

State Water Project Incidental Take Permit Risk Assessment for Delta Smelt

Section 1: Overview

Date: 1/19/2023 (off-cycle meeting)

Life Stages Present:

Delta Smelt (DS): Sub-adults and Adults

Advice to Water Operations Management Team (WOMT):

SMT did not reach a consensus as there are uncertainties in the magnitude of change in risk of entrainment for DS from operational changes from -2,000 cfs to -3,500 cfs. The SMT does not think the turbidity bridge can be resolved by any changes to operations and that the turbidity bridge will continue to elevate risk for Delta smelt in the South Delta. The SMT agrees that risk is high in the OMR corridor (moderate outside) due to turbidity and that risk increases with more negative OMRI. The SMT differed in understanding the magnitude of that increase in risk, given inherently high uncertainty.

Risk Assessment:

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 likely migrating and distributing throughout the Delta. The last Delta Smelt observations were on 1/19/23 by Chippis Island Trawl, 1/17/2023 by EDSM in the South Delta and on 1/7/2023 at the CVP (salvage). Integrated Early Winter Pulse Protection (IEWPP) ended on 1/16/2023 and the Turbidity Bridge Avoidance Action is in effect starting 1/17/2023 due to continued elevated turbidity at OBI and is expected to continue through 1/21/2023 depending on turbidity. The implementation of the Turbidity Bridge Avoidance Action is expected to reduce the risk of entrainment to pre-spawning Delta smelt in the OMR Corridor. Overall risk for entrainment is moderate for Delta smelt outside of the OMR corridor; risk is high for fish within the South Delta. A more negative OMRI of -3,500 cfs will further increase entrainment risk for DS in the OMR corridor.

Section 1-A: Sacramento River and Confluence

Table 1: Risk of entrainment into the Central Delta and export facilities for Delta Smelt in the Sacramento River and Confluence:

Species and life stage	Risk type	Risk level	Rationale (turbidity, exports, OMR level, X2, Q west, temperature, distribution etc.)
DS larvae and juveniles	Exposure Risk (Hydrology)	NA	Spawning hasn't started, no larvae present.
DS subadults and adults	Routing Risk (Behavior and life history)	Low	A turbidity bridge is present, which increases the possibility that DS could migrate into the central and south delta. However, Turbidity Bridge Avoidance has been triggered and OMRI is limited to -2,000 cfs for the next 5-days which will help off-set the risk that DS will migrate into the central and south delta. With first flush conditions being met, the migration in preparation for spawning is underway. Distribution is expected to shift upstream into fresh water.
DS	Overall Entrainment Risk	Low	Same as above.

Section 1-B: Central Delta

Table 2: Risk of entrainment into the export facilities for Delta Smelt in the central Delta:

Species and life stage	Risk type	Risk level	Rationale (turbidity, exports, OMR level, X2, Q west, temperature, distribution etc.)
DS subadults and adults	Exposure Risk (Hydrology)	High	Turbidity Bridge Avoidance has been triggered and OMRI is limited to -2,000 cfs for the next 5-days (through 1/21/23) which may help off-set the risk that DS will migrate into the Central and South Delta. One wild individual was detected in the Central Delta in EDSM 1/17/23, and one cultured adult was detected in salvage on 1/7/23. A turbidity bridge is present, which increases the possibility that DS could migrate into the Central and South Delta. Risk is high within the South Delta and moderate in the Central Delta. A more negative OMRI of -3,500 cfs will further increase entrainment risk.

- Change in exposure from previous week: *(Note: The change in risk compared to previous weeks is not required by the Incidental Take Permit [ITP]).*

- DS: Risk in South Delta remains high. One unmarked adult was detected by EDSM on 1/17/23 in the South Delta. One marked adult DS was detected in salvage on 1/7/23, the cultured fish came from the DS Experimental Release that occurred on 11/30/22 which released a total of 13,140 DS in the Sacramento River near Rio Vista. Turbidity Bridge Avoidance has been triggered and OMRI is limited to -2,000 cfs for 5-days (through 1/21/23); however, turbidity is high across the system including the OMR corridor. Risk in the Central Delta remains moderate. A more negative OMRI of -3,500 cfs will further increase entrainment risk for DS in the OMR corridor.
- Additionally, Chipps Island Trawl detected one marked adult DS from the release yesterday.
- Reporting Old and Middle River Index (OMRI) (*Number and range of OMRI bins will vary based on anticipated hydrology and operations*)
 - Relevant COA 8.5.1 was triggered.
 - Expected OMRI range this week: -2,000 cfs.

Section 2: Basis for Advice

The 2020 ITP ([Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta 2081-2019-066-00](#)) states that advice to WOMT shall be based the following Conditions of Approval:

List relevant Condition of Approval number and title based on species/life stage, time of year, etc.

8.5.1 Turbidity Bridge Avoidance. The purpose of this Condition is to minimize the risk of entrainment of adult DS in the corridors of the Old and Middle rivers into the south Delta export facilities. This Condition is intended to avoid the formation of a turbidity bridge from the San Joaquin River shipping channel to the south Delta export facilities, which historically has been associated with elevated salvage of pre-spawning adult DS.

After the Integrated Early Winter Pulse Protection (Condition of Approval 8.1.3) or February 1 (whichever comes first), until April 1, Permittee shall manage exports to maintain daily average turbidity in Old River at Bacon Island (OBI) at a level of less than 12 FNU. If the daily average turbidity at OBI is greater than 12 FNU, Permittee shall restrict south Delta exports to achieve an OMR flow that is no more negative than -2,000 cfs until the daily average turbidity at OBI is less than 12 FNU.

If, after five consecutive days of OMR flow that is less negative than -2,000 cfs, the daily average turbidity at OBI is not less than 12 FNU the Smelt Monitoring Team may convene to assess the risk of entrainment of DS (Condition of Approval 8.1.5.2). The Smelt Monitoring Team may provide advice to WOMT regarding changes in operations that could be conducted to minimize the risk of entrainment of DS (Condition of

Approval 8.1.3). The Smelt Monitoring Team may also determine that OMR restrictions to manage turbidity are infeasible and may instead provide advice for a different OMR flow target that is between -2,000 and -5,000 cfs and is protective based on turbidity and adult DS distribution and salvage to the WOMT for consideration (Condition of Approval 8.1.3). Operational decisions shall be made following the process described in Condition of Approval 8.1.4 (Collaborative Real Time Risk Assessment).

Turbidity readings at individual sensors can generate spurious results in real time. Spurious results could be incorrectly interpreted as a turbidity bridge, when in fact the cause is a result of local conditions or sensor error. To assess whether turbidity readings at OBI are attributable to a sensor error or a localized turbidity spike, Permittee, in coordination with Reclamation, may consider and review data from other nearby locations and sources. Additional information that will be reviewed include regional visualizations of turbidity, alternative sensors, and boat-based turbidity mapping, particularly if there was evidence of a local sensor error. Permittee may bring data from these additional sources to the Smelt Monitoring Team for consideration during the development of a risk assessment to be provided to the WOMT for evaluation (Condition of Approval 8.1.3).

Permittee shall use the decision-making process described Condition of Approval 8.1.4 (Collaborative Real-time Risk Assessment) to determine if south Delta exports may increase after five-days of OMR no more negative than -2,000 cfs, or to determine that this action is not warranted due to a sensor error or localized turbidity event. Permittee shall implement this action until CDFW is in agreement that the action may be ended or modified.

Discussion of Conditions of Approval

Provide discussion addressing criteria for each Condition of Approval listed in "Basis for Advice" section. Refer to data below where appropriate.

COAs relevant to OMR management went into effect December 1st. The Smelt Monitoring Team (SMT) conducted a Risk Assessment based on COA 8.1.5.2.

8.5.1: This condition has been triggered on 1/17/23 by the conditions measured on 1/17/23 when the turbidity at OBI was 17 FNU. OMRI will be limited to no more negative than -2,000 cfs. After the first five days (1/17/23 through 1/21/23), if turbidity is still above 12 FNU at OBI, then SMT may reconvene to assess the risk for Delta Smelt.

Section 3: Hydrology and Operations

Assessment of hydrologic, operational, and meteorological information. 8.1.5.2 A.

Section 3-A: Water operations conditions. 8.1.5.2.A. i

- Antecedent Actions: *(e.g. Delta Cross Channel [DCC] gate closure and actions such as integrated early winter pulse protection, etc.)*
 - DCC is closed as of 11/28/22.
 - COA 8.5.1 was triggered by conditions on 1/17/23.
- Controlling Factors: Available Facility Capacity and OMRI 5-day average no more negative than -2,000 cfs due to Turbidity Bridge Avoidance being triggered.
- Water Temperature:
 - Clifton Court Forebay (CCF) Daily Average Water Temperature = NA
 - 3 Station Average = 10.26°C
- Tidal Cycle: Spring tide, king tide on 1/21/23
- Turbidity:
 - 8.3.1 Freeport 3-day average = 83.57 formazin nephelometric units (FNU)
 - 8.5.1 Old River at Bacon Island (OBI) Turbidity = 20.82 FNU
- Salinity: X2 < 56 km
- Hydrologic Footprint: No Particle Tracking Models were requested.

Section 3-B: Water operations outlook. 8.1.5.2.A. ii

- Outages
 - State Water Project (SWP): None
 - Central Valley Project (CVP): None
- Exports:
 - CCF: 4,000 to 9,500 cfs
 - Jones: 3,500 to 4,200 cfs
 - Combined: 7,500 to 13,700 cfs
- Meteorological Forecast: Cool and showery conditions continue on Monday. Dry weather on Tuesday, before another quick shot of precipitation and wind Wednesday. On Thursday, prolonged dry conditions are expected to continue into next week.
- Storm Event Projection: Anticipating light rain in the north coast and northern Sierra.

Section 3-C: Projected conditions. 8.1.5.2.A. iii

- DCC Gates position: Scheduled to remain closed for season.
- Sacramento River flow at Freeport: 71,450 cfs as of 1/18/2023. Anticipated range: 60,000 to 80,000 cfs
- San Joaquin River flow at Vernalis: 24,076 cfs as of 1/18/2023. Anticipated range: 15,000 to 23,000 cfs
- Qwest: +37,609 cfs as of 1/17/2023. Anticipated range: continue to be significantly positive, but may drop to +20,000 throughout the week
- OBI Turbidity: 20.82 FNU

- NDOI: 170,301 cfs as of 1/17/2023. Anticipated range this week from outlook is 80,000-170,000 cfs.
- Upstream releases:
 - Keswick = 4,050 cfs. Anticipated range: 3,250 to 4,050 cfs due to flood control and side-flow management at Keswick.
 - Nimbus = 10,000 cfs. Anticipated range: 8,000 to 10,000 cfs due to flood control and side-flow management.
 - Goodwin = 1,950 cfs. Anticipated range: 200 to 3,150 cfs due to Tulloch side-flow management.
 - Oroville = 950 cfs. No anticipated changes.

Table 5: Comparison of OMR and OMR Index (5-day and 14-day averages for OMR Index and USGS gauge were reported on [SacPAS website](#), accessed 19 January 2023.

Date	Averaging Period	USGS gauges (cfs)	Index (cfs)
1/15/2023	Daily	-1,691	-2,310
1/15/2023	5-day	-1,920	-2,020
1/15/2023	14-day	-2,230	-2,250

Section 4: Distribution and Biology.

8.1.5.2.B. Assessment of biological information for Delta Smelt

Section 4-A: Delta Smelt population status 8.1.5.2.B. i

- EDSM: One unmarked adult DS (Fork length (FL): 71mm) was detected in the South Delta near Franks Tract on 1/17/23. One subadult DS (FL: 55mm) and one adult DS (FL: 62mm) were detected in Lower Sacramento River on 11/3/22 and 11/7/22 respectively.
- Chipps Island Trawl: One marked DS detected on 1/19/23. This fish was from the experimental release at Rio Vista on 1/18/23.
- Fall Mid-water Trawl (FMWT) Index for Delta Smelt: 0
- Delta Smelt life cycle model (LCM) discussion: NA
- Biological Conditions: Migration into freshwater is underway due to increased flows and turbidity. Increased flows have pushed X2 downstream to < 56 km and OMRI is limited to -2,000 cfs. A turbidity bridge formed on 1/1/2023 and extends from the Lower San Joaquin River into the South Delta and export facilities, increasing the risk of DS migration into the Central and South Delta.
- % of population in Delta zones: NA
- Smelt Larva Survey (SLS) or 20mm Survey: Many stations are still being processed, but SLS has not detected any DS so far this season.

- Salvage: One cultured adult (FL: 74mm) DS was salvaged at CVP on 1/7/2023. The expanded seasonal salvage is four. This is the first detection of WY 2023. This is the first adult salvage detected since February and March 2019. One cultured sub-adult (FL: 54mm) DS was salvaged at CVP on 1/16/2022.
- FCCL lampara net sampling detected two adult DS (FL: ~60mm [estimated since fish were not directly handled]) in the Lower Sacramento River on 12/14/22. One fish was untagged, and the other fish was tagged with red VIE tag (hard release) from the experimental release.
- Experimental release: 17,570 cultured DS were released in the Sacramento River near Rio Vista on 1/18/23 and 1/19/23, and 13,140 fish were released in the Sacramento River near Rio Vista on 11/30/22.

Section 4-C: Additional data sources to assess sensitivity to entrainment Delta.8.1.5.2.C & D. i

- Smith et al. 2021
- USBR and DWR presented figure 3 from Smith et al. (2021), which compared the proportion of mortality of late sub-adult and adult DS due to entrainment between low and high turbidity conditions at different OMR flow. The figure indicated that proportion of mortality increased with more negative OMR flow. During high turbidity conditions, the estimated difference between OMR flow of -2,000 cfs and -3,500 cfs increased late sub-adult and adult DS entrainment mortality by approximately 0.05. However, at the higher end of the dark band representing the model uncertainty, the corresponding difference doubled and increased to approximately 0.10. The paper concluded that turbidity is additive to a more negative OMRI in increasing risk.
- USBR presented preliminary results from their DSM2 model of the flow at various locations in the South Delta at -2,000 cfs and -3,200 cfs. This model did not take into account the possible change in San Joaquin River flow at Vernalis. All locations had variable difference, but the highest difference was at Old River with approximately -600 cfs difference between the two scenarios. Additional modeling with -3,500 cfs OMRI limit is planned to run after the meeting.

Notes:

- When Vernalis drops below 20,000 cfs maximum exports can't continue with -2,000 cfs OMRI limit in place. Once flows at Vernalis drop to 15,000 cfs, OMRI will be -5,000 cfs. To maintain 9,500 cfs (maximum exports) at SWP when Vernalis gets down around 18,500 cfs OMRI will be -3,500 cfs.
- Turbidity will not change with operations, staying at -2,000 cfs OMRI will not resolve the turbidity bridge and moving to -3,500 cfs OMRI will not prolong the turbidity bridge.
- DS caught by EDSM in the South Delta on Tuesday died. FCCL staff is confident that it was a DS and genetics will be run next week.
- Next week EDSM will sample in the South Delta on Monday and Tuesday next week, they will also sample 2 days in the lower San Joaquin River.
- The BiOp does not have SMT as part of the process to off-ramp from the -2,000 cfs

OMRI limit required by the Turbidity Bridge Avoidance measure. USFWS will participate in the risk assessment, however their position is that any more negative OMRI will increase the risk of entrainment, therefore OMRI should target -2,000 cfs until turbidity resolves. USFWS can't make a recommendation of -3,500 cfs as that would be recommending a range outside the range outline in the BiOp when turbidity is present.

- There is a consensus that a more negative OMRI will increase risk of entrainment, but the magnitude of that change in risk remains uncertain.
- CDFW and USFWS recommend staying at -2,000 cfs as DS were already at high risk at -2000 cfs OMRI limit, and that risk will only increase with the more negative OMRI limit.
- DWR and USBR recommend changing the OMRI limit to -3,500 cfs, because neither operational scenario would change the turbidity which is the driving factor attracting DS into the South Delta towards the export facilities.
- SWRCB did not take a position.

Literature Cited

Smith, W. E., Polansky, L., & Nobriga, M. L. (2021). Disentangling risks to an endangered fish: using a state-space life cycle model to separate natural mortality from anthropogenic losses. *Canadian Journal of Fisheries and Aquatic Sciences*, 78(8), 1008–1029.
<https://doi.org/10.1139/cjfas-2020-0251>