State Water Project Incidental Take Permit Risk Assessment for Delta Smelt and Longfin Smelt

Section 1: Overview

Date: 03/29/2022

Life Stages Present:

Delta Smelt (DS): Adults, sub-adults, and larvae
Longfin Smelt (LFS): Adults, sub-adults, juveniles, and larvae

Advice to Water Operations Management Team (WOMT):

The SMT recommends an OMRI no more negative than -1250 cfs on a 7-day average for the protection of larval DS under the 2019 Biological Opinion. Larvae are present in the lower San Joaquin River and the more negative OMRI range (-5000 cfs) expected this week will increase the likelihood of entrainment.

Both Smelt Larval Survey (SLS) 6 and 20mm triggered ITP COA 8.4.2 on March 29th and the SMT recommends limiting OMRI to -1250 cfs on a 7-day average to limit risk of entrainment of larval and juvenile LFS. This recommendation is based on an increased risk of entrainment due to increased larval LFS densities detected in the surveys in the central and south Delta, increased LFS juvenile salvage over the last week, and OMRI becoming more negative with increasing exports this week. PTM run results discussed this week show that there is less risk of entrainment into the OMR corridor and projects from the Central and South Delta at the -1250 cfs recommendation scenario than at the more negative OMRI -5000 cfs expected this week.

Risk Assessment:

Delta Smelt: Based on recent detections, Delta Smelt are present in the South Delta. Detection data support Delta Smelt also being present in the Sacramento Deep Water Ship Channel, Lower Sacramento River, Cache Slough Liberty Island, Suisun Marsh, and the lower San Joaquin River. Delta Smelt adults and sub-adults are less likely to move into the south and central delta since turbidity remains low. Eight marked adult Delta Smelt have been collected since 3/22/2022. Nine larval Delta Smelt have been collected since 3/22/2022, including one larval Delta Smelt at station 815 in the lower San Joaquin River. A turbidity bridge avoidance action in not anticipated to be necessary in the next seven days. The expected OMR Index represents a higher likelihood of entrainment for larval Delta Smelt in the South Delta. The SMT recommends an OMRI of -1250 cfs on a 7-day average for the protection of larval DS. Larvae are present and the more negative OMRI range will increase the likelihood of entrainment. Water temperatures are within the range for Delta Smelt spawning.

Longfin Smelt: SLS 6 and 20mm detected an increase in larval LFS density in the central and south Delta, including yolk-sac larvae, indicating that larval fish are present at higher densities in areas at high risk of entrainment than previous weeks. Additionally, juvenile LFS salvage has increased in the last week. Both SLS 6 and 20mm triggered ITP COA 8.4.2 on March 29th and the SMT recommends limiting OMRI to -1250 cfs on a 7-day average to limit risk of entrainment of larval and juvenile LFS. This recommendation is based on increased LFS densities in the central and south Delta detected in the surveys, increased juvenile salvage, and increased risk as OMRI is expected to become more negative with increasing exports. OMRI is expected to be between -500 cfs and -5000 cfs this week and PTM results show risk of entrainment into the OMR corridor and projects increases with this more negative OMRI. The storm produced more precipitation than expected and to capture that runoff, exports are projected to increase later today and for the next two days through Thursday, resulting in an OMRI of down to -5000 cfs. PTM run results discussed this week show that there is less risk of entrainment into the OMR corridor and projects from the Central and South Delta at the -1250 cfs recommendation scenario. These PTM results, in combination with field survey and salvage information, showed medium risk for LFS larvae in the lower San Joaquin River (812 and 815) and high risk for LFS larvae in the OMR corridor (902). However, under both scenarios there was a very small difference in the low percent of particles that made it past Chipps and many particles were unresolved, particularly in the central Delta, indicating poor hydrologic conditions for LFS larvae in the central and south Delta.

The SMT makes this recommendation with the full understanding that it may not have time to be implemented or may not be implemented very long, but we are concerned about entrainment and salvage trajectory at the -5000 cfs OMRI expected this week. This recommendation is made to prevent and minimize entrainment this week and future entrainment later this season of larval and juvenile LFS, to maintain consistency with past recommendations, and to reflect our concern for larval and juvenile LFS in the central and south Delta.

SLS 6 detected 34 larvae at 5 of the 11 stations processed so far in the central and south Delta and some larvae still had yolk sacs, indicating that spawning is ongoing and has occurred in areas at high risk of entrainment. 20mm survey 1 also detected 71 LFS larvae at 5 of the 6 stations processed so far in the central and south Delta. Densities detected in SLS 6 and 20mm 1 are higher than SLS 5 were. Additionally, a sub-adult LFS was caught in the lower San Joaquin River by Enhanced Delta Smelt Monitoring (EDSM) on March 9th. From 3/21/2022 through 3/27/2022, 176 juvenile LFS were salvaged at the SWP fish facility and 160 juvenile LFS were salvaged at the CVP fish facility, resulting in a total salvage of 416 juvenile LFS this season. LFS larvae also continue to be detected in qualitative larval sampling at both fish facilities. The Smelt Monitoring Team (SMT) has determined that the overall risk of entrainment is low for sub-adults and adults.

Barker Slough: COA 8.12 was triggered on 3/23/2022 by 20mm survey 1 with the detection of two larval DS at station 716. No LFS were detected by 20mm survey 1 at station 716, however SLS 6 station 716 has not been processed yet. This limits BSPP maximum diversion rate to be

less than 60 cfs on a seven-day running average for the protection of larval LFS. COA 8.12 became active on 02/08/2022 when the Sacramento Valley Water Year Type Index (SVI) February Forecast was released. The forecasted value of 6.2 (50% exceedance) is within the range for a dry water year. The updated March forecast was released on 03/08/2022 and is a forecasted value of 4.8 (50% exceedance) is within the range for a critically dry water year, therefore this COA remains in effect. BSPP was experiencing an outage and came back online 3/24/2022.

Section 1-A: Sacramento River and Confluence

Risk of entrainment into the central Delta and export facilities for DS and LFS in Sacramento River (8.1.5.2 C ii, iii, iv)

- Exposure Risk (Hydrology):
    - DS: Low. DS are expected to have made their migration in response to first flush and current temperatures are conducive to spawning as reported in Damon et al. (2016). Two ripe females DS were detected by SKT 3 in Suisun Marsh. DS were last detected in the lower Sacramento River by SKT 3 on March 17th; however, export levels and low turbidity create a low risk of entrainment. Larval DS were detected in surveys last week for the first time this season, indicating that spawning has begun.
    - LFS: Risk for larvae is low, however exports are increasing later this week and Qwest will decrease to near zero temporarily. However, at the range of OMRIs expected this week, operations will not result in an increase in risk for larvae in the Sacramento River and confluence. See 'Routing Risk' for more information on adults and sub-adults.
- Routing Risk (Behavior and life history):
    - DS: Low. DS are unlikely to move into the central and south Delta since turbidity remains low throughout the lower San Joaquin River. Water temperatures are increasing, and spawning has begun, however turbidity remains low and DS are unlikely to move into the central and south Delta.
    - LFS: Low risk of entrainment. Larvae do not exhibit swimming behaviors that would result in volitional movement into areas with a higher risk of entrainment. Some larger juveniles are starting to be detected that may start having volitional movement soon. Adult detections are declining, however spawning is ongoing as yolk sac larvae are still being detected. There is potential for adult and sub-adult movement into the central Delta however, risk remains low at the range of expected OMRIs this week.
- Overall Entrainment Risk:
    - DS: Low.
    - LFS: Low for adults, sub-adults, juveniles, and larvae, due to projected operations resulting in an OMR Index around -1300 cfs for most of this week, with the potential for OMRI briefly being no more negative than -2500 cfs as exports may increase later this week. X2 is currently at 79 km and is expected to remain steady. Qwest will become less positive reaching near zero later this week as exports increase.

Section 1-B: Central Delta

Risk of entrainment into the export facilities for DS and LFS in the central Delta (8.1.5.2 D iii, iv, v)

- Exposure Risk (Low, Medium, High):
    - DS:
        - Adults and sub-adults: Low. DS have been detected in the south Delta based on a marked fish in salvage on 01/16/2022 and EDSM caught a marked DS in the lower San Joaquin River on 02/04/2022. However, the likelihood of adult and sub-adult DS entrainment remains low, due to no recent detections. There is a high degree of uncertainty regarding the response of cultured fish to environmental cues typically applied to wild DS. Water temperatures are increasing, spawning has begun, and larvae are present. Two ripe females were detected by SKT 3 in Suisun Marsh.
        - Larvae: Medium. SLS 6 detected a larval DS at station 815 in the central Delta, indicating larvae are present in areas at higher risk of entrainment. PTM results show that the more negative OMRI expected this week (-5000 cfs) will increase risk of entrainment for larvae in the lower San Joaquin River. After 3 weeks, the PTM run results show that 10% of the particles at 815 were entrained into the OMR corridor and projects at the -4000 to -5000 cfs base scenario and 5% were entrained into the OMR corridor and projects at the -1250 cfs scenario.
    - LFS:
        - Adults and sub-adults: Low risk for adult and sub-adult LFS entrainment. EDSM collected one sub-adult LFS in the lower San Joaquin River on 03/09/2022, providing evidence that adults are still present. Under current hydrology risk remains low and an OMRI temporarily reaching -5,000 cfs won't increase risk. Low risk for adults as adult salvage has been rare in recent years.
        - Larvae and juveniles:
            - Medium risk for larvae observed in the lower San Joaquin River by SLS five, as OMRIs approach -5000 cfs this risk increases. Qwest is positive and is expected to turn negative around -500 cfs as exports increase, as of April 1st they will be positive or near zero. Exports have remained low since 02/01/2022 but are increasing over the next couple of days to capture storm runoff, which will increase risk of entrainment. X2 is currently at 82 km and is expected to move upstream as outflow decreases. The risk of entrainment increases as OMRI becomes more negative, PTM results show that particles injected in the lower San Joaquin River (812 and 815) are at medium risk of entrainment to the facilities and into the OMR corridor. However, only a few particles made it past Chipps under both scenarios and many particles were unresolved.

- High risk for LFS larvae and juveniles in the OMR corridor. LFS larvae and juveniles are present in the OMR corridor and in West Canal, based on salvage and survey detections. Larvae have been detected in the qualitative larval sampling at both fish facilities in the last week. Salvage increased over the past week with 336 juveniles salvaged at both facilities from 3/21/2022 through 3/27/2022. This pattern may be expected, given dry conditions this year and that LFS spawned in the central and south Delta and, as fish grow, the likelihood of being detected in salvage increases. However, the SMT will explore historical salvage and continue to monitor salvage trends, particularly looking at salvage relative to the number of adult spawners at the beginning of the spawning season. SLS 6 detected three LFS larvae at station 902 in the OMR corridor. Under current conditions, those fish are unlikely to make their way out of the OMR corridor based on PTM results and since LFS larvae are planktonic and can't volitionally move downstream once in the OMR corridor. A few juvenile LFS have been salvaged that are at a larger size that can start volitionally swimming downstream. PTM results show that with a more negative OMRI of –4000 to -5000 cfs as with the base case scenario, 63% of particles are entrained into the projects and into the OMR corridor after 3 weeks (27% to the projects, 36% into the OMR corridor). Whereas the -1250 cfs scenario, showed 55% of particles are entrained into the facilities and into the OMR corridor after 3 weeks (12% to the projects, 43% into the OMR corridor). This shows that a recommendation of -1250 cfs on a 7-day average will help decrease risk of entrainment of LFS larvae and juveniles in the OMR corridor, particularly entrainment to the projects, under these two scenarios. Salvage is increasing and expected to peak in April and May, this recommendation is made to help decrease the risk of high salvage this year.

- 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: Increased risk due to detection of a larval DS in the lower San Joaquin River and OMRI expected to become more negative this week (-5000 cfs). Increasing exports will increase risk for the larvae that are present.
    - LFS: Increased risk- Higher densities of larval and juvenile LFS were detected with SLS 6 and 20mm 1 in the central and south Delta than in previous weeks, juvenile LFS salvage has increased substantially since last week, and more negative OMRI expected, PTM results. We expect to see more consistent detections at the fish facilities as larvae grow. Despite low exports and low turbidity, larvae have been detected in the OMR corridor and at the facilities. Juvenile salvage has increased and field surveys show juveniles are also present in the south delta. Risk for LFS larvae and juveniles in the south Delta is high and will increase as exports increase. PTM run results show that an OMRI recommendation of -1250 cfs will help reduce this risk.

- Reporting OMRI (Number and range of OMRI bins will vary based on anticipated hydrology and operations)
    - The SMT has determined that risk of entrainment is low for adult and sub-adult DS across the range of expected OMRI values. Larval DS were detected for the first time this season last week, and one larvae was detected at station 815 in the lower San Joaquin River. The more negative OMRI expected this week (-5000 cfs) poses an increased risk of entrainment into the OMR corridor and water projects from the lower San Joaquin River.
    - The SMT determined that risk of entrainment is low for adult and sub-adult LFS, medium for LFS larvae in the lower San Joaquin River, and high for LFS larvae in the OMR corridor across the range of expected OMRI values.

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 on the following Conditions of Approval:

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

8.3.1 Integrated Early Winter Pulse Protection. Between December 1 and January 31 each year Permittee shall reduce south Delta exports for 14 consecutive days to maintain a 14-day average OMR index no more negative than -2,000 cfs, and convene the Smelt Monitoring Team within one day of triggering the following criteria:

- Three-day running average daily flows at Freeport greater than, or equal to, 25,000 cfs, AND
- Three-day running average of daily turbidity at Freeport greater than, or equal to, 50 Nephelometric Turbidity Units (NTU), OR
- The Smelt Monitoring Team determines that real-time monitoring of abiotic and biotic factors indicates a high risk of DS migration and dispersal into areas at high risk of future entrainment.

After maintaining a 14-day average OMR index no more negative than -2,000 cfs for 14 days, Permittee shall maintain a 14-day average OMR index no more negative than -5,000 cfs, initiating the OMR Management season, until the OMR Management Season ends (Condition of Approval 8.8).

The Integrated Early Winter Pulse Protection Action may only be initiated once during the December 1 through January 31 time period each year.

8.3.3 Adult Longfin Smelt Entrainment Protection. After December 1, if an Integrated Early Winter Pulse Protection (Condition of Approval 8.3.1) has not yet initiated, Permittee shall reduce south Delta exports to maintain a 14-day average OMR index no more negative than -5,000 cfs and initiate OMR Management (Condition of Approval 8.3) if:

- Cumulative combined LFS salvage (total estimated LFS counts at the CVP and SWP salvage facilities beginning December 1 through February 28 exceeds the most recent Fall Midwater Trawl (FMWT) LFS index[1] divided by 10, OR
- Real-time monitoring of abiotic and biotic factors indicates a high risk of LFS movement into areas at high risk of future entrainment, as determined by DWR and CDFW Smelt Monitoring Team staff.

When evaluating the possibility of LFS movement into areas that may be subject to an elevated risk of entrainment, the Smelt Monitoring Team shall evaluate catch of LFS with fork length ≥ 60 mm by the Chipps Island Trawl (conducted by USFWS) as an early warning indicator for LFS migration movement into the Delta, in addition to other available survey and abiotic data. The Smelt Monitoring Team shall communicate the results of these risk assessments and advice to the WOMT (Condition of Approval 8.1.3), and operational decisions shall be made as described in Condition of Approval 8.1.4 (Collaborative Approach to Real-time Risk Assessment).

8.4.1 OMR Management for Adult Longfin Smelt. From the onset of OMR Management (Condition of Approval 8.3) through February 28, the Smelt Monitoring Team shall conduct weekly, or more often as needed, risk assessments (see Condition of Approval 8.1.5.2) and decide whether to recommend an OMR flow requirement between -5,000 cfs and -1,250 cfs to minimize entrainment and take of adult LFS. The Smelt Monitoring Team may provide advice to restrict south Delta exports for seven consecutive days to achieve a seven-day average OMR index within three risk categories:

- Low risk: OMR between -4,000 cfs to -5,000 cfs
- Medium risk: OMR between -2,500 cfs to -4,000 cfs
- High risk: OMR between -1,250 cfs to -2,500 cfs

If a risk assessment conducted by the Smelt Monitoring Team determines that a more restrictive OMR flow requirement is needed to minimize take of adult LFS, the Smelt Monitoring Team shall provide its advice to WOMT (Condition of Approval 8.1.3) and operational decisions shall be made following the process described in Condition of Approval 8.1.4 (Collaborative Approach to Real-time Risk Assessment).

This Condition will terminate when a high-flow off-ramp occurs (Condition of Approval 8.4.3), or when LFS spawning has been detected in the system, as determined by the Smelt Monitoring Team, or, if there is disagreement and resolution is not reached within WOMT, as determined by CDFW. The Smelt Monitoring Team shall consider results from Additional LFS Larval Sampling (Condition of Approval 7.6.1) to inform its assessment of the start of LFS spawning.

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[1] The Fall Midwater Trawl (FMWT) Survey annual abundance index for LFS is calculated as the sum of September through December monthly abundance indices and is typically reported at about the same date as adult salvage begins in December. The FMWT Index available beginning on December 1 each year shall be used to establish this threshold.

After LFS spawning has been observed, Permittee shall implement Condition of Approval 8.4.2 to minimize take of larval and juvenile LFS.

8.4.2 Larval and Juvenile Longfin Smelt Entrainment Protection. From January 1 through June 30, when a single Smelt Larva Survey (SLS) or 20 mm Survey (20 mm) sampling period exceeds one of the following thresholds:

- LFS larvae or juveniles found in four or more of the 12 SLS or 20 mm stations in the central Delta and south Delta (Stations 809, 812, 815, 901, 902, 906, 910, 912, 914, 915, 918, 919), or
- LFS catch per tow exceeds five LFS larvae or juveniles in two or more of the 12 stations in the central Delta and south Delta (Stations 809, 812, 815, 901, 902, 906, 910, 912, 914, 915, 918, 919).

Permittee shall restrict south Delta exports for seven consecutive days to maintain a seven-day average OMR index no more negative than -5,000 cfs. Permittee shall also immediately convene the Smelt Monitoring Team to conduct a risk assessment (see Condition of Approval 8.5.1.2) to assess the risk of larval and juvenile LFS entrainment into the South Delta Export Facilities, determine if an OMR flow restriction is warranted, and recommend an OMR flow limit between -1,250 and -5,000 cfs. The Smelt Monitoring Team risk assessment and operational advice shall be reviewed by the WOMT (Condition of Approval 8.1.3) via the Collaborative Real-time Decision-making process (Condition of Approval 8.1.4). Permittee shall operate to the export restriction and OMR flow target approved through Conditions of Approval 8.1.3 and 8.1.4. Each week the Smelt Monitoring Team shall convene to conduct a new risk assessment and determine whether to maintain, or off ramp from, export restrictions based on the risk to LFS, or until the DS and LFS off-ramp has been met as described in Condition of Approval 8.8 (End of OMR Management).

From January 1 through June 30, DWR and CDFW Smelt Monitoring Team staff shall conduct weekly, or more often as needed, risk assessments (see Condition of Approval 8.5.1.2) to assess the risk of larval and juvenile LFS entrainment into the South Delta Export Facilities. As a part of the risk assessment the Smelt Monitoring Team shall provide advice on the appropriate OMR flow targets to minimize LFS entrainment or entrainment risk, or both. The Smelt Monitoring Team shall provide its advice to WOMT (Condition of Approval 8.1.3) and use the Collaborative Approach to Real-time Risk Assessment process described in Condition of Approval 8.1.4 to determine if an OMR flow restriction is warranted and determine OMR flow limit between -1,250 and -5,000 cfs. The OMR flow limit shall be in place until the next risk assessment conducted by the Smelt Monitoring Team determines that it is no longer necessary to minimize take or related impacts to LFS, or until the DS and LFS off-ramp has been met as described in Condition of Approval 8.8 (End of OMR Management).

8.4.3 High Flow Off-Ramp from Longfin Smelt OMR Restrictions. OMR management for adult, juvenile, or larval LFS as described in Conditions of Approval 8.4.1 and 8.4.2 are not required, or would cease if previously required, when river flows are (a) greater than 55,000 cfs in the Sacramento River at Rio Vista or (b) greater than 8,000 cfs in the San Joaquin River at Vernalis.

If flows subsequently drop below 40,000 cfs in the Sacramento River at Rio Vista or below 5,000 cfs in the San Joaquin River at Vernalis, the OMR limit previously required as a part of Conditions of Approval 8.4.1 and 8.4.2 shall resume.

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 NTU. If the daily average turbidity at OBI is greater than 12 NTU, 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 NTU.

If, after five consecutive days of OMR flow that is less negative than -2,000 cfs and the daily average turbidity at OBI is not less than 12 NTU, 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 in 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.

8.5.2 Larval and Juvenile Delta Smelt Protection. If the five-day cumulative salvage of juvenile DS at the CVP and SWP facilities is greater than or equal to one plus the average prior three years' FMWT index (rounded down), Permittee shall restrict south Delta exports for seven consecutive days to maintain a seven-day average OMR index no more negative than -5,000 cfs. Additionally, if the five-day cumulative salvage threshold is met or exceeded, Permittee shall immediately convene the Smelt Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.2) and determine the future risk of entrainment and take of larval and juvenile DS. The Smelt Monitoring Team may provide advice to further restrict south Delta exports to maintain a more positive OMR than -5,000 cfs. The Smelt Monitoring Team may provide advice for further restrictions within three risk categories:

- Low risk: Limit OMR between -4,000 cfs to -5,000 cfs
- Medium risk: Limit OMR between -2,500 cfs to -4,000 cfs
- High risk: Limit OMR between -1,250 cfs to -2,500 cfs

The duration and magnitude of operational advice shall be provided to the WOMT (Condition of Approval 8.1.3) and decisions shall be made following the process described in Condition of Approval 8.1.4 (Collaborative Real Time Risk Assessment). When conducting risk assessments to evaluate the risk of entrainment and take of juvenile DS, the Smelt Monitoring Team shall evaluate the following information sources, in addition to any other models or surveys they deem appropriate and those listed in Condition of Approval 8.1.5.2:

- Results from a CDFW approved DS life cycle model.
- DS recruitment levels identified by the Smelt Monitoring Team using the CDFW-approved life cycle model that links environmental conditions to recruitment, including factors related to loss as a result of entrainment such as OMR flows. In this context, recruitment is defined as the estimated number of post-larval DS in June per number of spawning adults in the prior February-March period.
- Hydrodynamic models and forecasts of entrainment informed by the EDSM or other relevant survey data to estimate the percentage of larval and juvenile DS that could be entrained.

If expanded salvage at the CVP and SWP facilities of juvenile DS exceeds 11 within a three-day period under this condition, Permittee shall restrict south Delta exports for seven consecutive days to maintain a seven-day average OMR index no more negative than -3,500 cfs. If juvenile DS continue to be salvaged at the CVP and SWP facilities during the seven days of OMR restrictions, then Permittee shall continue restrictions and request a risk assessment by the Smelt Monitoring Team to determine if additional advice and subsequent restrictions are warranted and provide advice to WOMT (see Condition of Approval 8.1.3) and follow the decision-making process described in Condition of Approval 8.1.4.

8.12 Barker Slough Pumping Plant Longfin and Delta Smelt Protection. Permittee shall operate the BSPP to protect larval LFS from January 15 through March 31 of dry and critical water years. Permittee shall operate to protect larval DS from March 1 through June 30 of dry and critical years. If the water year type changes after January 1 to below normal, above normal

or wet, this action will be suspended. If the water year type changes after January to dry or critical, Permittee shall operate according to this Condition of Approval.

From January 15 through March 31 of dry and critical water years, Permittee shall reduce the maximum seven-day average diversion rate at BSPP to less than 60 cfs when larval LFS are detected at Station 716. In addition, in its weekly meetings from January 15 through March 31, the Smelt Monitoring Team shall review LFS abundance and distribution survey data and other pertinent abiotic and biotic factors that influence the entrainment risk of larval LFS at the BSPP. When recommended by the Smelt Monitoring Team, and as approved through the decision-making processes described in Conditions of Approval 8.1.3 and 8.1.4, Permittee shall reduce the maximum seven-day average diversion rate at BSPP according to the advice provided by the Smelt Monitoring Team.

From March 1 through June 30 of dry and critical water years, Permittee shall reduce the maximum seven-day average diversion rate at BSPP to less than 60 cfs when larval DS are detected at Station 716. In addition, in its weekly meetings from March 1 through June 30, the Smelt Monitoring Team shall review DS abundance and distribution survey data and other pertinent abiotic and biotic factors that influence the entrainment risk of larval DS at the BSPP (including temperature and turbidity). When recommended by the Smelt Monitoring Team, and as approved through the decision-making processes described in Conditions of Approval 8.1.3 and 8.1.4, Permittee shall reduce the maximum seven-day average diversion rate at BSPP to less than 60 cfs.

The DS requirements described in this condition may be adjusted to align with USFWS requirements to minimize take of DS through an amendment to this ITP.

8.13 Water Year Type Definition. All references to water year type in this ITP shall be defined based on the Sacramento Valley Index unless otherwise noted.

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 initiating OMR management went into effect December 1st. The Smelt Monitoring Team conducted a Risk Assessment based on COA 8.1.5.2.

8.3.1: This COA was triggered by conditions measured on 12/17/2021 when the running three-day average of daily flow and turbidity reached 27,152 cfs and 66.79 FNU respectively. Operations were reduced on 12/20/2021 targeting a 14-day average OMR index no more negative than -2,000 cfs for 14 consecutive days. After maintaining a 14-day average OMR index no more negative than -2,000 cfs for 14 days, Permittee shall maintain a 14-day average OMR index no more negative than - 5,000 cfs, initiating the OMR Management season, until the OMR Management Season ends (Condition of Approval 8.8).

8.3.3: This COA is no longer active due to the initiation of an Integrated Early Winter Pulse Protection (COA 8.3.1).

8.4.1: This COA is no longer active due to the detection of larval LFS by Smelt larva Survey (SLS).

8.4.2: This COA went into effect on 01/03/2022 following the 14-day Integrated Early Winter Pulse Protection (COA 8.3.1).

- SLS 1 was initially canceled due to COVID mitigation, however, the 12 south and central Delta stations listed in this COA were sampled on 1/18/2022. The resulting data triggered this COA by detection of larval LFS at more than four stations (809, 812, 815, 901, 906, and 910) and larval catch exceeded 5 fish per tow at two stations (809 and 812).
- Data collected by SLS 2 triggered this action for the second time this season on 1/31/2022. Larval LFS were detected at four of the relevant stations (809, 812, 815 and 906) and catch per tow exceeded five LFS at two stations (809 and 812). The SMT did not advise a less negative OMR Index under this COA due to reduced exports.
- Data collected by SLS 3 did not trigger this COA.
- Data collected by SLS 4 triggered this action for the third time this season on 2/28/2022. Larval LFS were detected at five of the relevant stations (809, 812, 901, 902, and 915) and catch per tow exceeded five LFS at three stations (809, 812, and 901). However, the SMT did not advise a less negative OMRI under this COA due to low exports and positive Qwest. On March 8th the SMT requested a PTM run to help inform risk for larvae and determine if the fate of particles in the lower San Joaquin River and the central and south Delta would change if a recommendation to limit OMR was made. The injection points selected were at stations 812, 815, and 902. The scenarios modeled compared planned exports (-3000 cfs for a couple of days slowly ramping down to -1400 cfs) with a recommendation to limit OMR to -1250 cfs.
- Data collected by SLS 5 triggered this action for the fourth time this season on 03/11/2022. Larval LFS were detected at four of the relevant stations (809, 812, 815, and 901). Of the 21 larvae detected, 12 had yolk sacs indicating spawning is ongoing. On March 11th the SMT met to discuss the results of the PTM run and evaluate survey and salvage data. The PTM results show that with a more negative OMRI of -3000 cfs as with the base case scenario 43% of particles are entrained into the facilities and into the OMR corridor after 3 weeks. Whereas the -1250 cfs scenario showed 31% of particles are entrained into the facilities and into the OMR corridor after 3 weeks. This shows that at the more negative OMRI scenario (base case) there is an increased risk to larvae and juveniles in the OMR corridor, and this difference in particles entrained under different scenarios is consistent with prior years when recommendations to limit OMR were made. The SMT met on 3/15/2022 and continued the recommendation that was made

on 3/11/2022 to limit OMRI to no more negative than -1250 cfs for the protection of juvenile LFS.

- Data collected by SLS6 and 20mm survey 1 triggered this action for the fifth time this season on 03/29/2022. SLS 6 detected 34 LFS larvae at 5 of the 11 stations processed so far in the central and south Delta (see table 1 in attachments), and densities were higher than those detected by SLS 5 earlier in March. Some of the larvae detected by SLS 6 in the central and south Delta still had yolk-sacs. 20mm survey 1 detected 71 LFS larvae at 5 of the 6 stations processed so far in the central and south Delta (see table 2 in attachments). On March 29th the SMT met to discuss the results of the PTM run and evaluate survey and salvage data. After 3 weeks, the PTM run results show that 10% of the particles at 815 (lower San Joaquin River) were entrained into the OMR corridor and projects at the -5000 cfs scenario, whereas 5% were entrained into the OMR corridor and projects at the -1250 cfs scenario. PTM results also show that at station 902 with a more negative OMRI of -5000 cfs as with the base case scenario, 63% of particles are entrained into the projects and into the OMR corridor after 3 weeks (27% to the projects, 36% into the OMR corridor). Whereas the -1250 cfs scenario, showed 55% of particles entrained into the facilities and into the OMR corridor after 3 weeks (12% to the projects, 43% into the OMR corridor). This shows that a recommendation of -1250 cfs on a 7-day average will help decrease risk of entrainment of LFS larvae and juveniles in the OMR corridor, particularly entrainment to the projects, under these two scenarios. Juvenile LFS salvage is increasing and expected to peak in April and May, this recommendation is made to help decrease the risk of higher salvage this year.

8.5.1: This COA went into effect on 01/03/2022 following the 14-day Integrated Early Winter Pulse Protection (COA 8.3.1). Current OBI turbidity levels are below the threshold.

8.5.2: The 2021 FMWT Annual Index for DS is zero for the fourth consecutive year. The salvage threshold is one Juvenile DS. No juvenile DS have been salvaged this water year. One cultured subadult DS (fork length = 54 mm, adipose fin clipped) was salvaged on 1/16/2022.

8.12: This COA became active on 02/08/2022 when the Sacramento Valley Water Year Type Index (SVI) February Forecast was released. The forecasted value of 6.2 (50% exceedance) is within the range for a dry water year. SLS 3 collected 3 LFS larvae at station 716. This data was reported to the SMT via email on 2/14/2022, triggering this COA. SLS 2 also detected larvae at station 716, however, this COA was not active at the time based on the January SVI. SLS 4 did not detect LFS or DS larvae at station 716, therefore this COA was not triggered thereby removing the limitation on BSPP of no more than 60 cfs exports on a 7-day average that was previously triggered by SLS 3. SLS 5 collected 3 LFS larvae at station 716. This data was reported to the SMT via email on 3/11/2022, triggering this COA for the second time this season. 20mm survey 1 detected 5 larval DS on 3/21/2022, triggering this COA for the third time this season.

8.13: The Sacramento Valley Water Year Type Index (SVI) February forecast corresponding to the 50% probability of exceedance is 6.2 which is in the range for a Dry water year classification. The forecast was reported on the California Data Exchange Center (CDEC) Water Supply Index Webpage, accessed on 02/08/2022.

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.)*
    - OMR Management was initiated on 01/03/2021 following the 14-day Integrated Early Warning Pulse Protection action (COA 8.3.1).
    - COA 8.3.1 was triggered by conditions measured on 12/17/2021. Exports were reduced to comply with this COA on 12/20/2021 through 01/02/2021.
    - DCC gates closed on 11/30/2021.
    - The Drought barrier at False River has been notched. The notch is quite large, such that hydrodynamically no barrier is present.
- Controlling Factors: Delta outflow/X2 (D-1641)
- Water Temperature:
    - Clifton Court Forebay (CCF) Daily Average Water Temperature = NA
    - 3 Station Average = 14.41°C
- Tidal Cycle: Near equinox, so muted difference between spring and neap.
- Turbidity:
    - 8.3.1 Freeport 3-day average = NA
    - 8.5.1 OBI Turbidity Daily Average = 5.44 FNU.
- Salinity: X2 is at 82 km.
- Hydrologic Footprint: A PTM run was requested on March 22nd with injection points at 812, 815, and 902. The scenarios modeled compared a “no recommendation” or base case scenario (highest plausible OMR, and consists of 4 days (3/29-4/1) of OMR in the -4000 to -5000 cfs range while the projects pick up the extra outflow from the precipitation that fell on Sunday and Monday, followed by a decrease to an OMR of -1200 cfs) with a recommendation to limit OMR to -1250 cfs. After 3 weeks, the PTM run results show that 10% of the particles at 815 (lower San Joaquin River) were entrained into the OMR corridor and projects at the -5000 cfs scenario, whereas 5% were entrained into the OMR corridor and projects at the -1250 cfs scenario. PTM results also show that at station 902 with a more negative OMRI of -5000 cfs as with the base case scenario, 63% of particles are entrained into the projects and into the OMR corridor after 3 weeks (27% to the projects, 36% into the OMR corridor). Whereas the -1250 cfs scenario, showed 55% of particles entrained into the facilities and into the OMR corridor after 3 weeks (12% to the projects, 43% into the OMR corridor). This shows that a recommendation of -1250 cfs on a 7-day average will

help decrease risk of entrainment of LFS larvae and juveniles in the OMR corridor, particularly entrainment to the projects, under these two scenarios.

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

- Outages:
  - State Water Project (SWP): None
  - Central Valley Project (CVP): None
- Exports: Combined exports are targeting an NDOI of 7,100 cfs, may be an opportunity to increase exports if a recommendation was not made.
  - SWP: 0 to 2,500 cfs
  - CVP: 800 to 2,700 cfs

Meteorological Forecast: No significant precipitation is in the forecast. Section 3-C: Projected conditions. 8.1.5.2.A. iii

- More rain than was anticipated fell Sunday and Monday, however no more significant precipitation is expected this week.
- DCC Gates position: Closed 11/30/2021.
- Sacramento River flow at Freeport 9,400 cfs.
- San Joaquin River flow at Vernalis 800-900 cfs.
- Qwest: +1,700 cfs, expected to decrease to around -500 with increased exports, then will go to near zero to low positives for the remainder of the week.
- Expected changes in South Delta Exports: CCF had been at 600 cfs, increased to 2,500 cfs today, 2,500- 2,000 cfs range this week until April 1st, then will decrease to 600 cfs. CVP exports were at 900 cfs, but increased to 1,800 cfs today and at noon today will increase to 2,700 cfs for the next two days, then decrease to 800-900 cfs as of the 1stIncreased exports may result in OMRI temporarily reaching -5000 cfs for a few days this week.
- NDOI: 8,100 cfs yesterday
- Upstream releases:
  - Keswick = 3,250 cfs
  - Nimbus = 1,200 cfs
  - Goodwin = 300 cfs, looking to reduce
  - Oroville = 3,500 cfs

Table 1: Comparison of OMR and OMR Index (5-day and 14-day averages in this table for OMR Index and USGS gauge were reported on SacPAS website, accessed 03/29/2022).

Date	Averaging Period	USGS gauges (cfs)	Index (cfs)
03/27/2022	Daily	Not Reported	-1,565 cfs
03/26/2022	5-day	-2,820 cfs	-1,550 cfs

03/26/2022	14-day	-2,280 cfs	-1,520 cfs

Section 4: Distribution and Biology.

8.1.5.2.B. Assessment of biological information for Delta Smelt and Longfin Smelt

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

- The last marked DS detection occurred on 03/23/2022 in the Sacramento Deep Water Ship Channel (n=6). The last wild DS detection occurred on 1/5/2022 in the lower Sacramento River stratum. Spawning has started and 9 larval DS were detected by SLS 6 and 20mm survey 1.
- SLS: Survey 6 was on the water from 3/21/2022 through 3/24/2022. Processing is ongoing. So far, one larval DS was detected at 815 in the lower San Joaquin River. See Table 1 in attachments for details.
- 20mm: Survey 1 was on the water from 3/21/2022 through 3/28/2022. Processing is ongoing. So far, 8 larval DS were detected in the northern stations (711, 716, 718, 719). See Table 2 in attachments for details.
- EDSM: From 03/20/2022 through 03/26/2022 EDSM completed sampling at 33 sites and collected 6 marked DS in the SDWSC, 1 in Cache Slough, and 1 in Suisun Marsh. See Table 3 in Attachments for details. The abundance estimate for last week was 11,721.
- Chipps: From 03/20/2022 through 03/26/2022 Chipps Island Trawl completed 50 tows and collected no DS. See Table 4 in Attachments for details.
- Spring Kodiak Trawl (SKT): Survey 3 is complete and 11 marked DS were caught in the SDWSC, the Lower Sacramento River, and Suisun Marsh. Two ripe females were detected in Suisun Marsh on 3/17/2022.
- Bay Study: Survey 3 sampling is complete and no DS were detected.
- Salvage: No DS have been salvaged at either facility in the past seven days and no larvae have been detected.
- Fall Mid-water Trawl (FMWT) Index for DS = 0
- DS life cycle model (LCM) discussion: NA
- Biological Conditions: Water temperatures are within the range conducive to spawning as reported in Damon et al. (2016) and the detection of larval fish last week indicates that spawning and hatching have begun.
- % of population in Delta zones: NA

Section 4-B: Longfin Smelt population status 8.1.5.2.B. ii.

- FMWT Index for LFS = 323
- SLS: Survey 6 was on the water from 3/21/2022 through 3/24/2022. Processing is ongoing. So far, SLS 6 detected 34 larvae at 5 of the 11 stations processed so far in the central and south Delta and some larvae still had yolk sacs. Densities of LFS larvae in the samples processed so far in the Central and South Delta indicate that

densities were higher than those detected during SLS 5 earlier in March. See table 1 in attachments for details.

- 20mm: Survey 1 was on the water from 3/21/2022 through 3/28/2022. Processing is ongoing. Seventy-one LFS larvae were detected at 5 of the 6 stations processed so far in the central and south Delta. See table 2 in attachments for details.
- EDSM: From 03/20/2022 through 03/26/2022 EDSM completed sampling at 33 sites and collected 4 LFS in Suisun Bay and 20 in Suisun Marsh. See Table 3 in attachments for details.
- Chipps: From 03/20/2022 through 03/26/2022 Chipps Island Trawl completed 50 tows and collected 17 LFS. See Table 4 in attachments for details.
- SKT survey 3 sampling is complete and 73 LFS were detected in Suisun Marsh and Suisun Bay.
- LEPS sampling has ended and processing is ongoing, however final data will not be available until the end of the season. Larval LFS were detected at low densities as of sampling conducted on 02/25/2022. No yolk sac larvae were present as of February 25th.
- Salvage: One hundred sixty juvenile LFS were salvaged at the CVP fish facility between 3/21/2022 and 3/27/2022, bringing the total federal salvage this season to 184. One hundred seventy-six juvenile LFS were salvaged at the SWP fish facility between 3/21/2022 and 3/27/2022, bringing the total state salvage this season to 236.
- Qualitative larval sampling began at both facilities on February 7th and larvae were detected at the CVP only this week.

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

Notes:

- The SMT discussed when the decision was made to increase exports this week and timing if a recommendation was made. More rainfall than anticipated fell on Sunday and Monday increasing flows at Freeport and Vernalis, the decision to increase exports was made on late Monday and was reflected in the Operations outlook distributed to SMT this week. However, with exports increasing during the SMT meeting today and any recommendation needing to go through WOMT tomorrow and then the mandatory three days to comply to reduce exports, any recommendation will likely not be implemented in time to reduce risk of entrainment. The SMT is concerned about larval and juvenile LFS in the central and south Delta and frustrated that a recommendation will likely not be implemented in time to reduce risk for these fish.

Literature cited:

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.

Attachments: Table 1: SLS 6 Catch Table, Figure 1: SLS Station Locations, Table 2: 20mm 1 Catch Table, Figure 2: 20mm Station Locations, Table 3: EDSM Catch Table, Figure 3: EDSM bubbleplot map of DS and LFS catch, Table 4: Chipps Island Catch Table

Table 1. Longfin Smelt and Delta Smelt catch per station from 2022 Smelt Larva Survey, Survey 6 conducted between 03/21/2022 – 3/24/2022. Longfin Smelt incidental take permit criteria stations are highlighted in blue (Barker Slough Pumping Plant station 716) and yellow (South Delta exports stations 809, 812, 815, 901, 902, 906, 910, 912, 914, 915, 918, 919). This data is preliminary and subject to change.

Year	Survey #	SLS Station	Turbidity (NTU)	Sample Status	Species	Smelt Catch	Min Length	Max Length	Mean Length
2022	6	340	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	342	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	343	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	344	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	345	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	346	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	347	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	348	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	349	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	405	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	411	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	418	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	501	NA	Not Yet Processed	NA	NA	NA	NA	NA

Year	Survey #	SLS Station	Turbidity (NTU)	Sample Status	Species	Smelt Catch	Min Length	Max Length	Mean Length
2022	6	504	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	508	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	513	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	519	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	520	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	602	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	606	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	609	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	610	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	703	18.3	Proccessed	Longfin Smelt	10	7	13	8.7
2022	6	704	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	705	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	706	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	707	NA	Processed	Longfin Smelt	31	5	14	10.2
2022	6	711	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	716	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	723	NA	Not Yet Processed	NA	NA	NA	NA	NA

Year	Survey #	SLS Station	Turbidity (NTU)	Sample Status	Species	Smelt Catch	Min Length	Max Length	Mean Length
2022	6	801	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	804	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	809	11.3	Processed	Longfin Smelt	18	6	14	7.5
2022	6	812	7.3	Processed	Longfin Smelt	10	6	8	6.7
2022	6	815	3.7	Processed	Delta Smelt	1	10	10	10.0
2022	6	901	7.2	Processed	NA	No Smelt Catch	NA	NA	NA
2022	6	902	11.3	Processed	Longfin Smelt	3	7	14	10.7
2022	6	906	3.1	Processed	Longfin Smelt	1	11	11	11.0
2022	6	910	3.0	Processed	NA	No Smelt Catch	NA	NA	NA
2022	6	912	2.2	Processed	NA	No Smelt Catch	NA	NA	NA
2022	6	914	2.5	Processed	NA	No Smelt Catch	NA	NA	NA
2022	6	915	NA	Not Yet Processed	NA	NA	NA	NA	NA
2022	6	918	3.2	Processed	NA	No Smelt Catch	NA	NA	NA
2022	6	919	2.5	Processed	Longfin Smelt	1	9	9	9.0

Processing is complete through 3/29/2022.

Figure 1: Smelt Larva Survey station locations.

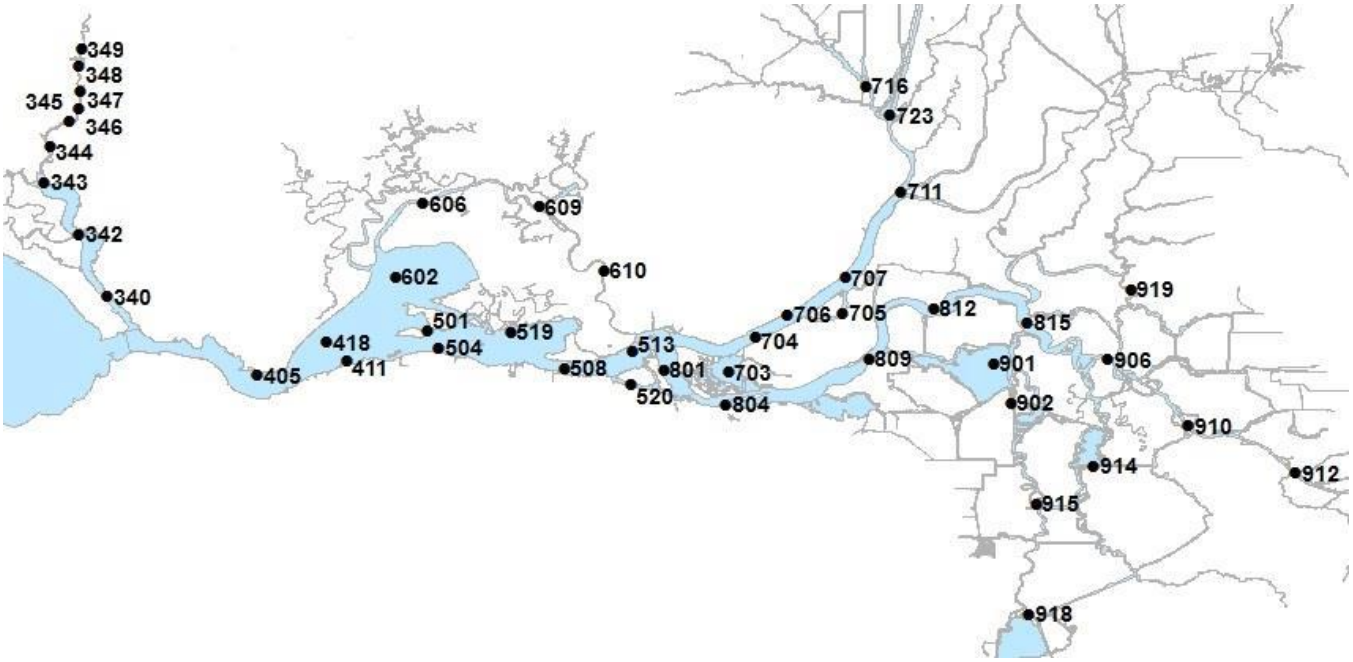

Table 2. Delta Smelt and Longfin Smelt catch per station from 2022 20-mm survey 1, which was in the field 3/21/2022 - 3/24/2022. These data are preliminary and subject to change.

Year	Survey	Station	Date	# Tows Processed	Species	Total Catch	Min Length	Max Length	Avg Length	Region
2022	1	328	NA	0	Not Yet Processed	0	NA	NA	NA	San Pablo Bay
2022	1	329	NA	0	Not Yet Processed	0	NA	NA	NA	San Pablo Bay
2022	1	334	NA	0	Not Yet Processed	0	NA	NA	NA	San Pablo Bay
2022	1	335	NA	0	Not Yet Processed	0	NA	NA	NA	San Pablo Bay
2022	1	336	NA	0	Not Yet Processed	0	NA	NA	NA	San Pablo Bay
2022	1	323	NA	0	Not Yet Processed	0	NA	NA	NA	San Pablo Bay
2022	1	340	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West

Year	Survey	Station	Date	# Tows Processed	Species	Total Catch	Min Length	Max Length	Avg Length	Region
2022	1	342	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	343	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	344	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	345	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	346	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	405	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	411	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	418	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	501	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	504	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	519	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	602	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	606	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	609	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	610	NA	0	Not Yet Processed	0	NA	NA	NA	Suisun Bay & West
2022	1	508	NA	0	Not Yet Processed	0	NA	NA	NA	Confluence

Year	Survey	Station	Date	# Tows Processed	Species	Total Catch	Min Length	Max Length	Avg Length	Region
2022	1	513	NA	0	Not Yet Processed	0	NA	NA	NA	Confluence
2022	1	520	NA	0	Not Yet Processed	0	NA	NA	NA	Confluence
2022	1	801	NA	0	Not Yet Processed	0	NA	NA	NA	Confluence
2022	1	804	NA	0	Not Yet Processed	0	NA	NA	NA	Confluence
2022	1	703	22-Mar-22	3	Longfin Smelt	101	6	17	11.3	Sac. River System
2022	1	704*	23-Mar-22	3	Longfin Smelt	31	6	21	12.0	Sac. River System
2022	1	705	NA	0	Not Yet Processed	0	NA	NA	NA	Sac. River System
2022	1	706	NA	0	Not Yet Processed	0	NA	NA	NA	Sac. River System
2022	1	707	23-Mar-22	2	Longfin Smelt	209	10	24	14.3	Sac. River System
2022	1	711	23-Mar-22	3	Longfin Smelt	10	9	14	11.6	Sac. River System
2022	1	711	23-Mar-22	3	**Delta Smelt**	3	8	12	10.3	Sac. River System
2022	1	716	21-Mar-22	3	**Delta Smelt**	2	8	9	11.2	Sac. River System
2022	1	718	21-Mar-22	3	**Delta Smelt**	1	13	13	13.0	Sac. River System
2022	1	719	21-Mar-22	3	**Delta Smelt**	2	12	13	12.5	Sac. River System
2022	1	719	21-Mar-22	3	Longfin Smelt	3	19	21	19.0	Sac. River System

Year	Survey	Station	Date	# Tows Processed	Species	Total Catch	Min Length	Max Length	Avg Length	Region
2022	1	720	NA	0	Not Yet Processed	0	NA	NA	NA	Sac. River System
2022	1	723	NA	0	Not Yet Processed	0	NA	NA	NA	Sac. River System
2022	1	724	NA	0	Not Yet Processed	0	NA	NA	NA	Sac. River System
2022	1	726	NA	0	Not Yet Processed	0	NA	NA	NA	Sac. River System
2022	1	809	22-Mar-22	3	Longfin Smelt	29	8	16	12.3	Central & South Delta
2022	1	812	22-Mar-22	2	Longfin Smelt	10	7	15	12.3	Central & South Delta
2022	1	815	22-Mar-22	3	Longfin Smelt	25	9	15	12.4	Central & South Delta
2022	1	901	21-Mar-22	3	Longfin Smelt	6	10	15	12.5	Central & South Delta
2022	1	902	21-Mar-22	3	Longfin Smelt	1	13	13	13.0	Central & South Delta
2022	1	906	NA	0	Not Yet Processed	0	NA	NA	NA	Central & South Delta
2022	1	910	NA	0	Not Yet Processed	0	NA	NA	NA	Central & South Delta
2022	1	912	NA	0	Not Yet Processed	0	NA	NA	NA	Central & South Delta
2022	1	914	21-Mar-22	3	No Smelt Catch	0	NA	NA	NA	Central & South Delta
2022	1	915	NA	0	Not Yet Processed	0	NA	NA	NA	Central & South Delta
2022	1	918	NA	0	Not Yet Processed	0	NA	NA	NA	Central & South Delta

Year	Survey	Station	Date	# Tows Processed	Species	Total Catch	Min Length	Max Length	Avg Length	Region
2022	1	919	NA	0	Not Yet Processed	0	NA	NA	NA	Central & South Delta

Processing complete through 3/28/2022.

Figure 2: 20mm station locations.

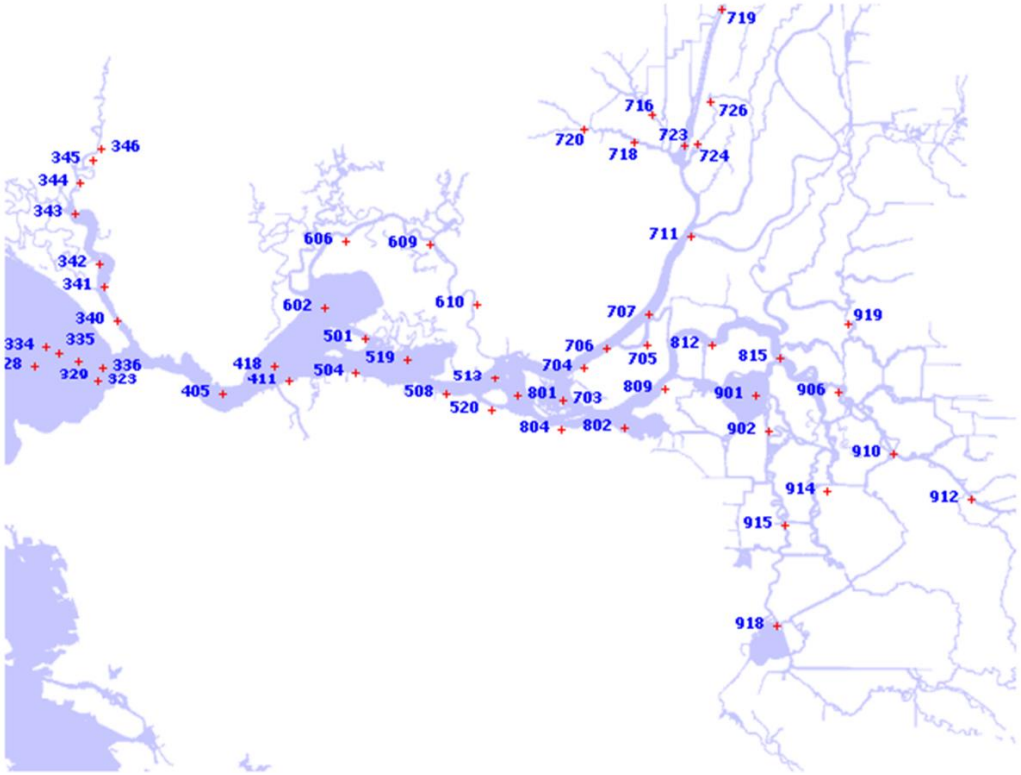

Table 3. Delta Smelt (DSM) and Longfin Smelt (LFS) catch per station for EDSM 2022 Phase 1 Kodiak trawls, from 3/21/2022–3/25/2022. These data are preliminary and subject to change.

Water Year	Phase	Station Code	Date	# Tows	Species	Mark Type	Fork Length	Total Catch	Disposition	Stratum
2022	1	22-34-CF01	3/23/2022	4	NA	NA	NA	NA	NA	Suisun Bay
2022	1	22-34-CF02	3/23/2022	4	NA	NA	NA	NA	NA	Suisun Bay
2022	1	22-34-HB01	3/23/2022	4	LFS	None	74	1	Released	Suisun Bay
2022	1	22-34-HB01	3/23/2022	4	LFS	None	78	1	Released	Suisun Bay
2022	1	22-34-HB01	3/23/2022	4	LFS	None	87	1	Released	Suisun Bay

Water Year	Phase	Station Code	Date	# Tows	Species	Mark Type	Fork Length	Total Catch	Disposition	Stratum
2022	1	22-34-SBM01	3/24/2022	4	LFS	None	87	1	Released	Suisun Bay
2022	1	22-34-SBW01	3/24/2022	4	NA	NA	NA	NA	NA	Suisun Bay
2022	1	22-34-SBW02	3/24/2022	4	NA	NA	NA	NA	NA	Suisun Bay
2022	1	22-34-GB01	3/22/2022	4	LFS	None	28	1	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	31	1	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	66	1	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	75	1	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	76	1	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	78	1	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	79	2	Released	Suisun Marsh
2022	1	22-34-GB01	3/22/2022	4	LFS	None	89	1	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	67	1	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	79	2	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	80	1	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	82	1	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	84	1	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	85	1	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	86	3	Released	Suisun Marsh
2022	1	22-34-GB02	3/22/2022	4	LFS	None	90	1	Released	Suisun Marsh
2022	1	22-34-SM01	3/22/2022	3	DSMT	AdClipped	71	1	UCD AHP	Suisun Marsh
2022	1	22-34-LSR01	3/24/2022	4	NA	NA	NA	NA	NA	Lower Sac River
2022	1	22-34-LSR02	3/24/2022	4	NA	NA	NA	NA	NA	Lower Sac River

Water Year	Phase	Station Code	Date	# Tows	Species	Mark Type	Fork Length	Total Catch	Disposition	Stratum
2022	1	22-34-LSR03	3/24/2022	4	NA	NA	NA	NA	NA	Lower Sac River
2022	1	22-34-LSR04	3/25/2022	1	NA	NA	NA	NA	NA	Lower Sac River
2022	1	22-34-SJT01	3/23/2022	4	NA	NA	NA	NA	NA	Lower San Joaquin River
2022	1	22-34-SJT02	3/23/2022	4	NA	NA	NA	NA	NA	Lower San Joaquin River
2022	1	22-34-SJT03	3/23/2022	4	NA	NA	NA	NA	NA	Lower San Joaquin River
2022	1	22-34-PP01	3/24/2022	4	NA	NA	NA	NA	NA	Lower San Joaquin River
2022	1	22-34-PP02	3/24/2022	2	NA	NA	NA	NA	NA	Lower San Joaquin River
2022	1	22-34-SJT04	3/24/2022	4	NA	NA	NA	NA	NA	Lower San Joaquin River
2022	1	22-34-CS01	3/21/2022	2	NA	NA	NA	NA	NA	Cache Slough
2022	1	22-34-CS02	3/21/2022	4	NA	NA	NA	NA	NA	Cache Slough
2022	1	22-34-CS03	3/21/2022	3	DSMT	AdClipped	68	1	UCD AHP	Cache Slough
2022	1	22-34-LSSC01	3/23/2022	3	DSMT	AdClipped	63	1	UCD AHP	Sac DW Ship Channel
2022	1	22-34-LSSC02	3/23/2022	2	DSMT	AdClipped	67	1	UCD AHP	Sac DW Ship Channel
2022	1	22-34-LSSC02	3/23/2022	2	DSMT	AdClipped	69	1	UCD AHP	Sac DW Ship Channel
2022	1	22-34-LSSC02	3/23/2022	2	DSMT	AdClipped	71	1	UCD AHP	Sac DW Ship Channel

Water Year	Phase	Station Code	Date	# Tows	Species	Mark Type	Fork Length	Total Catch	Disposition	Stratum
2022	1	22-34-LSSC02	3/23/2022	2	DSMT	VIE	65	1	UCD AHP	Sac DW Ship Channel
2022	1	22-34-USSC01	3/23/2022	3	DSMT	AdClipped	69	1	UCD AHP	Sac DW Ship Channel
2022	1	22-34-MRW01	3/21/2022	4	NA	NA	NA	NA	NA	Southern Delta
2022	1	22-34-MRW02	3/21/2022	4	NA	NA	NA	NA	NA	Southern Delta
2022	1	22-34-VC01	3/21/2022	4	NA	NA	NA	NA	NA	Southern Delta
2022	1	22-34-FT07	3/22/2022	4	NA	NA	NA	NA	NA	Southern Delta
2022	1	22-34-MIW01	3/22/2022	4	NA	NA	NA	NA	NA	Southern Delta
2022	1	22-34-MIW02	3/22/2022	4	NA	NA	NA	NA	NA	Southern Delta
2022	1	22-34-CQS01	3/21/2022	4	NA	NA	NA	NA	NA	Western Delta
2022	1	22-34-LNR01	3/21/2022	4	NA	NA	NA	NA	NA	Western Delta
2022	1	22-34-SPE01	3/21/2022	4	NA	NA	NA	NA	NA	Western Delta

Unmarked DSM collected during Phase 1 are transferred alive to FCCL to contribute to DSM broodstock if tow temperatures are below 17°C. If tow temperatures are above 17°C, unmarked DSM are flash frozen in liquid nitrogen and transferred to the UC Davis Aquatic Health Program for processing. All marked DSM are flash frozen in liquid nitrogen and transferred to UC Davis for processing.

Figure 3: Delta Smelt (DSM) and Longfin Smelt (LFS) catch per station for EDSM 2022 Phase 1 Kodiak trawls, from March 21–25, 2022. Sites with no DSM or LFS catch are indicated with squares.

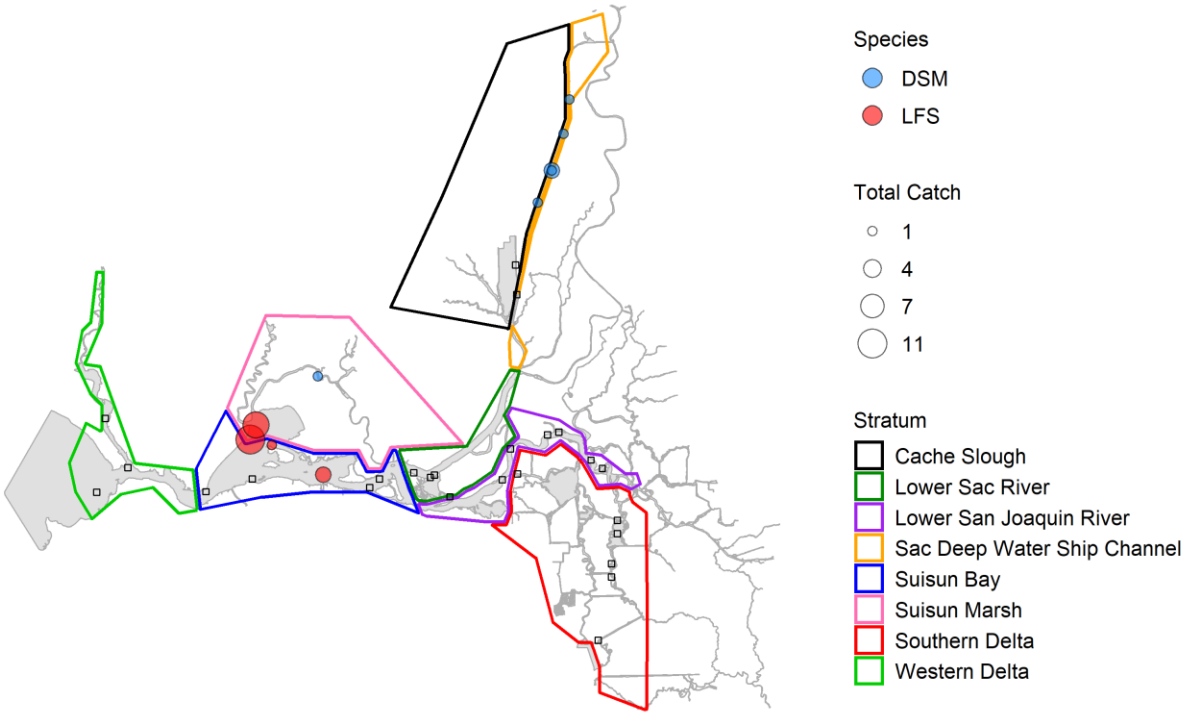

Table 4. Delta Smelt (DSM) and Longfin Smelt (LFS) catch in Chipps Island midwater trawls from a total of 50 tows conducted on March 20, 21, 23, 24, and 25, 2022. These data are preliminary and subject to change.

Water Year	Station Code	Date	Species	Mark Type	Fork Length	Total Catch	Disposition	Location
2022	SB018M	3/20/2022	LFS	None	81	1	Released	Chipps Island
2022	SB018N	3/20/2022	LFS	None	80	1	Released	Chipps Island
2022	SB018M	3/21/2022	LFS	None	77	1	Released	Chipps Island
2022	SB018M	3/21/2022	LFS	None	78	2	Released	Chipps Island
2022	SB018M	3/21/2022	LFS	None	79	1	Released	Chipps Island
2022	SB018M	3/21/2022	LFS	None	84	1	Released	Chipps Island
2022	SB018M	3/21/2022	LFS	None	86	1	Released	Chipps Island

Water Year	Station Code	Date	Species	Mark Type	Fork Length	Total Catch	Disposition	Location
2022	SB018N	3/21/2022	LFS	None	84	2	Released	Chipps Island
2022	SB018M	3/23/2022	LFS	None	90	1	Released	Chipps Island
2022	SB018N	3/23/2022	LFS	None	78	1	Released	Chipps Island
2022	SB018N	3/23/2022	LFS	None	85	1	Released	Chipps Island
2022	SB018S	3/23/2022	LFS	None	82	1	Released	Chipps Island
2022	SB018N	3/25/2022	LFS	None	78	1	Released	Chipps Island
2022	SB018N	3/25/2022	LFS	None	89	1	Released	Chipps Island
2022	SB018N	3/25/2022	LFS	None	92	1	Released	Chipps Island

LFS >80 mm fork length collected in Chipps Island trawls during Dec–Apr are transferred alive to FCCL to contribute to LFS broodstock if tow temperatures are below 14.5°C. All DSM are flash frozen in liquid nitrogen and transferred to the UC Davis Aquatic Health Program for processing.