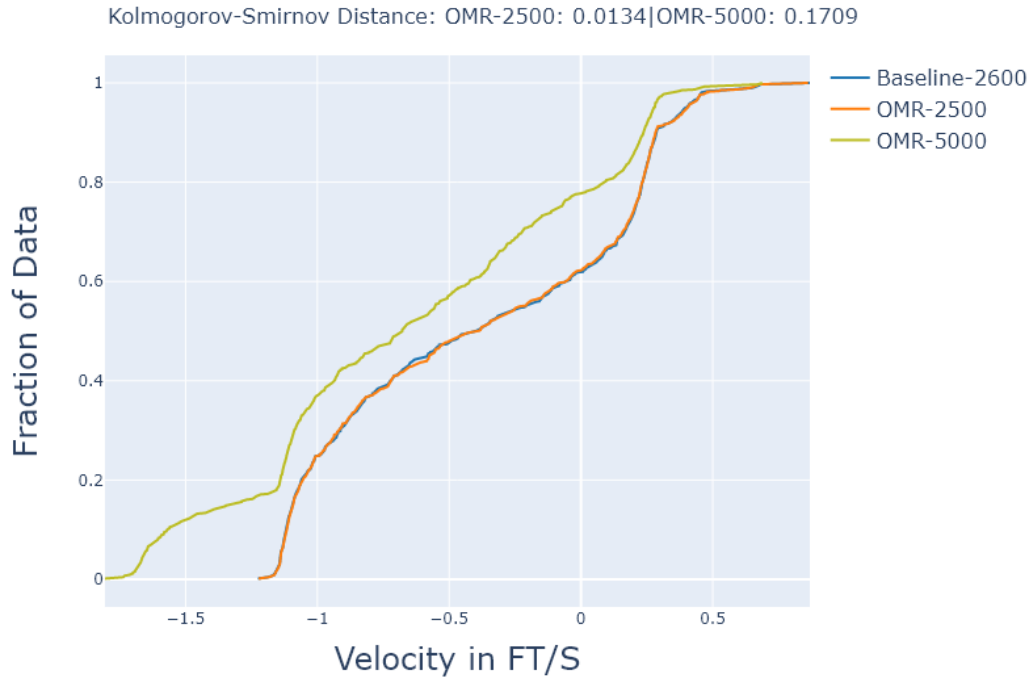
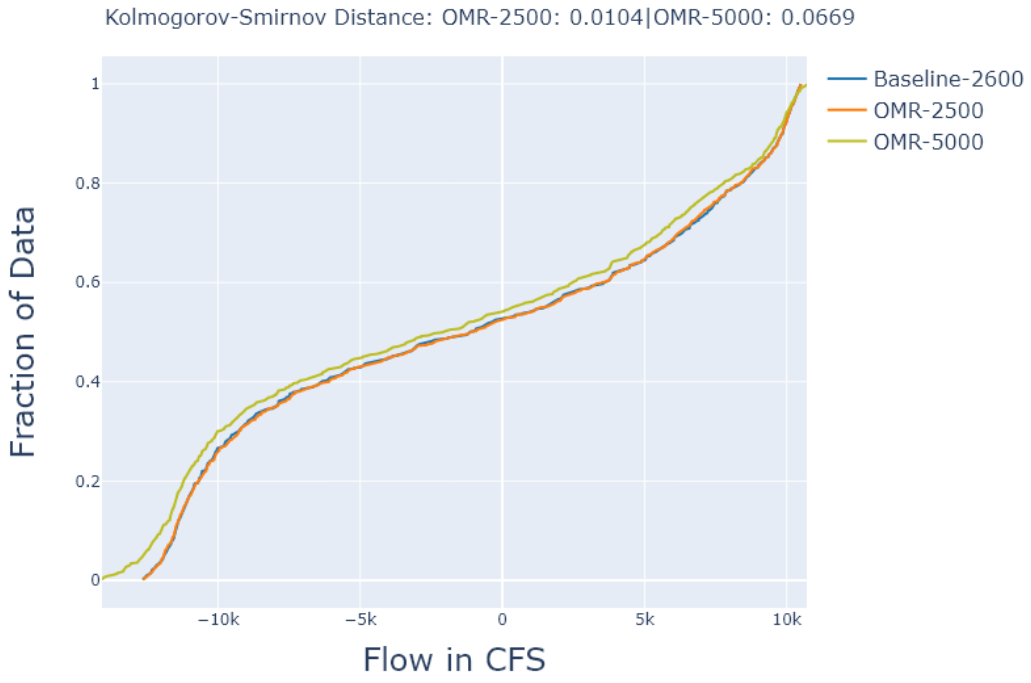


(b)

Figure B9: South Delta along Old River (CHAN094)



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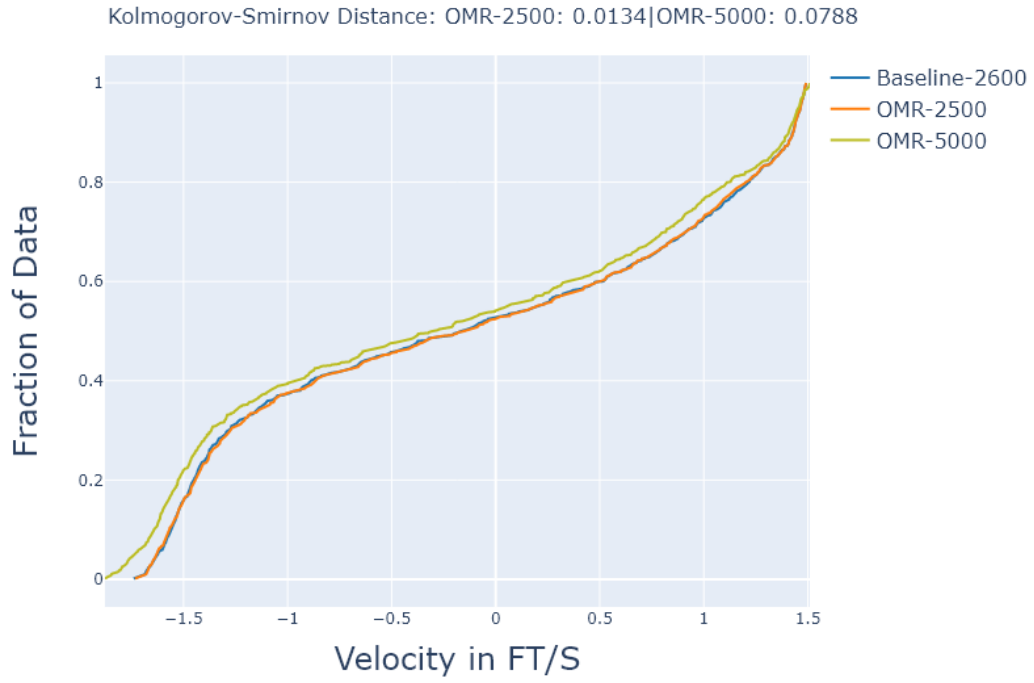
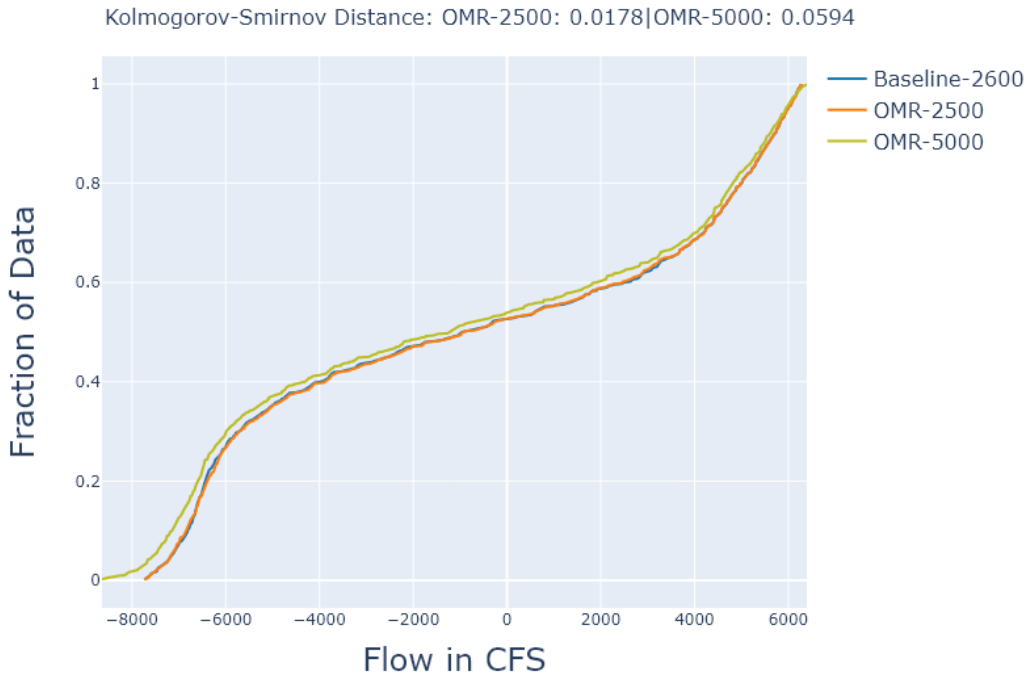


(b)

Figure B10: South Delta along Middle River (CHAN148)



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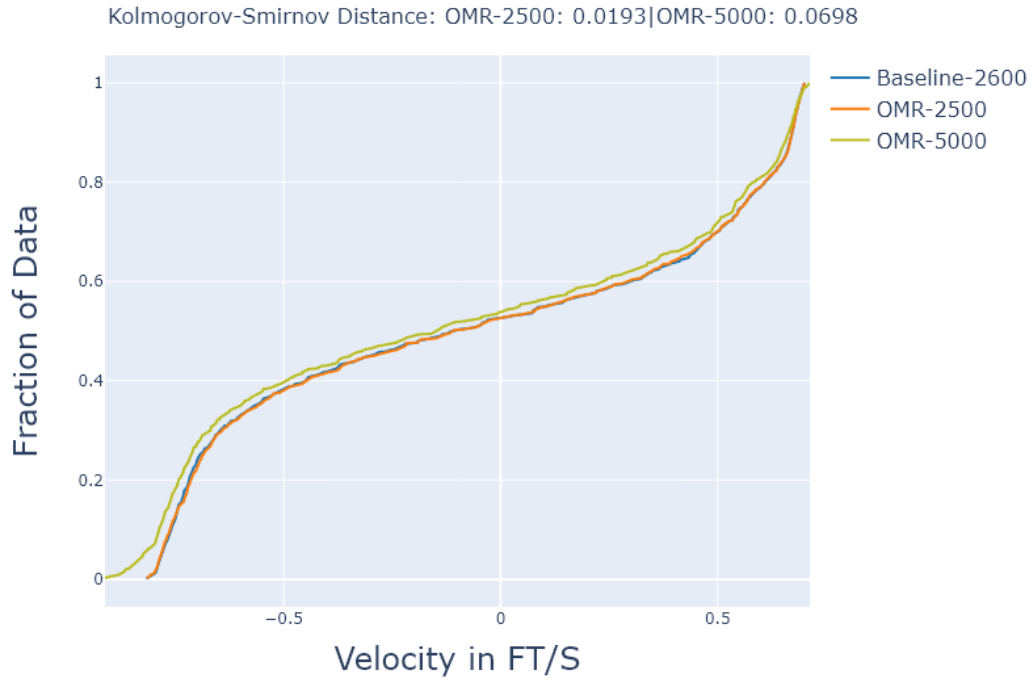
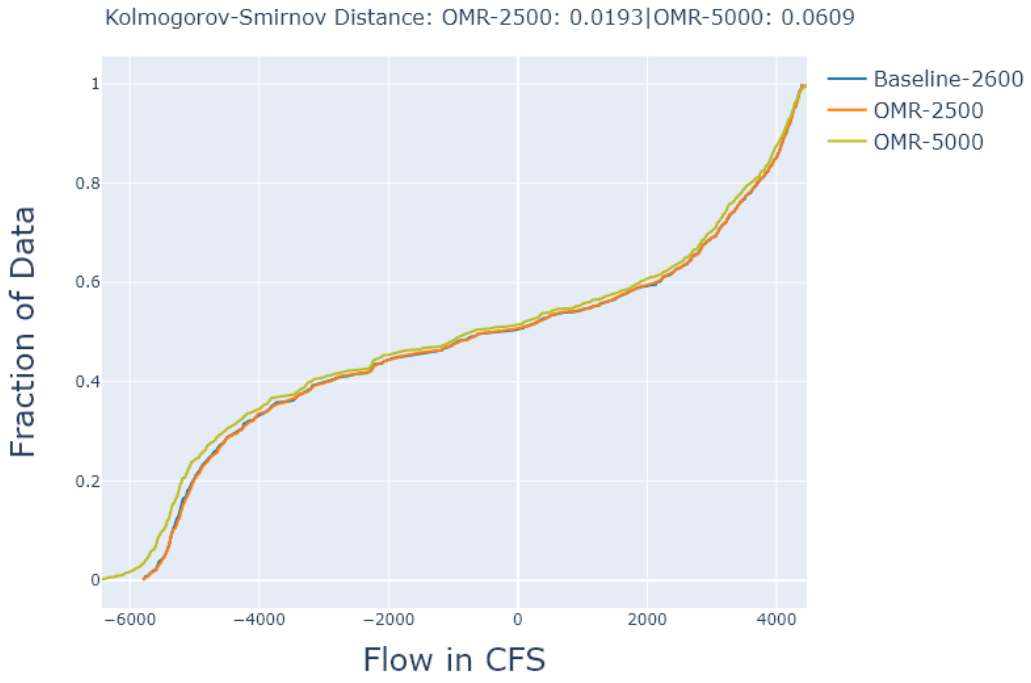


(b)

Figure B11: South Delta along Middle River (CHAN107)



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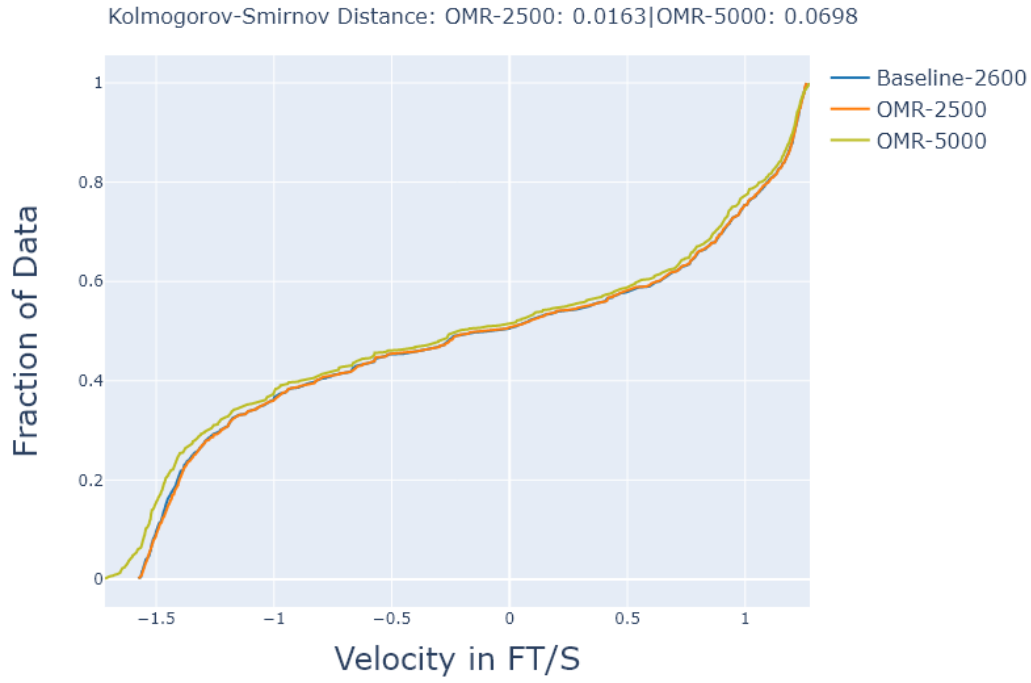

(b)

Summary Tables

Table 1. Reported KS-statistic values for each scenario's OMR value compared with baseline OMR value. For Baseline, Scenario 1, and Scenario 2 values refer to "Hydraulic Footprint Information" in the section above.

DSM2 Channel	Flow (cfs): Scenario 1 OMR	Flow (cfs): Scenario 2 OMR	Velocity (ft/s): Scenario 1 OMR	Velocity (ft/s): Scenario 2 OMR
6	0.0	0.4	0.0	0.3
21	0.0	0.1	0.0	0.1
49	0.0	0.0	0.0	0.0
81	0.0	0.2	0.0	0.2
94	0.0	0.1	0.0	0.1
107	0.0	0.1	0.0	0.1
124	0.0	0.0	0.0	0.0
148	0.0	0.1	0.0	0.1
160	0.0	0.1	0.0	0.1
434	0.0	0.0	0.0	0.0

Table 2. Summary of minimum, maximum, mean, and percent positive flows (cfs) and velocities (ft/s) by DSM2 channel for OMR scenarios over a 6-day time period. For Baseline, Scenario 1, and Scenario 2 values refer to "Hydraulic Footprint Information" in the section above.

Scenario (cfs)	DSM2 Channel	Flow Min.	Flow Max.	Flow Mean	Flow % Positive	Velocity Min.	Velocity Max.	Velocity Mean	Velocity % Positive
Baseline	6	-663.4	1811.9	926.1	88	-0.3	1.1	0.5	87.8
Scenario 1	6	-662.8	1813.7	926.2	88	-0.3	1.1	0.5	87.5
Scenario 2	6	-663.3	3057.6	1632.8	95	-0.3	1.5	0.8	94.5
Baseline	21	-7784.8	7060.7	299.2	53	-0.5	0.5	0.0	53.1
Scenario 1	21	-7763.2	7062.7	298.8	53	-0.5	0.5	0.0	53.1
Scenario 2	21	-7421.1	7790.4	561.4	53	-0.5	0.5	0.0	53.5
Baseline	49	-159572.4	147245.1	310.2	51	-2.0	1.9	0.0	51.4
Scenario 1	49	-159334.1	147267.9	334.7	51	-2.0	1.9	0.0	51.4
Scenario 2	49	-159300.9	148350.6	472.7	52	-2.0	2.0	0.0	51.6
Baseline	81	-4618.1	2931.3	-1468.6	38	-1.2	0.9	-0.4	38.2
Scenario 1	81	-4621.3	2913.3	-1469.8	38	-1.2	0.9	-0.4	37.9
Scenario 2	81	-6627.6	2383.6	-2336.4	22	-1.8	0.7	-0.6	22.3
Baseline	94	-12645.4	10497.3	-1212.1	47	-1.7	1.5	-0.1	47.3
Scenario 1	94	-12644.5	10500.0	-1194.4	48	-1.7	1.5	-0.1	47.6
Scenario 2	94	-14080.2	10705.9	-1803.6	46	-1.9	1.5	-0.2	45.9
Baseline	107	-5796.7	4397.0	-546.6	49	-1.6	1.3	-0.1	49.5
Scenario 1	107	-5797.7	4398.1	-542.9	49	-1.6	1.3	-0.1	49.3
Scenario 2	107	-6428.3	4464.9	-705.6	49	-1.7	1.3	-0.2	48.7
Baseline	124	-18509.6	13096.6	-2763.2	43	-0.6	0.4	-0.1	43.1
Scenario 1	124	-18581.7	13100.2	-2756.8	43	-0.6	0.4	-0.1	43.1
Scenario 2	124	-19648.7	12959.2	-3275.9	42	-0.6	0.4	-0.1	42.2
Baseline	148	-7726.9	6272.1	-714.1	48	-0.8	0.7	-0.1	47.6
Scenario 1	148	-7731.7	6277.6	-706.3	47	-0.8	0.7	-0.1	47.4
Scenario 2	148	-8638.8	6393.8	-990.7	46	-0.9	0.7	-0.1	46.2

Scenario (cfs)	DSM2 Channel	Flow Min.	Flow Max.	Flow Mean	Flow % Positive	Velocity Min.	Velocity Max.	Velocity Mean	Velocity % Positive
Baseline	160	-5000.6	3812.4	-250.0	50	-0.5	0.5	0.0	50.2
Scenario 1	160	-4996.5	3813.6	-241.6	51	-0.5	0.5	0.0	50.7
Scenario 2	160	-5200.7	3776.0	-428.8	49	-0.5	0.5	0.0	49.3
Baseline	434	-168793.6	163604.3	4797.9	53	-1.8	1.9	0.1	52.6
Scenario 1	434	-168786.8	163642.2	4805.1	53	-1.8	1.9	0.1	52.6
Scenario 2	434	-165605.2	169971.9	9275.9	54	-1.8	2.0	0.2	53.6