

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

Section 1: Overview

Date: 12/14/2021

Life Stages Present:

Delta Smelt (DS): Sub-Adult

Longfin Smelt (LFS): Adults and juveniles are present. Adults were detected at Chipps Island Trawl.

Advice to Water Operations Management Team (WOMT):

No Advice.

Risk Assessment:

Delta Smelt: Based on distribution patterns over the past decade and rare detections, DS are unlikely to be prevalent in the South Delta. Limited detection data support DS being present in the Sacramento Deep Water Ship Channel (SDWSC) and life history information support the centroid of distribution being close to the X2 position (Sommer et al. 2011). The last DS observed was in the SDWSC on 8/20/2021. The increase in exports will result in a more negative OMR which increases the likelihood of entrainment if Delta Smelt are in the region. The likelihood of Delta Smelt adult entrainment is low due to seasonal timing. First flush conditions may occur within the next seven days. The regulations for Integrated Early Winter Pulse Protection went into effect 12/1/2021.

Longfin Smelt: Adult (FL > 84 mm) and Juvenile LFS were detected by Chipps Island Trawl during sampling conducted from 12/6/2021 to 12/9/2021. Six juvenile LFS was detected in Suisun Marsh by EDSM on 12/9/2021 and an additional nine LFS (FL = 63 – 90 mm) were collected in the Suisun Marsh stratum on 12/13/2021 (**NOTE:** The nine LFS collected by EDSM on 12/13/2021 will appear on the next catch table). Preliminary data from December Bay Study reported one Adult LFS (FL = 106 mm) and 1 juvenile LFS (FL = 70 mm) were collected in the lower Sacramento River as well as three adult (FL = 94 – 100 mm) and 20 juvenile LFS collected in Suisun Bay. (**Note:** December Bay Study sample collection is not complete, and data is preliminary). LFS adults are entering the Delta based on detections by Chipps Island Trawl and preliminary Bay Study data. There is evidence that the spawning migration has begun. Based on our understanding of LFS life history, the SMT believes that spawning has begun but hatching has not commenced. Risk of entrainment has increased slightly due to increased exports; however overall risk of adult entrainment remains low. LFS are present within the Delta, however, there have been no detections in the lower San Joaquin River or in the south Delta.

Adult salvage is rare and the SMT determined that adults are at low risk of entrainment though detections in the SDWSC, by FMWT in October, and X2 position indicate that spawning may occur further upstream than in wetter years. Due to dry hydrology, the SMT expects to see larvae in the central and south Delta when they begin to emerge.

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
 - LFS: Low
- Routing Risk (Behavior and life history):
 - DS: Low
 - LFS: Moderate. Spawning migration has begun and the upstream location of X2
- Overall Entrainment Risk
 - DS: Low
 - LFS: Low
 - Lack of detections in the Lower San Joaquin/South Delta
 - Adult salvage is historically rare

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: Medium risk if DS are present, however low turbidity in the region reduces the probability that they are present.
 - LFS: Medium risk if LFS are present in the Lower San Joaquin River and south Delta, however no LFS have been detected by EDSM in that region.
- 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: No change
 - LFS: Increased risk due to more negative OMR. Overall risk remains low due to lack of detections and historic salvage trends.
- Reporting Old and Middle River Index (OMRI) (Number and range of OMRI bins will vary based on anticipated hydrology and operations)
 - OMR management has not been initiated.

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.

8.3.1 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 is 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 expanded 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 index¹ divided by 10, OR

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.

- 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).

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 go into effect December 1st. The Smelt Monitoring Team (SMT) conducted a Risk Assessment based on COA 8.1.5.2.

8.3.1: Conditions have not exceeded thresholds described in this COA.

8.3.3: No adult LFS have been salvaged. The FMWT LFS indices for September and October are 1 and 12, respectively. The LFS index for November is not yet available. Therefore, the expanded salvage threshold to trigger this COA is 1 LFS until it is updated to include the November index.

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 gates closed on 11/30/2021.
 - OMR management has not been initiated.
 - Grantline barrier has been breached. This changes the OMRI calculation.
- Controlling Factors: E:I
- Water Temperature:
 - Clifton Court Forebay (CCF) Daily Average Water Temperature = NA
 - 3 Station Average = 11.23°C
- Tidal Cycle: Not discussed
- Turbidity:
 - 8.3.1 Freeport 3-day average = 3.60 formazin nephelometric units (FNU)
 - Hourly turbidity readings at Freeport reached 16 FNU and may increase

- 8.5.1 Old River at Bacon Island (OBI) Turbidity = NA
- Salinity: X2 = >82 km, estimated at 97.12km for Sacramento River
- 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: Increased to 1,500 cfs on 12/13/2021 and is projected to increase to 3,000 cfs on 12/14/2021 and 12/15/2021.
 - Jones: Increased to 1,700 cfs on 12/13/2021 and is projected to increase to 3,700 cfs on 12/14/2021 then to 4,200 cfs on 12/15/2021
- Meteorological Forecast: Major storm system passed through region over past several days. Runoff is expected to move through system over next several days. Potential for a smaller system this week and early next week.
- Storm Event Projection: NA

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

- DCC Gates position: Closed 11/30/2021.
- Sacramento River flow at Freeport: 7,000 cfs and may peak at 27,000 cfs in the coming days.
- San Joaquin River flow at Vernalis: 600 cfs and may peak at 1,600 cfs in the next couple days.
- Qwest: Expected to reach 5,000 cfs to 8,000 cfs then may trend negative after storm pulse passes through system.
- OBI Turbidity: NA
- Expected changes in South Delta Exports: CVP may reach maximum exports on 12/14/2021. SWP will operate to the E:I ratio. SWP exports may reach 5,000 cfs depending on hydrology and future precipitation.
- NDOI: 11,000 cfs and increasing. May peak as high as 30,000 cfs briefly.
- OMR is expected to reach -7,000 cfs.
- Upstream releases: (Note: upstream releases may increase due to flood management)
 - Keswick = 3,250 cfs
 - Nimbus = 550 cfs
 - Goodwin = 200 cfs
 - Oroville = 1,500 cfs decreasing to 950 cfs by end of the week.

Table 1: Comparison of OMR and OMR Index (5-day and 14-day averages for OMR Index and USGS gauge were reported on [SacPAS website](#), accessed 12/7/2021.

Date	Averaging Period	USGS gauges (cfs)	Index (cfs)
12/14/21	Daily	Not Reported	-5,500 cfs
12/11/21	5-day	-920 cfs	-1,230 cfs
12/11/21	14-day	-1,560 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 Delta Smelt detection occurred on 8/20/2021 in the SDWSC.
- EDSM: No Delta Smelt have been collected during recent sampling.
- Fall Mid-water Trawl (FMWT) Index for Delta Smelt: September and October Indices = 0.
- Delta Smelt life cycle model (LCM) discussion: NA
- Biological Conditions: NA
- % of population in Delta zones: NA
- Smelt Larva Survey (SLS) began on 12/13/2021.
- Salvage: No DS have been salvaged at either facility.

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

- FMWT Index: September Index = 1, October Index = 12. November index is not yet available.
- Other Surveys:
 - EDSM: Six juvenile LFS was detected in Suisun Marsh by EDSM on 12/9/2021 and an additional nine LFS (FL = 63 – 90 mm) were collected in the Suisun Marsh stratum on 12/13/2021 (NOTE: The nine LFS collected by EDSM on 12/9/2021 will appear on the next catch table).
 - Chipps Island Trawl: Sixteen adult LFS (FL ≥ 85 mm) and 11 juvenile LFS (FL < 84 mm) were collected from 12/6/2021 to 12/9/2021
 - Bay Study: Preliminary results from December Bay Study reported one adult LFS (FL = 106 mm) and one juvenile (FL = 70 mm) collected in the Lower Sacramento River, as well as three adults (FL = 94 – 100 mm) and 10 juveniles (FL = 57 – 82 mm) collected in Suisun Bay. Data presented here is based on stations sampled as of 12/6/2021. Data is preliminary and subject to change pending quality assurance/quality control procedures.
 - Salvage: No LFS have been salvaged at either facility.

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

The SMT used an excel worksheet to estimate X2 for the Sacramento and San Joaquin Rivers.

Notes:

- CDFW provided an update on the interpretation of COA 8.3.3. LFS smaller than 85 mm FL collected during the period in which this COA is active will count towards the salvage threshold.
- Experimental release of Delta Smelt is ongoing. Timing of release was adjusted due to wind.
- December SLS was delayed due to weather. SLS sampled 2 stations on 12/13/2021.
- The SMT discussed the potential for a first flush event. Conditions did not reach the thresholds described in COA 8.3.1. The SMT will review conditions at the next SMT meeting and assess the possibility that the recent storm event could trigger DS migration.
- The SMT discussed how current conditions may set up a juvenile LFS entrainment event in March. Dry conditions, as indexed by X2, are expected to shift the spawning distribution of LFS upstream potentially placing emerging larvae at risk of entrainment. LFS larvae are expected to begin emerging in late December. Larval and juvenile LFS protections do not go into effect until January 1st which limits the actions the SMT can take. Currently the SMT can provide advice for the protection of adults under COA 8.3.3 which would initiate OMR management.
- Discussion regarding the FMWT LFS index and the shift in the proportion of catch occurring in November and December will happen over email.

Literature Cited

Davis, Brittany E., Dennis E Cocherell, Ted Sommer, Randall D Baxter, Tien-Chieh Hung, Anne E Todgham, Nann A Fangué, Sensitivities of an endemic, endangered California smelt and two non-native fishes to serial increases in temperature and salinity: implications for shifting community structure with climate change, Conservation Physiology, Volume 7, Issue 1, 2019, coy076, <https://doi.org/10.1093/conphys/coy076>

Jassby, Alan D., William J. Kimmerer, Stephen G. Monismith, Charles Armor, James E. Cloern, Thomas M. Powell, Jerry R. Schubel, Timothy J. Venlinski (1995) Isohaline Position as a Habitat Indicator for Estuarine Populations. Ecological Applications, 5:1, 272-289, DOI: <https://doi.org/10.2307/1942069>

Sommer, T., F. Mejia, M. Nobriga, and L. Grimaldo. 2011. The Spawning Migration of Delta Smelt in the Upper San Francisco Estuary. San Francisco Estuary and Watershed Science 9(2), DOI: <https://doi.org/10.15447/sfews.2014v9iss2art2>

Attachments: Table 1: EDSM Catch Table, Figure 1: EDSM Sample Locations, Table 2: Chipps Island Catch Table, Table 3: Preliminary Bay Study Data, Figure 2: Bay Study Sample Locations

Table 1: Delta Smelt (DSM) and Longfin Smelt (LFS) catch per station for EDSM 2022 Phase 1 Kodiak trawls, from 12/6/2021 – 12/9/2021. These data are preliminary and subject to change.

Year	Phase	Station Code	Date	# Tows	Species	Fork Length	Total Catch	Stratum
2022	1	22-19-SBW01	12/7/2021	4	NA	NA	NA	Suisun Bay
2022	1	22-19-SBW02	12/7/2021	4	NA	NA	NA	Suisun Bay
2022	1	22-19-SBW03	12/7/2021	4	NA	NA	NA	Suisun Bay
2022	1	22-19-CF01	12/8/2021	3	NA	NA	NA	Suisun Bay
2022	1	22-19-SBM01	12/8/2021	4	NA	NA	NA	Suisun Bay
2022	1	22-19-SBW04	12/8/2021	4	NA	NA	NA	Suisun Bay
2022	1	22-19-GB01	12/6/2021	4	LFS	65	1	Suisun Marsh
2022	1	22-19-GB01	12/6/2021	4	LFS	67	1	Suisun Marsh
2022	1	22-19-GB01	12/6/2021	4	LFS	70	1	Suisun Marsh
2022	1	22-19-GB01	12/6/2021	4	LFS	74	1	Suisun Marsh
2022	1	22-19-GB01	12/6/2021	4	LFS	77	1	Suisun Marsh
2022	1	22-19-GB01	12/6/2021	4	LFS	83	1	Suisun Marsh
2022	1	22-19-SM01	12/6/2021	4	NA	NA	NA	Suisun Marsh
2022	1	22-19-SM03	12/6/2021	4	NA	NA	NA	Suisun Marsh
2022	1	22-19-RV01	12/7/2021	4	NA	NA	NA	Lower Sac River
2022	1	22-19-RV02	12/7/2021	4	NA	NA	NA	Lower Sac River
2022	1	22-19-RV03	12/7/2021	4	NA	NA	NA	Lower Sac River
2022	1	22-19-LSR01	12/8/2021	2	NA	NA	NA	Lower Sac River

Year	Phase	Station Code	Date	# Tows	Species	Fork Length	Total Catch	Stratum
2022	1	22-19-LSR02	12/8/2021	4	NA	NA	NA	Lower Sac River
2022	1	22-19-RV04	12/8/2021	4	NA	NA	NA	Lower Sac River
2022	1	22-19-LSJ01	12/8/2021	4	NA	NA	NA	Lower San Joaquin River
2022	1	22-19-LSJ03	12/8/2021	4	NA	NA	NA	Lower San Joaquin River
2022	1	22-19-LSJ04	12/8/2021	4	NA	NA	NA	Lower San Joaquin River
2022	1	22-19-LSJ02	12/9/2021	4	NA	NA	NA	Lower San Joaquin River
2022	1	22-19-PP01	12/9/2021	4	NA	NA	NA	Lower San Joaquin River
2022	1	22-19-SJT01	12/9/2021	4	NA	NA	NA	Lower San Joaquin River
2022	1	22-19-CS01	12/6/2021	4	NA	NA	NA	Cache Slough
2022	1	22-19-CS02	12/6/2021	4	NA	NA	NA	Cache Slough
2022	1	22-19-CS03	12/6/2021	4	NA	NA	NA	Cache Slough
2022	1	22-19-LSSC01	12/9/2021	2	NA	NA	NA	Sac Deep Water Ship Channel
2022	1	22-19-LSSC02	12/9/2021	2	NA	NA	NA	Sac Deep Water Ship Channel

Year	Phase	Station Code	Date	# Tows	Species	Fork Length	Total Catch	Stratum
2022	1	22-19-USSC01	12/9/2021	2	NA	NA	NA	Sac Deep Water Ship Channel
2022	1	22-19-MIW01	12/6/2021	4	NA	NA	NA	Southern Delta
2022	1	22-19-MIW02	12/6/2021	4	NA	NA	NA	Southern Delta
2022	1	22-19-MRW01	12/6/2021	4	NA	NA	NA	Southern Delta
2022	1	22-19-FT01	12/7/2021	4	NA	NA	NA	Southern Delta
2022	1	22-19-HC01	12/7/2021	4	NA	NA	NA	Southern Delta
2022	1	22-19-OR01	12/7/2021	4	NA	NA	NA	Southern Delta
2022	1	22-19-CQS01	12/9/2021	4	NA	NA	NA	Western Delta
2022	1	22-19-CQS02	12/9/2021	4	NA	NA	NA	Western Delta
2022	1	22-19-SPE02	12/9/2021	4	NA	NA	NA	Western Delta

DSM collected during Phase 1 are transferred alive to FCCL to contribute to DSM brood stock if tow temperatures are below 17°C. If tow temperatures are above 17°C, DSM are flash frozen in liquid nitrogen and transferred to UC Davis. Processing is complete through 12/9/2021.

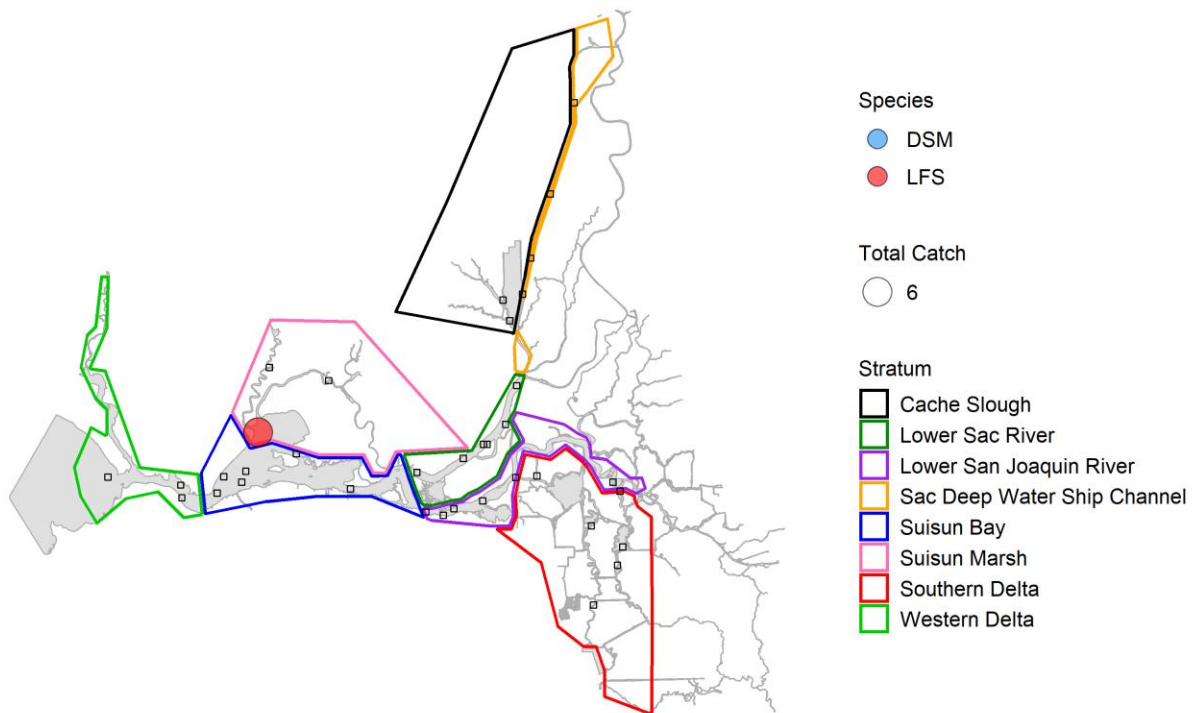


Figure 1: Delta Smelt (DSM) and Longfin Smelt (LFS) catch per station for EDSM 2022 Phase 1 Kodiak trawls, from 12/6/2021 – 12/9/2021. Sites with no DSM or LFS catch are indicated with squares.

Table 2: Delta Smelt (DSM) and Longfin Smelt (LFS) catch in Chipps Island mid-water trawls from 12/6/2021 – 12/9/2021. These data are preliminary and subject to change.

Year	Station Code	Date	Species	Fork Length	Total Catch	Maturation	Special Study	Location
2021	SB018M	12/9/2021	LFS	57	1	n/p	n/a	Chipps Island
2021	SB018M	12/9/2021	LFS	72	1	X	n/a	Chipps Island
2021	SB018M	12/9/2021	LFS	105	1	n/p	FCCL	Chipps Island
2021	SB018M	12/9/2021	LFS	105	1	n/p	FCCL	Chipps Island
2021	SB018M	12/9/2021	LFS	112	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	98	1	n/p	FCCL	Chipps Island

Year	Station Code	Date	Species	Fork Length	Total Catch	Maturation	Special Study	Location
2021	SB018N	12/9/2021	LFS	98	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	100	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	100	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	109	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	109	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	94	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	100	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	110	1	n/p	FCCL	Chipps Island
2021	SB018N	12/9/2021	LFS	63	1	n/p	n/a	Chipps Island
2021	SB018N	12/9/2021	LFS	68	1	X	n/a	Chipps Island
2021	SB018N	12/9/2021	LFS	73	1	X	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	107	1	n/p	FCCL	Chipps Island
2021	SB018M	12/10/2021	LFS	60	1	n/p	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	61	1	n/p	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	67	1	X	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	72	1	X	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	74	1	X	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	75	1	X	n/a	Chipps Island
2021	SB018M	12/10/2021	LFS	93	1	n/p	FCCL	Chipps Island

Year	Station Code	Date	Species	Fork Length	Total Catch	Maturation	Special Study	Location
2021	SB018M	12/10/2021	LFS	100	1	n/p	FCCL	Chipps Island
2021	SB018S	12/10/2021	LFS	92	1	n/p	FCCL	Chipps Island

LFS > 80 mm fork length collected in Chipps Island trawls during Dec - Apr are transferred alive to FCCL to contribute to LFS brood stock if tow temperatures are below 14.5°C. LFS collected >65 mm are checked for expression (M=milt, E=Eggs, X=no expression). Fish transferred to FCCL are NOT expressed. All DSM collected will be retained and flash frozen in liquid nitrogen for genetic analysis and ID verification.

Table 3: Preliminary Bay Study Data. Nets are otter trawl (OT) or mid-water trawl (MWT). **NOTE:** December Bay Study sample collection is ongoing. Data presented here is based on stations sampled as of 12/6/2021. Preliminary and subject to change pending quality assurance/quality control procedures.

Station	FL	Net	Life Stage
761	106	OT	Adult
736	70	MWT	Juvenile
535	59	MWT	Juvenile
535	64	MWT	Juvenile
535	74	OT	Juvenile
534	100	MWT	Adult
534	64	MWT	Juvenile
433	63	MWT	Juvenile
433	60	MWT	Juvenile
433	61	MWT	Juvenile
433	94	OT	Adult
432	70	MWT	Juvenile
431	61	OT	Juvenile
431	65	OT	Juvenile
431	77	OT	Juvenile
431	84	OT	Juvenile
430	61	OT	Juvenile
430	73	OT	Juvenile
430	57	OT	Juvenile
429	58	MWT	Juvenile
429	59	MWT	Juvenile
429	73	MWT	Juvenile
428	73	MWT	Juvenile
428	82	MWT	Juvenile
427	94	OT	Adult

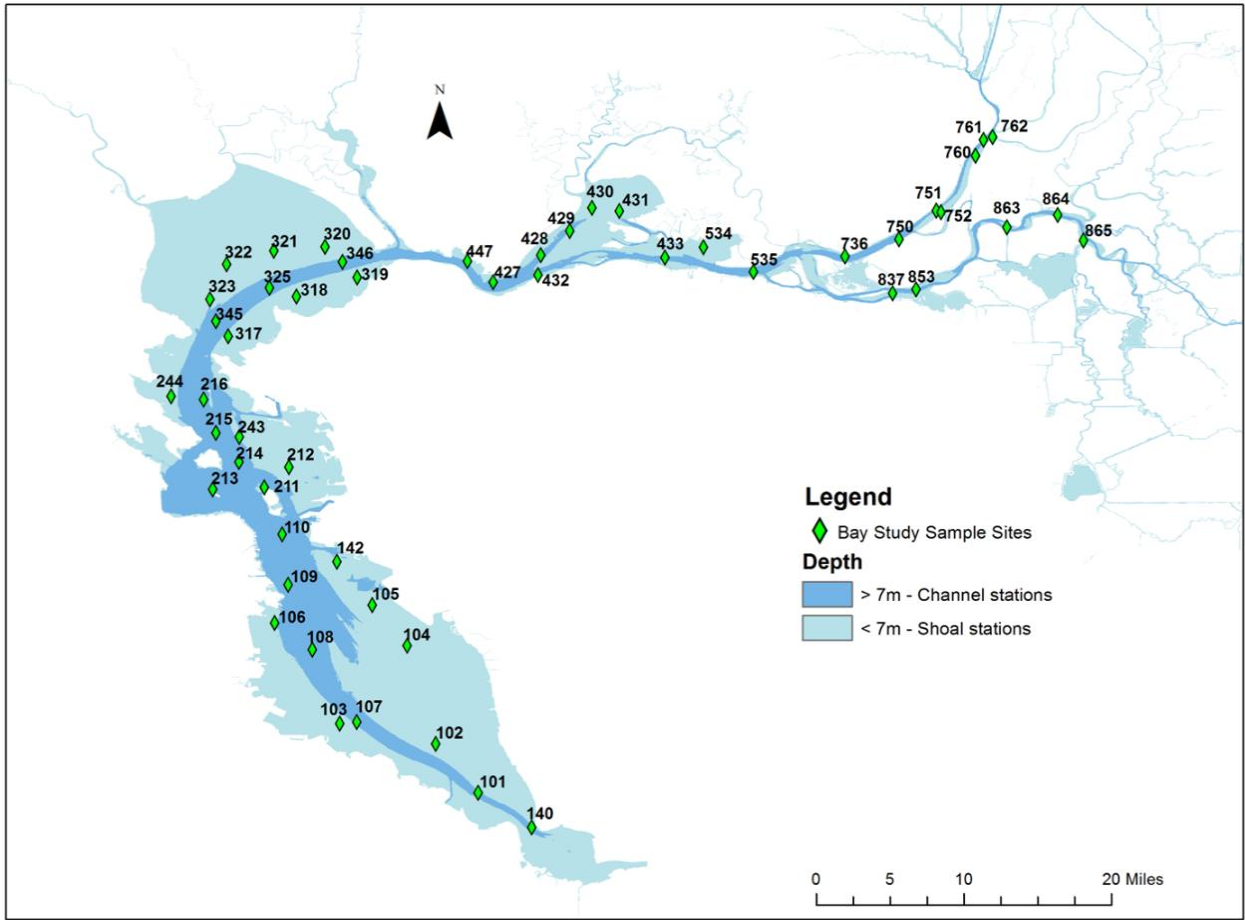


Figure 2: Map of Bay Study sampling locations