Science Plan to Assess the Effects of Ambient Environmental Conditions and Flow-Related Management Actions on Delta Smelt

Appendices

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Appendix 1. Summary of Recent Scientific Developments

Delta Smelt Condition and Vital Rates

Studies of juvenile Delta Smelt collected in 2012 and 2013 showed that those in Suisun Marsh were in better nutritional and histopathological condition than in other regions (Hammock et al., 2015). The same study found that fish in the Suisun Bay and Cache Slough regions showed the most severe signs of nutritional and contaminant related stress, respectively. Relatively poor nutritional status was identified in juveniles from the Suisun Bay region, and the Confluence to a lesser extent. Further, juvenile Delta Smelt collected in Suisun Marsh exhibited relatively good nutritional, growth and morphometric status compared to those collected at the Confluence and in Suisun Bay. The authors suggest that contaminant exposure maybe damaging the livers and gills of juveniles in the freshwater portions of its range, particularly in Cache Slough.

Variation in Delta Smelt vital rates has also been found among sites and among years. Studies of the fall of 2011 (Wet Year) and 2012-2014 (Below Normal to Critically Dry Years) found marginal otolith accretion appeared to be lower for individuals having spent the fall in salinity habitats greater than 2.5psu. Otolith accretion rates in September 2011 were approximately 1.5 times faster than September accretion rates for the 2012-2014 years (Hobbs, 2015 unpublished). The same study found that fish fork-length and fall growth had a significant positive effect on fecundity, and freshwater resident fish had slightly higher fecundity than migratory fish. Growth rates did not respond to higher freshwater outflow (Hobbs and Bush, 2015 unpublished).

While field studies of spawning are limited, fecundity can be examined from females collected during the spawning window, the length of which depends on water temperature. Examination of near-ripe females collected from 2012 through 2015 enabled the identification of the relationship of fecundity and length (Damon et al., 2017). The same study found that females continued to grow throughout the spawning season, with the largest females being ready to spawn first and producing the largest clutches. Delta Smelt were found to be serial spawners, capable of producing multiple clutches of eggs. Small females produced fewer and smaller clutches.

Delta Smelt Distribution

Delta Smelt occur in a wide range of channel sizes, although Sommer & Mejia (2013) note that they seem to be rarer in small channels (<15 m wide) even though there is some evidence that open water adjacent to habitats with long water-residence times (e.g. tidal marsh, shoal, low-order channels) may be favorable. Most long-term monitoring programs do not currently target Delta Smelt in shallow waters and natural littoral edges, of which only very small amounts remain compared to historic conditions. The Enhanced Delta Smelt Monitoring program has been developed to provide finer temporal resolution information than existing surveys provided about Delta Smelt spatial distribution. Recent electrofishing surveys in flooded islands of the delta (Young et al., 2018) did not catch any Delta Smelt but they note the limitations of electrofishing for small fish. Brown & Michniuk (2007) similarly found few Delta Smelt in electrofishing surveys of shoreline habitats. Other researchers have used modified plankton nets, beach seines and gill nets and few consistent patterns emerge of Delta Smelt use of shallow water habitats (Grimaldo et al. 2004; McLain & Castillo, 2009; Nobriga et al. 2005).

Abiotic Conditions

The ways in which physical conditions in the estuary are determinants of Delta Smelt distribution and how they influence factors such as foraging and health has been the subject of both field and laboratory study.

Turbidity/Suspended Sediment

The relationship of Delta Smelt distribution to turbidity (Feyrer et al., 2011) has been investigated in more detail by Hasenbein et al. (2013) who exposed juvenile Delta Smelt to turbidities of up to 250 NTU for 24 hours (with salinity at 12ppt) and examined feeding across this range. Mortality increased above 120 NTU and overall there was negative relationship between turbidity and feeding performance with highest feeding rates at low turbidity (<12 NTU), relatively persistent feeding rates over 12–120 NTU, and a strong decline in feeding rates at levels of 250 NTU.

The combined role of wind resuspensions and tidal advection in controlling spatial patterns of turbidity in Suisun Bay is well established, as is the long-term decline in sediment delivery to the estuary. Further, a recent study documented a 1995-2015 decline in monthly averaged wind speed for October to January for 10 of 11 wind station around the estuary, with no such widespread trends for February to September (Bever et al., 2018). The authors combined this decrease with modeling to show this could result in a 12NTU decrease in turbidity during the time of year when turbidity is normally lowest in Suisun Bay.

In addition, recent studies in Suisun Bay (Brown, 2017) have examined the dynamics of the erodible sediment pool – a source for locally generated turbidity – in Suisun Bay. USGS found that cumulative sediment deposition in Suisun Bay is negative in high flow years such as 2006 and 2011, and during low flow years Suisun Bay imports sediment from its landward and seaward boundaries resulting in net deposition. Suisun Bay deposition is well-correlated (negatively) with Delta outflow. They conclude that Suisun Bay is likely approaching a state of dynamic equilibrium with no significant trend in sediment supply from the Delta since 1999. The same report examines recent dynamics in the sediment pool in the Liberty/Cache system. Examination of the relationship between suspended sediment concentration and bed shear stress showed a greater slope in both 2016 and 2017 after Yolo Bypass inflow than before. This indicates a more erodible sediment bed. The fraction of fines in suspension also increased at most stations in 2017 following the high Bypass flows.

Salinity

Several recent experiments examined an array of Delta Smelt responses to salinity in the laboratory. Hammock et al. (2017) found no evidence that salinity influenced the metabolic demand of Delta Smelt following acclimation. They concluded that differences in stomach fullness between freshwater and brackish habitats unlikely to be caused by differences in osmoregulatory costs. Acclimation to various salinities was examined by Kammerer et al. (2016) who looked at the effects of increases of 4ppt on adults. They found no apparent increase in length or weight occurred nor did a difference in survival compared to the control up to 10 ppt and found acclimation to be achieved within a few days. Pre-spawning adults were found to effectively osmoregulate and regain homeostasis, via coordinated molecular responses, following salinity increases (Komoroske et al., 2016), and fish rapidly adjusted to considerable increases in osmotic gradients.

Velocity

Several studies, using different approaches, have specifically identified Delta Smelt response to velocity. Bennett & Burau (2015) analyzed data from their field study using Kodiak trawls and beach seines. They found Delta Smelt occurrence was best explained by current velocity and turbidity in trawls, whereas for beach seine, only current velocity was a significant predictor. Bever et al. (2016) examined historical survey data and found that three metrics (% time salinity was less than 6 psu, the maximum depth-averaged current speed, and the Secchi depth at each FMWT station) in the vicinity of Suisun Bay were the most predictive of historical Delta Smelt catch (FMWT).

Contaminants

A number of ongoing studies relate the effects of contaminants on foodwebs and species in the Delta (see http://scienceconf2018.deltacouncil.ca.gov/content/full-conference-program). Fong et al. (2016) summarized the state of the science. They reviewed studies using ambient water and concluded that there is evidence to support that contaminants are bioavailable in Bay–Delta waters at concentrations that are affecting Delta Smelt. They also noted laboratory studies with cultured fish and contaminants at levels detected in the Delta. Findings included decreased growth, abnormal development, and altered behavior associated with exposure to pyrethroids, and effects on immune, nervous, and muscular systems from exposure to copper. Ammonium induced effects were similar, affecting immune- and muscular-system functioning, as well as development and behavior.

Combined Effects of Abiotic Factors

A recent study used a smoothing term to examine regional variation in Delta Smelt catch in the Spring Kodiak Trawl and identified density hot spots which were consistent between cohorts (Polansky et al., 2018). In contrast to previous work on subadults (Feyrer et al., 2011), Polansky et al. found that salinity and turbidity explained very little of the variation in adult Delta Smelt catch when the regional spatial adjustment to density was included. Polansky et al. conclude that while suitable local environmental conditions are necessary to explain the distribution and abundance of adult Delta Smelt, they are not sufficient. This was also noted by (Manly et al., 2015).

Food Availability

This section outlines recent studies which have examined changes zooplankton and other prey over time, their spatial distribution, and utilization by smelt. In addition, flow related studies of phytoplankton blooms, clam grazing and other factors influencing food are considered. Few recent papers have addressed the effect of contaminants on Delta Smelt prey although a recent synthesis noted that smelt prey organisms exhibit effects when exposed to ambient Delta waters or control waters amended with Delta-relevant concentrations of contaminants (Fong et al., 2016).

Delta Smelt Prey

The type of prey utilized by Delta Smelt by life stage/season has previously be characterized (Baxter et al., 2015). A detailed study of Delta Smelt collected between April and September in 2005-2006 showed copepods comprised over 90% of their diet by number and over 85% by weight (Slater & Baxter, 2014). This study also documented high feeding (numerical and weight based) on *L. tetraspina* between July - September. During development from larvae through juvenile stages, Delta Smelt initially consumed *E. affinis* nauplii, then copepodites, followed by *E. affinis* and *P. forbesi* adults, and finally to *S. doerrii, A. sinensis* and *Tortanus* spp., and less-common mysids and amphipods. A study of foraging success of wild Delta Smelt in freshwater and brackish regions across seasons (collected between Aug 2011 and May 2014) showed stomach fullness was 1.54-fold higher for Delta Smelt caught in brackish habitat than in freshwater (Hammock et al., 2017). The effect was consistent across the three-year period. The authors also found foraging efficiency (i.e., the ratio of prey items in Delta Smelt stomachs to mesozooplankton abundance in the water column) was significantly higher in brackish regions and increased significantly from summer to fall surveys. Stomach fullness peaked at 2±4 psu and was 1.5-fold higher in brackish than freshwater averaged across all seasons. Juveniles did appear to be under nutritional stress in parts of their brackish habitat in summer but for most of the year, foraging success was higher in brackish regions. The authors also note that temperature was poorly correlated with stomach fullness and cannot easily explain the large seasonal shifts in stomach fullness between freshwater and brackish habitats.

Changes over Time

The zooplankton community has been influenced by several invasive species. *Limnoithona tetraspina* significantly increased in Suisun Bay region beginning in the mid-1990 and is now the most abundant copepod species in the Suisun Bay and confluence region (Baxter et al., 2015). *Acartiella sinensis* invaded at the same time as *L. tetraspina* and has also reached considerable densities in Suisun Bay and the western Delta over the last decade.

A review of change in the pelagic food web over time found that between 1972 and 1980 phytoplankton biomass and abundance of rotifers, *E. affinis*, and *N. mercedis* declined by greater than two-fold (Brown et al., 2016). These authors also describe important changes in Suisun Bay and the western Delta post 1987 associated with the invasion of *Potamocorbula amurensis.* These include a five-fold decrease in phytoplankton biomass, a shift in the size distribution of phytoplankton toward smaller cells, dramatic reduction in production by diatoms, decline in abundance of brackish-water rotifers and *E. affinis* and other copepods (apparently from predation by and competition with clams), and decline in abundance of the mysid *N. mercedis* in brackish water (reduced food supply). They also note that biomass of copepods in the low salinity zone (LSZ) decreased less than the biomass of phytoplankton, rotifers, or mysids, due to the departure of Northern Anchovy (planktivorous fish), and because newly introduced species used resources previously used by *E. affinis*.

A study examining trends between 1972 and 2014 from the zooplankton monitoring program of the California Department of Fish and Wildlife (CDFW) for stations San Pablo Bay, Suisun Bay, Suisun Marsh, through the Delta Confluence up to the South Delta showed that all zooplankton taxa, except cyclopoids, exhibited a shift to earlier peak abundance across time (Merz et al., 2016). These authors also found that the mean timing of peak abundance of *Eurytemora* shifted 3 months earlier across time. The overall abundance of *Eurytemora* was also found to have declined significantly for this species since the mid-1980s, while *Pseudodiaptomus* abundance simultaneously rose.

A decline in mesozooplankton abundance since the 1970s has been identified in both freshwater and brackish (>0.55 psu) habitat (Hammock et al., 2017) with the steepest decline occurring in brackish regions. Averaged across the 44-year dataset, copepods and cladocerans comprised 45.5 and 36.1% of the freshwater mesozooplankton, respectively; and 73.2 and 3.8% of the brackish mesozooplankton. The same study found that mesozooplankton abundance was higher in freshwater than brackish overall with the greatest difference in the summer and no significant difference in fall and winter.

Monitoring data from 1994 to 2015 was combined with short term studies from 2010-2012 to elucidate factors influencing *P. forbesi* (Kimmerer et al., 2018c). The found that the abundance of *P. forbesi* in fresh water rose rapidly in spring of each year to a seasonal maximum in July–September, then began to decline in October. The timing of the abundance increase varied with freshwater flow, while the summer abundance maximum in fresh water, higher than the summer maximum in Suisun, did not vary with flow. In addition, neither egg production rate nor stage durations nor, by implication, growth rate of *P. forbesi* varied with freshwater flow.

Spatial Distribution

The LSZ is presently a net sink for phytoplankton, organic matter, and zooplankton (Brown et al., 2016) due to grazing pressure (recent studies outlined below). However, summer abundance of *P. forbesi* in the LSZ increases with increasing flow (Kimmerer et al., 2018c). This does not appear to be related to a stimulation of growth or reproduction as neither of these, or chlorophyll were related to flow. Rather it appears to be due to advection of copepods from their freshwater population center to the low-salinity zone. Further work combining *P. forbesi* data with a box model to simulate movement (Kimmerer et al., 2018a) showed sharp gradients in abundance vs. salinity, potentially resulting from high seaward *in situ* mortality rates or from a reduction in dispersion. There were more adults at higher salinities likely due to mortality of nauplii and copepodites at lower salinities. The study concludes that 'spatial subsidies can shore up a population in places where spatial losses and in situ mortality together exceed its productive capacity'.

A study of the abundance and dynamics of zooplankton in the Cache Slough Complex in 2015 showed the abundance of P. *forbesi* was similar to freshwater reaches of the central and eastern Delta and higher than that in the adjacent Sacramento River (Kimmerer et al., 2018b). In addition, growth rate of *P. forbesi* was higher than previously measured in large estuarine channels because of higher temperature and phytoplankton biomass in the region. Samples of *P. forbesi* examined with molecular techniques contained an unexpectedly high proportion of DNA from cyanobacteria and little DNA from more nutritious phytoplankton.

A recent study examined smaller scale spatial gradients in zooplankton in the western delta (Kimmerer & Slaughter, 2016). Samples were collected along transects from nearshore to the channel and found little consistent pattern in abundance. Except for *P. forbesi*, there was little difference between transects conducted by day and by night. Abundance of the two most common copepods was found to have distributions consistent with IEP monitoring during the same time frame showing IEP sampling to be representative of daytime abundance patterns for zooplankton in the centers and margins of the channels where samples are taken. It is also representative of nighttime abundance for species that are not demersal or in areas where high turbidity depresses migratory behavior of demersal species.

Phytoplankton

Phytoplankton large enough to be readily consumed by copepods (and clams) make up only about half of the spring–summer primary production in the LSZ (Brown et al., 2016). The same synthesis also notes that growth and reproduction of all three species of copepod that are abundant during summer in the LSZ are food limited, and that phytoplankton provide less support to copepods and other consumers since 1993 than before 1993. How changes in food influence Delta Smelt was tested using an individual-based model (Kimmerer & Rose, 2018) by substituting historical food for present-day food. The result was higher juvenile consumption and growth rates, leading to larger recruits, earlier maturity, and higher individual fecundity. Results were robust to four sets of simulations using alternative formulations for density dependence, mortality, maturity, and larval growth.

Food limitation of *P. forbesi* was demonstrated by a persistently low development index (Kimmerer et al., 2018c) and the relationship of the index for late copepodites to chlorophyll concentration. However, the poor fit of the relationships indicated that chlorophyll concentration may be a poor proxy for food supply for *P. forbesi*. The study suggests this may be because copepods were chronically stressed and unable to grow at their maximum rate.

Despite changes, phytoplankton blooms can still occur within the estuary. For example, a large export of phytoplankton biomass out of the north Delta and into the estuary was documented in spring of WY 2017 (Brown, 2017). The phytoplankton was likely produced in the Yolo Bypass and exported whilst it was draining. Observations within Yolo Bypass suggest that much of the phytoplankton production occurs in the shallower western part of the Bypass, where residence time is longer. The same report describes a significant phytoplankton bloom was in the confluence area and at Decker Island in July of WY 2017. The bloom propagated up-river from the confluence area to past Decker Island, depleting the nitrate pool and elevating the dissolved oxygen concentrations. USGS high speed mapping during the bloom and analysis of available data ruled out Sherman Lake or other nearby areas as the source of the bloom, indicating that the bloom was active in the deep channels of the confluence region and lower Sacramento River, showing that blooms can be sustained in deep, fast-flowing channels.

Role of Clams

Biomass accumulation of phytoplankton can be controlled by grazing, and phytoplankton biomass is higher in both the freshwater Delta and the seaward higher-salinity areas than in the LSZ (Brown et al., 2016). Clam grazing is depressing phytoplankton biomass in the LSZ and the upstream and downstream areas are providing a spatial subsidy to the LSZ. The same synthesis also notes that mortality of *P. forbesi* and other copepod nauplii from P. amurensis grazing in the LSZ is high despite strong escape responses.

The distribution and dynamics of bivalve biomass was examined using data from 1977 to 2013 (Crauder et al., 2016). They found that during winter of most years, *Potamocorbula* biomass was low at all locations and was near zero at the shallow San Pablo Bay station. Biomass at shallow stations consistently peaked during summer and fall, but they found no consistent peak season in the deep stations. *Corbicula* had a much less consistent seasonal biomass pattern than *Potamocorbula*. *Potamocorbula* recruitment occurred anytime between spring and fall, with the most downstream stations recruiting in spring and the most upstream stations recruiting in fall. Recruitment in Grizzly Bay was varied in timing. The conceptual model for the distribution of *Corbicula* and *Potamocorbula* is based on the physiological salinity limits of the recruits (*Potamocorbula* ≥ 2, *Corbicula* ≤ 2) and the adults (*Potamocorbula* > 0, *Corbicula* < 10) of each species.

Using data from 2007 to 2016, USGS (Brown, 2017) showed clam grazing rates were highest in Suisun Marsh and second highest grazing rates were in Suisun Bay with *Potamocorbula* are dominant benthic grazers in the LSZ. In 2011 biomass decreased in spring (except in Suisun Bay) due to lower salinity especially in the shallows where the populations disappear every winter. The shallowest areas, Grizzly Bay and Honker Bay, showed significant declines in biomass in the wet year 2011. Biomass in Sacramento River South, Confluence, Honker Bay, Suisun Bay and SJR West all declined in 2014 but less than in 2011. The report also shows the percent split between biomass in spring and summer differed before and after 2011. This may reflect recruitment patterns: if the freshwater in 2011 resulted in a loss of adults, the individual bivalves may take time to get as large as they were before 2011.

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Appendix 2. Summary of Relevant Current Monitoring Activities

IEP Programs

Fall Midwater Trawl Survey (FMWT)

The Fall Midwater Trawl Survey (FMWT) provides long-term abundance trend information for age-0 Striped Bass, age-0 American Shad, Splittail Threadfin Shad, Delta Smelt, and Longfin Smelt. These data will be used by CDFW personnel in conjunction with other survey data to determine species status and to evaluate the success of various mitigation and restoration plans for fishes in the estuary.

Summer Townet Survey (STN)

The Summer Townet Survey (STN) samples throughout the summer with a towed, small mesh net from eastern San Pablo Bay throughout the Delta to monitor the annual abundance and distribution of juvenile fish in the upper estuary, and evaluate factors affecting abundance. Annual delta smelt and striped bass indices are used to track long-trends of relative abundance. Water quality profile and simultaneous zooplankton samples are collected as well. Data from this element was used to help determine the conservation status of Delta Smelt, Longfin Smelt and Splittail.

Delta Flow Measurement and Database Management

The Delta Flow Network consists of 35 flow and water quality monitoring stations located throughout the Sacramento-San Joaquin Delta; eleven of these stations are supported by the IEP. Data from this network of stations are used by Delta managers and scientists to make real-time decisions and plan for future events such as climate change, water operations, restoration projects, evaluate fish transport, and migration issues. In addition, these data are used to calibrate and validate numerical models that are used to predict water levels, flow speeds, and spatial and temporal evolution of salinity in the Delta.

20mm Delta Smelt Survey (20mm)

A fine-mesh trawl survey that monitors larval and juvenile Delta Smelt and Longfin Smelt distribution and abundance throughout the historical Delta Smelt spring range in the Sacramento-San Joaquin Delta and San Francisco Estuary. Zooplankton and water quality sampling is conducted simultaneously. Sampling is conducted every two weeks from mid-March through mid-July at 35-40 stations from eastern San Pablo Bay through the Delta. The near real-time sample processing enables distribution data to be used by agency managers in the Smelt Working Group to assess risk of Delta Smelt and Longfin Smelt entrainment.

Upper Estuary Zooplankton Sampling

The Zooplankton Study has estimated the abundance of zooplankton taxa in the upper San Francisco Estuary since 1972 as a means of assessing trends in fish food resources and is part of a D-1641 mandate to monitor water quality and related parameters. Sampling with three gear types occurs monthly at 22 stations located throughout San Pablo Bay, Suisun Marsh, Suisun Bay, and the Delta.

Spring Kodiak Trawl (SKT)
This program, established in 2002, was specially designed to sample mature and maturing Delta Smelt from January through May. The surface orientation of the sampling improved detection of Delta Smelt to better inform water export facility operators of the potential to entrain adult Delta Smelt in subsequent weeks as well as their offspring later in the year. Monthly Kodiak trawl sampling occurs from the Napa River and Carquinez Straight through the Delta. Data collected indicates the abundance, distribution and maturity status of adult Delta Smelt and occurrence of spent female Delta Smelt as an indication of the onset of larval recruitment in the Delta.

UCD Suisun Marsh Fish Monitoring
Since 1979, the Suisun Marsh Study has monitored fish populations, especially in response to modifications being made affecting the way water moves through the marsh. Monthly sampling is conducted within 21 sites among nine sloughs in Suisun Marsh, using a combination of otter trawls and beach seines. The objectives of the study are to understand the entire assemblage of fishes in the marsh by examining such factors as, changes in species abundance and composition through time, fish use of various habitats within the marsh, and changes in fish assemblages in association with natural and anthropogenic change.

Smelt Larva Survey (SLS)
This survey provides near real-time abundance and distribution data for Longfin Smelt larvae in the Delta, Suisun Bay and Suisun Marsh. Data are used by agency managers to assess vulnerability of Longfin Smelt larvae to entrainment in south Delta export pumps. Sampling begins within the first two weeks in January and repeats every other week through the second week in March.

Yolo Bypass Fish Monitoring Program (YBFMP)
The objectives of this interdisciplinary monitoring effort are to: (1) collect baseline data on lower trophic levels (phytoplankton, zooplankton and aquatic insects), juvenile fish and adult fish, hydrology and physical conditions; 2) conduct pilot investigations of the temporal and seasonal patterns in chlorophyll-a concentrations, including whether high concentrations are exported from the Bypass during fall flow events after rice field drainage, and 3) investigate the possibility of manipulating bypass flows to benefit listed species like Delta Smelt. The YBFMP operates a rotary screw trap and fyke trap, and conducts biweekly beach seine and lower trophic surveys in addition to maintaining water quality instrumentation in the bypass.

Liberty Island Fish Survey (DJFMP)
Liberty Island is a restoring wetland that provides important habitat for species of management concern, including Delta Smelt and Chinook salmon. This element conducts beach seining every month, and larval and zooplankton trawls from February through July. This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.

Fish Diet and Condition
This study examines differences in the diet and condition of fishes as related to species decline and provides field support (i.e., boats and operators) for related studies focused on contaminants, zooplankton and fish health indices. This study examines the stomach contents of several fishes for changes in diet composition, feeding success and parasite load. Weight at length (body

condition) of fishes will be examined regionally to look for effects of diet, food availability and environmental conditions such as conductivity, temperature, and water clarity.

Yolo Bypass Productivity Export Studies

This study investigates the potential for flow pulses through the Yolo Bypass to trigger phytoplankton blooms in the lower estuary, such as those that occurred in 2011 and 2012. Primarily, it examines the effects of fall rice field drainage flows, but will also investigate the effects of routing water through the Yolo Bypass during other times of the year to produce food for listed species such as Delta Smelt. This study uses phytoplankton, zooplankton, nutrients, contaminants, and water quality sampling to answer questions about the mechanisms surrounding food production within the bypass and what aspects of the exported water trigger further production lower in the estuary.

Delta Smelt Early Warning Studies: Application of the SmeltCam

This study will generate information that will contribute to a more complete understanding of Delta Smelt distribution in the water column and the processes driving Delta Smelt behavior and movements. Data collected will help to expand the utility and comparability of long-term IEP fish monitoring programs, data support for management of water project operations, and the continued research and development of non-lethal sampling methods for Delta Smelt and other fishes. In particular, this research will 1) estimate the vertical and lateral distribution of Delta Smelt in the water column in relation to physical and biological habitat features before and during upstream migration; 2) estimate a standardized spatial distribution of Delta Smelt with respect to tidal stage along the San Joaquin River corridor; and 3) advance the application and development of the SmeltCam through (a) improved species identification, (b) calibration of observations, and (c) assessment of indirect mortality.

Methods Development for Environmental DNA Surveying of the Wild Delta Smelt Population (eDNA)

The purpose of this project is to develop methods to sample environmental DNA (eDNA) to detect the presence of Delta Smelt (and ultimately of any desired target species) in the Sacramento/San Joaquin Delta. Currently, traditional surveys (e.g. Fall Midwater Trawl, Spring Kodiak Trawl) are detecting very few to no Delta Smelt, leaving managers with questions regarding abundance and persistence in certain areas of the Delta.

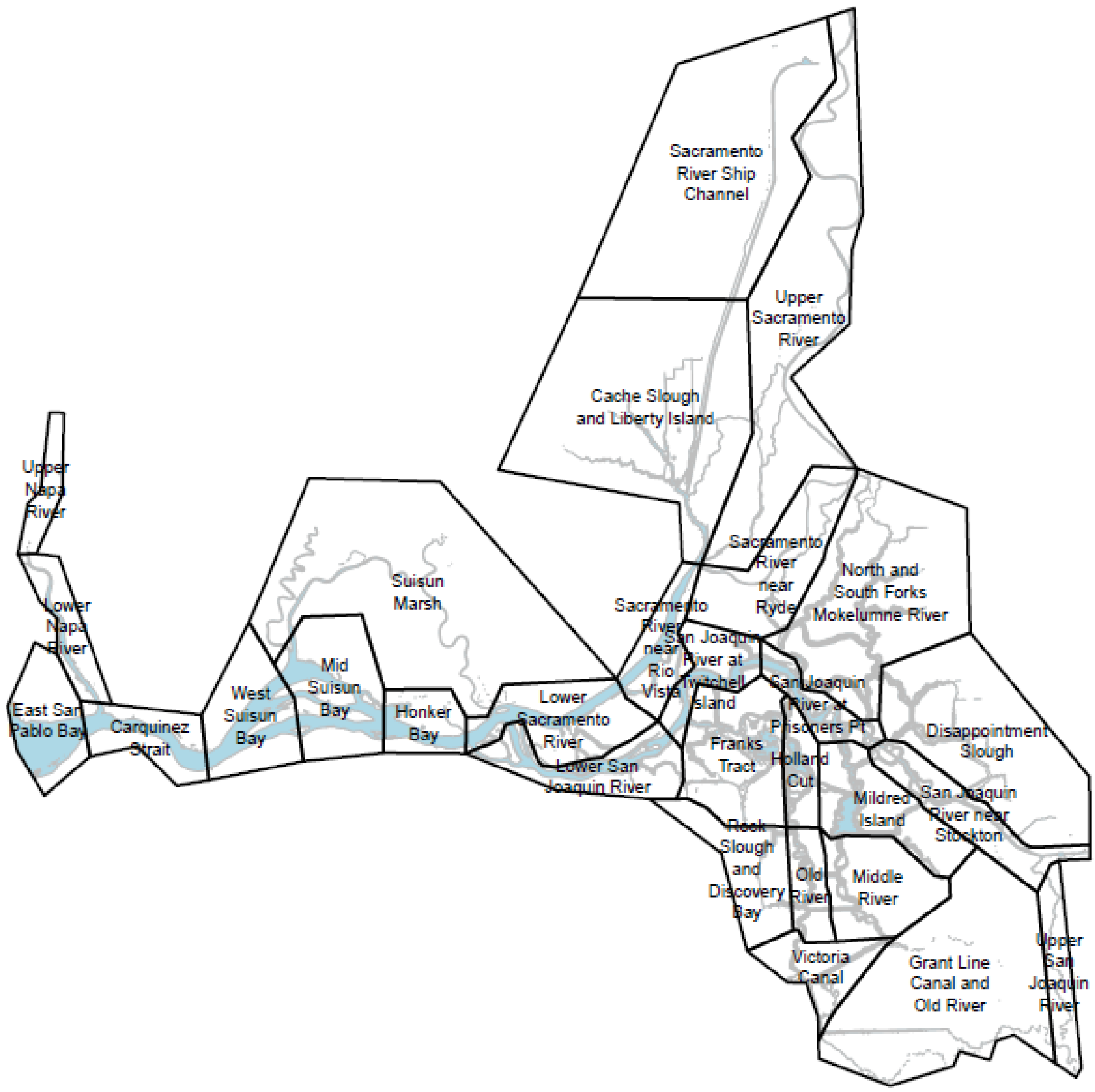
Enhanced Delta Smelt Monitoring (EDSM)

The Enhanced Delta Smelt Monitoring (EDSM) program is a year-round monitoring project tasked with investigating alternative methods of generating higher resolution estimates of Delta Smelt abundance, distribution, and, for selected life stages and times of year, estimates of the proportion of the population at risk of entrainment. The EDSM program will provide an early warning of entrainment events in a broader context than the previous Early Warning Survey and will employ a stratified sampling design that includes multiple crews trawling concurrently at multiple sites in pre-defined density strata within the low- and/or high-risk zones of entrainment in the San Francisco Estuary. Stopping rules were developed to minimize the impact of take on the population and effort can be modified to adapt to changing management needs and priorities.

Effect of Outflow Alteration upon Delta Smelt Habitat, Condition and Survival (Year 2)
The Directed Outflow Project (DOP) is a continuing collaborative effort among a dozen state, federal and non-governmental groups, which will employ a focused spatial and temporal approach to evaluate the benefit of outflow alteration for Delta Smelt and its habitat in the fall resulting from the summer Delta outflow and Yolo Bypass Toe Drain actions. Paired data collections (same location and time) of abiotic and biotic habitat constituents will be used to test specific hypotheses that will assist in avoiding shortcomings of using data collected for different studies/hypotheses and/or across variable spatial/temporal scales. Sampling will occur during the Delta Smelt juvenile rearing-stage, a period known to be associated with the location of the low salinity zone (LSZ).

Aquatic Habitat Sampling Platform: Standardized Fish Community Sampling Across Habitat Types
The Aquatic Habitat Sampling Platform (AHSP) is an integrated aquatic species and habitat sampling system that can effectively monitor aquatic organisms and reveal habitat associations while having minimal or no "take" of sensitive species. Further development and deployment of the AHSP will expand data collection to shallow and off-channel habitat, while offering the capability to transition to deeper and open water habitats, providing reliable sampling efficiency estimates (e.g., probability fish detection) and "catch" per unit effort (i.e., number of individual species per volume of water sampled) and improving our knowledge about populations, habitat associations and major stressors of key organisms within the San Francisco Estuary.

Spatial and Temporal Coverage of Some Relevant Monitoring Programs[1]



[1] The information presented here was developed informally during 2017 A. Schultz, personal communication) and may not represent the current character of the programs described.

Code	Study Name
20-mm	20-mm Survey
CDFW FRPMT	CDFW Fish Restoration Program Monitoring Team
BOR SS	BOR Special Studies
EDSM	Enhanced Delta Smelt Monitoring Project (EDSM)
EMP Benthic	IEP Special Studies; BOR special study
EMP Water	Environmental Monitoring Program: Continuous Water Quality
EMP Phyto	Environmental Monitoring Program: Phytoplankton
EMP Zoo	Environmental Monitoring Program: Zooplankton Study
Fish Restoration PMT	Fish Restoration Program Monitoring Team
FMWT	Fall Midwater Trawl
JFM KT	IEP long-term juvenile fish monitoring - Kodiak Trawl
JFM MWT	IEP long-term juvenile fish monitoring - Midwater trawl
JFM Seine	IEP long-term juvenile fish monitoring - Beach seining
Liberty Island LT	Liberty Island larval trawling
SF Bay	San Francisco Bay Study
SKT	Spring Kodiak Trawl
SLS	Smelt Larva Survey
STN	Summer Townet Survey
USGS CM	USGS Flux-based high frequency continuous monitoring
USGS Fish	USGS Tidal Wetlands Fish
USGS WQ	USGS Hydro Project Flow/WQ Monitoring
SDWSC	USGS SDWSC
USGS Zoo	USGS Tidal Wetlands Zooplankton
Yolo Bypass LTM	IEP Yolo Bypass Long-term Fish and Invertebrate Monitoring Program
Yolo Bypass S/F Food Web	IEP Investigating Yolo Bypass as a Summer/Fall Food Web Subsidy for the Delta

Adult Delta Smelt and Juvenile Fish

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Cache Complex	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm	STN						
Carquinez Strait	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
			SF Bay	SF Bay	SF Bay	SF Bay						
Disappointment Slough	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
East San Pablo Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SF Bay	SF Bay	20-mm	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
			SF Bay	STN	STN	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
Franks Tract	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
Grant Line Canal & Old River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm						
Holland Cut	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm	EDSM		FMWT	FMWT	FMWT	FMWT
Honker Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
			SF Bay	SF Bay	SF Bay	SF Bay						
Lower Napa River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Lower Sac River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
			SF Bay	SF Bay	SF Bay	SF Bay						
Lower SJR	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SF Bay	SF Bay	20-mm	20-mm	20-mm	20-mm	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
			SF Bay	SF Bay	SF Bay	SF Bay	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Mid Suisun Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	20-mm	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	20-mm	20-mm	20-mm	SF Bay	JFM MWT	STN	JFM MWT	JFM MWT	JFM MWT	JFM MWT
	JFM MWT	JFM MWT	SF Bay	SF Bay	SF Bay	JFM MWT	STN		FMWT	FMWT	FMWT	FMWT
			JFM MWT	JFM MWT	JFM MWT	STN						
Middle River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm	STN	STN	STN	FMWT	FMWT	FMWT

Mildred Island	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm						
N & S Fk Mok River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT				FMWT	FMWT	FMWT	FMWT
Old River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
						20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Rock Slough & Disc Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm						
Sac Deep Water Ship Cannal	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	SKT	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm	20-mm						
Sac River near Rio Vista	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm	STN						
Sac River near Ryde	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
SJR at Prisoners Pt	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
SJR at Twitchell Island	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
SJR near Stockton	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
Suisun Marsh	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	SKT	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm	20-mm						
Upper Napa River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
Upper Sac River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
									FMWT	FMWT	FMWT	FMWT
Upper SJR	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT	JFM MWT
Victoria Canal	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
West Suisun Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SKT	SKT	SKT	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	20-mm	20-mm	20-mm	SF Bay	STN	STN	FMWT	FMWT	FMWT	FMWT
			SF Bay	SF Bay	SF Bay	STN						

Bivalves/Benthic Invertebrates

	January	February	March	April	May	June	July	August	September	October	November	December

Sac Deep Water SC												
Cache Complex												
Upper Sac River												
Sac River near Ryde												
Sac River near Rio Vista												
Lower Sac River												
Suisun Marsh												
Honker Bay	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic
Mid Suisun Bay	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic
West Suisun Bay	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic
Carquinez Strait	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic
East San Pablo Bay	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic	EMP Benthic
Lower Napa River												
Upper Napa River												
Upper SJR												
SJR near Stockton												
Disappointment Slough												
Grant Line Canal & Old River												
Mildred Island												
Middle River												
Victoria Canal												
Old River												
Rock Slough & Disc Bay												
Holland Cut												

SJR at Prisoners Pt												
N & S Fk Mok River												
Franks Tract												
SJR at Twitchell Isl												
Lower SJR												

Chlorophyll

	January	February	March	April	May	June	July	August	September	October	November	December
Sac Deep Water SC	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web	Yolo Bypass LTM	Yolo Bypass LTM
Cache Complex							YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web		
Upper Sac River	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
Sac River near Ryde						Jared's info						
Sac River near Rio Vista	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	FMWT	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
							YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web		
Lower Sac River	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
Suisun Marsh	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
Honker Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
Mid Suisun Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
Carquinez Strait	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
East San Pablo Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
Lower Napa River												
Upper Napa River												
Upper SJR	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
SJR near Stockton	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
SJR near Stockton	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
Disappointment Slough												

Grant Line Canal & Old River												
Mildred Island												
Middle River												
Victoria Canal												
Old River	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
Rock Slough & Disc Bay												
Holland Cut												
SJR at Prisoners Pt	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water		
N & S Fk Mok River												
Franks Tract	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
SJR at Twitchell Isl	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
Lower SJR	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water

Conductivity

	January	February	March	April	May	June	July	August	September	October	November	December
Cache Complex	EDSM	EDSM	EDSM	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	EDSM
	SLS	SKT	20-mm	SKT	SKT	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	FMWT
	Yolo Bypass LTM	SLS	SLS	USGS WQ	USGS WQ	USGS WQ	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web		USGS WQ
	USGS WQ	USGS WQ	USGS WQ									
	SKT		SKT									
Carquinez Strait	EMP Water	EMP Water	20-mm	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Water	20-mm	20-mm	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SF Bay	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	STN	STN	SF Bay	SF Bay	SF Bay	SF Bay
	SLS	SLS	SKT	SKT	SKT	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	SLS	USGS WQ	USGS WQ	USGS WQ						
			USGS WQ									
Disappointment Slough						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
East San Pablo Bay	EMP Zoo	EMP Zoo	20-mm	20-mm	20-mm	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SF Bay	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	SF Bay	SF Bay	SF Bay	SF Bay	STN	STN	SF Bay	SF Bay	SF Bay	SF Bay
	USGS WQ	USGS WQ	SLS	USGS WQ	USGS WQ	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
			USGS WQ			USGS WQ						
Franks Tract	EMP Zoo	EMP Zoo	20-mm	EMP Zoo	EMP Zoo	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ				
Grant Line Canal & Old River	SLS	SLS	SLS									
Holland Cut	SKT	SKT	20-mm	20-mm	SKT	20-mm	USGS WQ	USGS WQ	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	SLS	SKT	20-mm	USGS WQ			USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ							
			SKT									
Honker Bay	EDSM	EDSM	EDSM	20-mm	20-mm	20-mm	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EDSM

	EMP Water	EMP Water	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water
	EMP Zoo	EMP Zoo	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	FMWT	FMWT	FMWT	EMP Zoo
	SF Bay	SF Bay	SKT	SF Bay	SF Bay	SF Bay	STN	STN	SF Bay	SF Bay	SF Bay	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	SF Bay
	SLS	SLS	SLS	USGS WQ	USGS WQ	USGS WQ						USGS WQ
	USGS WQ	USGS WQ	USGS WQ									
			EMP Water									
Lower Napa River	SKT	SKT	20-mm	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	SLS	20-mm	20-mm	20-mm	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ						
			SKT									
Lower Sac River	EDSM	EDSM	EDSM	20-mm	20-mm	20-mm	EMP Water	EMP Water	EMP Water	SF Bay	SF Bay	EDSM
	EMP Water	EMP Water	20-mm	EMP Water	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	JFM	JFM	FMWT	EMP Zoo	EMP Zoo	EMP Zoo
	JFM	JFM	EMP Zoo	JFM	JFM	JFM	SF Bay	SF Bay	JFM	FMWT	FMWT	FMWT
	SKT	SF Bay	JFM	SF Bay	SF Bay	SF Bay	STN	STN	SF Bay	JFM	JFM	JFM
	SLS	SKT	SF Bay	SKT	SKT	STN						SF Bay
		SLS	SKT			STN						
			SLS									
Lower SJR	EDSM	EDSM	EDSM	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	EMP Water	EMP Water	EMP Water	EDSM
	EMP Water	EMP Water	EMP Water	20-mm	20-mm	20-mm	20-mm	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	FMWT	FMWT	FMWT	EMP Zoo
	SF Bay	SF Bay	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	SF Bay	FMWT
	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	SKT	SKT	SKT	SKT				
	USGS WQ	USGS WQ	USGS WQ			STN	STN	STN				
Mid Suisun Bay	EDSM	EDSM	EDSM	20-mm	20-mm	20-mm	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EDSM
	EMP Water	EMP Water	20-mm	EMP Water	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water
	EMP Zoo	EMP Zoo	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	FMWT	FMWT	FMWT	EMP Zoo
	SF Bay	SF Bay	EMP Zoo	SF Bay	SF Bay	SF Bay	STN	STN	SF Bay	SF Bay	SF Bay	FMWT

	SKT	SKT	SF Bay	SKT	SKT	STN						SF Bay
	SLS	SLS	SLS									
Middle River	SKT	SKT	20-mm	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	SKT	20-mm	20-mm	20-mm	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	SLS	USGS WQ	USGS WQ	USGS WQ						
			USGS WQ									
Mildred Island	SKT	SKT	SKT	SKT	SKT	USGS WQ	STN	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	USGS WQ	USGS WQ		USGS WQ	USGS WQ				
	USGS WQ	USGS WQ	USGS WQ									
N & S Fk Mok River	SKT	SKT	SKT	SKT	SKT	20-mm	USGS WQ	USGS WQ	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	SLS	20-mm	20-mm	USGS WQ			USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ							
			20-mm									
Old River	EMP Zoo	EMP Zoo	20-mm	EMP Zoo	EMP Zoo	STN	EMP Zoo	EMP Zoo	EMP Zoo	FMWT	EMP Zoo	EMP Zoo
	SKT	SKT	EMP Zoo	20-mm	20-mm	20-mm	STN	STN	FMWT	USGS WQ	FMWT	FMWT
	SLS	SLS	SKT	SKT	SKT	EMP Zoo	USGS WQ	USGS WQ	FMWT		USGS WQ	FMWT
	USGS WQ	USGS WQ	SLS	USGS WQ	USGS WQ	USGS WQ			SKT			SKT
			USGS WQ						USGS WQ			USGS WQ
Rock Slough & Disc Bay				20-mm	20-mm	20-mm						
Sac Deep Water SC	Yolo Bypass LTM	EDSM	EDSM	EDSM	EDSM	EDSM	STN	STN	FMWT	FMWT	FMWT	EDSM
	EDSM	Liberty Island LT	Liberty Island LT	20-mm	20-mm	20-mm	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	FMWT
	SKT	Yolo Bypass LTM	Yolo Bypass LTM	Liberty Island LT	Liberty Island LT	Liberty Island LT	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web		Yolo Bypass LTM
	SLS	SKT	SKT	SKT	SKT	SKT						
		SLS	SLS	SLS	SLS	SLS						
			20-mm	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM						
Sac River near Rio Vista	EDSM	EDSM	EDSM	EMP Water	EMP Water	20-mm	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EDSM
	EMP Water	EMP Water	EMP Water	20-mm	20-mm	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	SF Bay	SF Bay	FMWT	EMP Zoo

	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	STN	STN	FMWT	FMWT	SF Bay	EMP Water
	SKT	SKT	SKT	SKT	SKT	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	FMWT
	SLS	SLS	SLS	USGS WQ	USGS WQ	USGS WQ	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web		USGS WQ
	USGS WQ	USGS WQ	USGS WQ									SF Bay
			20-mm									
Sac River near Ryde	SKT	SKT	SKT	SKT	SKT	USGS WQ	USGS WQ	USGS WQ	FMWT	FMWT	FMWT	FMWT
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ				USGS WQ	USGS WQ	USGS WQ	USGS WQ
SJR at Prisoners Pt	EMP Water	EMP Water	20-mm	20-mm	20-mm	20-mm	STN	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SF Bay	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	FMWT	FMWT	FMWT
	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	STN	FMWT	SF Bay	SF Bay	SF Bay
	SLS	SLS	SKT	SKT	SKT	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	SLS	USGS WQ	USGS WQ	USGS WQ						
			USGS WQ									
SJR at Twitchell Island	EMP Water	EMP Water	20-mm	20-mm	EMP Water	EMP Water	EMP Water	STN	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SF Bay	SF Bay	EMP Zoo	EMP Zoo	SF Bay	SF Bay	SF Bay	SF Bay	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SF Bay	SF Bay	SKT	STN	STN	USGS WQ	SF Bay	SF Bay	SF Bay	SF Bay
	SLS	SLS	SKT	SKT	20-mm	20-mm	USGS		USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	SLS	USGS WQ	USGS WQ	USGS WQ						
			USGS WQ									
SJR near Stockton	EMP Water	EMP Water	20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SKT	SKT	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SKT	SKT	SKT	STN	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	SLS	SLS	SLS	USGS WQ						
			USGS WQ	USGS WQ	USGS WQ							
Suisun Marsh	EMP Zoo	EMP Zoo	SKT	20-mm	20-mm	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SKT	SKT	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	STN	STN	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	EMP Zoo	SKT		STN						
			SLS									

Upper Napa River	SLS		20-mm	20-mm	20-mm	20-mm						
Upper Sac River	EMP Water	EMP Water	20-mm	20-mm	20-mm	20-mm	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SKT	SKT	EMP Water	EMP Water	EMP Water	EMP Water	USGS WQ	USGS WQ	USGS WQ	FMWT	FMWT	FMWT
	USGS WQ	USGS WQ	SKT	SKT	SKT	SKT				USGS WQ	USGS WQ	USGS WQ
			USGS WQ	USGS WQ	USGS WQ	USGS WQ						
Upper SJR	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Victoria Canal	SLS	SLS	SLS	20-mm	20-mm	STN	STN	STN				
			20-mm			20-mm						
West Suisun Bay	EMP Zoo	EMP Zoo	20-mm	20-mm	20-mm	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SF Bay	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	SF Bay	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	STN	STN	SF Bay	SF Bay	SF Bay	SF Bay
	SLS	SLS	SLS	SKT	SKT	STN	USGS WQ	USGS	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ						

Hydrology

	January	February	March	April	May	June	July	August	September	October	November	December
Cache Complex	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Carquinez Strait	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Disappointment Slough												
East San Pablo Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Franks Tract	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Grant Line Canal & Old River												
Holland Cut	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Honker Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Lower Napa River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Lower Sac River												
Lower SJR												
Mid Suisun Bay												
Middle River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Mildred Island	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
N & S Fk Mok River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Old River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Rock Slough & Disc Bay												
Sac Deep Water SC	have Jon check this again											
Sac River near Rio Vista	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Sac River near Ryde	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
SJR at Prisoners Pt	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ

SJR at Twitchell Isl	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
SJR near Stockton	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Suisun Marsh												
Upper Napa River												
Upper Sac River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Upper SJR	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
Victoria Canal												
West Suisun Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ

Temperature

	January	February	March	April	May	June	July	August	September	October	November	December
Sac Deep Water SC	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web	FMWT	FMWT
	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	
	SKT	SKT	SKT	SKT	SKT	STN	STN	STN	FMWT	FMWT		
	SLS	SLS	SLS	SLS	20-mm	20-mm						
			20-mm	20-mm								
Cache Complex	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web	FMWT	FMWT
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT		
	SKT	SKT	SKT	SKT	SKT	STN						
			20-mm									
Upper Sac River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SKT	SKT	SKT	SKT	SKT	20-mm			FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm							
Sac River near Ryde	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SKT	SKT	SKT	SKT	SKT				FMWT	FMWT	FMWT	FMWT
Sac River near Rio Vista	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	SKT	STN	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web	EMP Zoo	EMP Zoo
	SKT	SKT	SKT	EMP Zoo	EMP Water	EMP Zoo	STN	STN	EMP Zoo	EMP Zoo	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	SF Bay	EMP Zoo	EMP Water	EMP Zoo	EMP Zoo	EMP Water	EMP Water	SF Bay	SF Bay
	EMP Water	EMP Water	EMP Water	20-mm	20-mm	SF Bay	EMP Water	EMP Water	SF Bay	SF Bay	FMWT	FMWT
	SF Bay	SF Bay	SF Bay		SF Bay	20-mm	SF Bay	SF Bay	FMWT	FMWT		
			20-mm									
Lower Sac River	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine
	SLS	SLS	SLS	20-mm	20-mm	20-mm	20-mm	STN	SF Bay	SF Bay	SF Bay	SF Bay
	SKT	SKT	20-mm	SKT	SKT	SKT	SKT	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	SKT	SF Bay	SF Bay	SF Bay	SF Bay	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	FMWT	FMWT	FMWT	FMWT
			EMP Water	EMP Water	EMP Water	EMP Water	EMP Water					

Suisun Marsh	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SKT	SKT	SKT	SKT	SKT	STN	EMP Zoo	EMP Zoo	FMWT	FMWT	FMWT	FMWT
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo						
			20-mm	20-mm	20-mm							
Honker Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	SKT	SKT	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water						
			20-mm									
Mid Suisun Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	SKT	SKT	STN						
			20-mm									
West Suisun Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SLS	20-mm	20-mm	20-mm	20-mm	20-mm	20-mm	20-mm	20-mm	20-mm
	SKT	SKT	20-mm	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SF Bay	SF Bay	SKT	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
			SF Bay									
Carquinez Strait	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SLS	SLS	SLS	SF Bay	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	20-mm	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SF Bay	SF Bay	SF Bay		SF Bay	20-mm						
			20-mm									
East San Pablo Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay

	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SLS	20-mm	20-mm	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm			20-mm						
Lower Napa River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	20-mm	20-mm						
			20-mm									
Upper Napa River	SLS		20-mm	20-mm	20-mm	20-mm						
Upper SJR	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
SJR near Stockton	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SKT	SKT	SKT	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SLS	SLS	20-mm	20-mm	20-mm							
			SLS									
Disappointment Slough						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
Grant Line Canal & Old River	SLS	SLS	SLS									
Mildred Island	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
							STN	STN				
Middle River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	20-mm	20-mm			FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	SKT							
			SKT									
Victoria Canal	SLS	SLS	SLS	20-mm	20-mm	STN	STN	STN				
			20-mm			20-mm						
Old River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SLS	SKT	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT

	SKT	SKT	SKT	20-mm	SKT	STN						
			20-mm									
Rock Slough & Disc Bay												
Holland Cut	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	20-mm	20-mm			FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	SKT							
			20-mm									
SJR at Prisoners Pt	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SLS	SLS	SLS	SKT	20-mm	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	SKT	20-mm						
			20-mm									
N & S Fk Mok River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SKT	SKT	SKT	SKT	SKT	20-mm			FMWT	FMWT	FMWT	FMWT
	SLS	SLS	SLS	20-mm	20-mm							
			20-mm									
Franks Tract	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN				
			20-mm			STN						
SJR at Twitchell Isl	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SLS	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SKT	SLS	SLS	SKt	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SF Bay	SKT	SKT	20-mm	20-mm	20-mm						
			20-mm									
Lower SJR	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo

	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay	SF Bay
	SLS	SLS	SLS	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	20-mm	20-mm						
			20-mm									

Large Fish

	January	February	March	April	May	June	July	August	September	October	November	December
Sac Deep Water SC	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	-	-	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM
					USGS SDWS		-	-				
Cache Complex						CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT
Upper Sac River												
Sac River near Ryde												
Sac River near Rio Vista						CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT
Lower Sac River												
Suisun Marsh						CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT
Honker Bay												
Mid Suisun Bay						CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT
West Suisun Bay												
Carquinez Strait												
East San Pablo Bay												
Lower Napa River												
Upper Napa River												
Upper SJR												
SJR near Stockton												
Disappointment Slough												
Grant Line Canal & Old River												
Mildred Island												
Middle River												
Victoria Canal												
Old River												
Rock Slough & Disc Bay												

Holland Cut												
SJR at Prisoners Pt						CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT
N & S Fk Mok River												
Franks Tract												
SJR at Twitchell Isl												
Lower SJR						CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT	CDFW FRPMT

Larval Fish

	January	February	March	April	May	June	July	August	September	October	November	December
Sac Deep Water SC	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	Liberty Island LT	Liberty Island LT	Liberty Island LT						
		Liberty Island LT	Liberty Island LT	20-mm	20-mm	20-mm						
			20-mm									
Cache Complex	SLS	SLS	SLS	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	EDSM	EDSM	EDSM	20-mm	20-mm	20-mm						
		Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT	Liberty Island LT						
Upper Sac River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
			20-mm	20-mm	20-mm	20-mm						
Sac River near Ryde	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
Sac River near Rio Vista	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Lower Sac River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Suisun Marsh	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS									
			20-mm									
Honker Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Mid Suisun Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
West Suisun Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Carquinez Strait	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									

East San Pablo Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Lower Napa River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Upper Napa River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Upper SJR	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
SJR near Stockton	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	SLS	SLS	SLS						
			20-mm	20-mm	20-mm	20-mm						
Disappointment Slough	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
Grant Line Canal & Old River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS									
Mildred Island	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
Middle River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Victoria Canal	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Old River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Rock Slough & Disc Bay	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
Holland Cut	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
SJR at Prisoners Pt	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						

			20-mm									
N & S Fk Mok River	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Franks Tract	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
SJR at Twitchell Isl	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									
Lower SJR	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	SLS	SLS	SLS	20-mm	20-mm	20-mm						
			20-mm									

Turbidity

	January	February	March	April	May	June	July	August	September	October	November	December
Sac Deep Water SC	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	YB SF Food	YB SF Food	YB SF Food	YB SF Food	Yolo Bypass LTM	Yolo Bypass LTM
	SKT	SKT	SKT	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm	20-mm						
Cache Complex	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	YB SF Food	YB SF Food	YB SF Food	YB SF Food	Yolo Bypass LTM	Yolo Bypass LTM
	SLS	SLS	SLS	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	20-mm	20-mm						
			20-mm									
Upper Sac River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SKT	SKT	SKT	SKT	SKT	20-mm			FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm							
Sac River near Ryde	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SKT	SKT	SKT	SKT	SKT				FMWT	FMWT	FMWT	FMWT
Sac River near Rio Vista	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	YB SF Food	YB SF Food	YB SF Food	YB SF Food	Yolo Bypass LTM	Yolo Bypass LTM
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	SKT	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
			EMP Water	EMP Water	EMP Water	EMP Water						
Lower Sac River	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine	JFM Seine
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	SKT	EMP Water	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo						
			EMP Zoo									
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT

Suisun Marsh	SKT	SKT	20-mm	SKT	SKT	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	SKT	EMP Zoo	EMP Zoo	EMP Zoo						
			EMP Zoo									
Honker Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	SKT	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	EMP Zoo	EMP Water	EMP Water	EMP Water						
			EMP Water									
Mid Suisun Bay	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
			20-mm	SKT	SKT	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	SKT	SKT	SKT	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water						
	EMP Water	EMP Water	EMP Water									
West Suisun Bay	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	20-mm	20-mm	20-mm	20-mm						
Carquinez Strait	USGS WQ Monitoring //SLS //SKT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring //SLS //SKT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring //SLS //20-mm //SKT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring //20-mm //SKT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring //20-mm //SKT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring //20-mm //STN//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring//STN//EMP Zooplankton// EMP Continous Water Quality	USGS WQ Monitoring//STN//EMP Zooplankton// EMP Continous Water Quality	USGS WQ Monitoring//FMWT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring//FMWT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring//FMWT//EMP Zooplankton//EMP Continous Water Quality	USGS WQ Monitoring//FMWT//EMP Zooplankton//EMP Continous Water Quality
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	SKT	EMP Zoo	EMP Zoo	EPM Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	EMP Zoo	EMP Water	EMP Water	EMP Water						
			EMP Water									
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT

East San Pablo Bay	EMP Zoo	EMP Zoo	20-mm	EMP Zoo	EMP Zoo	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			EMP Zoo			EMP Zoo						
Lower Napa River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN						
			SKT									
Upper Napa River			20-mm	20-mm	20-mm	20-mm						
Upper SJR	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
SJR near Stockton	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SKT	SKT	SKT	SKT	SKT	EMP Zoo	EMP Zoo	USGS WQ	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	20-mm	STN	EMP Water	FMWT	FMWT	FMWT	FMWT
			20-mm		20-mm	STN		STN				
Disappointment Slough						STN	STN	STN	FMWT	FMWT	FMWT	FMWT
Grant Line Canal & Old River												
Mildred Island	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	SKT	SKT							
	SKT	SKT	SKT									
Middle River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN						
			SKT									
Victoria Canal	SLS	SLS	SLS	20-mm	20-mm	STN	STN	STN				
			20-mm			20-mm						
	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ

Old River	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	EMP Zoo	EMP Zoo	20-mm	EMP Zoo	EMP Zoo	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			EMP Zoo	SKT	SKT	EMP Zoo						
			SKT									
Rock Slough & Disc Bay	SLS	SLS	SLS									
Holland Cut	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm			FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT							
			SKT									
SJR at Prisoners Pt	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EDSM	EDSM	EDSM	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Water	EMP Water	EMP Water	20-mm	20-mm	20-mm	STN	STn	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	20-mm	SKT	SKT	STN						
			SKT									
N & S Fk Mok River	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SKT	SKT	SKT	SKT	SKT	20-mm			FMWT	FMWT	FMWT	FMWT
			20-mm	20-mm	20-mm							
Franks Tract	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	20-mm	20-mm	20-mm	STN	STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Zoo	EMP Zoo	20-mm	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo				
			EMP Zoo			STN						
SJR at Twitchell Isl	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM	EDSM
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	SKT	SKT	20-mm	20-mm	SKT	STN	STN	STN	FMWT	FMWT	FMWT	FMWT
			SKT	SKT	20-mm	20-mm		20-mm				
Lower SJR	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ	USGS WQ
	SLS	SLS	SLS	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water	EMP Water
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Water	EMP Water	EMP Water	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo

	EMP Water	EMP Water	EMP Water	SKT	SKT	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	SKT	SKT	SKT	20-mm	20-mm	STN						
			20-mm									

Zooplankton

	January	February	March	April	May	June	July	August	September	October	November	December
Sac Deep Water SC	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM
			20-mm	20-mm	20-mm	20-mm	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web	FMWT	FMWT
						STN	STN	STN	FMWT	FMWT		
Cache Complex	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
	USGS Zoo	USGS Zoo	20-mm	20-mm	20-mm	STN	YB SF Food Web	YB SF Food Web	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo
						Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	YB SF Food Web	YB SF Food Web	Yolo Bypass LTM	Yolo Bypass LTM
									Yolo Bypass LTM	Yolo Bypass LTM		
Upper Sac River			20-mm	20-mm	20-mm	20-mm						
Sac River near Ryde	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo
Sac River near Rio Vista	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	YB SF Food Web	YB SF Food Web	YB SF Food Web	YB SF Food Web	Yolo Bypass LTM	Yolo Bypass LTM
	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	Yolo Bypass LTM	FMWT	FMWT
			20-mm	20-mm	20-mm	20-mm	STN	STN	STN	STN	EMP Zoo	EMP Zoo
						STN	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo		
Lower Sac River	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Suisun Marsh	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Honker Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	20-mm	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Mid Suisun Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
West Suisun Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo

			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Carquinez Strait	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
East San Pablo Bay	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
Lower Napa River			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
Upper Napa River			20-mm	20-mm	20-mm	20-mm						
Upper SJR												
SJR near Stockton	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Disappointment Slough	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
						STN	STN	STN				
Grant Line Canal & Old River												
Mildred Island												
Middle River			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
Victoria Canal			20-mm	20-mm	20-mm	20-mm//STN	STN	STN				
						STN						
Old River	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
Rock Slough & Disc Bay												
Holland Cut			20-mm	20-mm	20-mm	20-mm						
SJR at Prisoners Pt	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN				
						STN						
N & S Fk Mok River	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo

			20-mm	20-mm	20-mm	20-mm						
Franks Tract	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			USGS Zoo	USGS Zoo	USGS Zoo	USGS Zoo	STN	STN				
			20-mm	20-mm	20-mm	20-mm						
SJR at Twitchell Isl	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						
Lower SJR	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo	EMP Zoo
			20-mm	20-mm	20-mm	20-mm	STN	STN	FMWT	FMWT	FMWT	FMWT
						STN						

Appendix 3. Hypothetical Example of Annual Supplement Process

The table below is presented as ***hypothetical example*** of how the Annual Supplement process could consider and weigh scientific activities. The examples are simplistic (issues are rarely as 'black and white' as represented) and designed to show how scientific information or issues might influence the development of an Annual Supplement to the Three-Year Science Plan.

	Process Step	**HYPOTHETICAL EXAMPLE –** *Reoperation of the Suisun Marsh Salinity Control Gates*	**Who is Involved?**

December - January	Step 1 - Prepare	a. Identify potential year specific low-related management actions and scientific activities related to those actions/ambient conditions identified in the Three-Year Science Plan.
		
		Were these activities undertaken the last time this flow-action was taken and what was learned?
		• *EXAMPLE – Sampling in shallow water areas (<2m) was conducted for prey resources and identified strong gradients where smaller marsh channels intersected with sloughs directly influence by the action*
		• *EXAMPLE – Water samples were taken an analyzed for Delta Smelt eDNA along the gradient of change in Montezuma Slough*
		What insights were gained from each and what is the potential benefit for Delta Smelt?
		
		Have approaches or methods been further tested or developed, or applied elsewhere in the system since the three-year plan was developed?
		• *EXAMPLE – High speed boat-based mapping of water quality has been used more extensively, and has been combined with drone-based sensors to provide rapid mapping of surface turbidity*
		What insights were gained and what could this add to understanding this action above that originally proposed in the three-year plan?
		
		Which scientific activities are planned for this year of the three-year cycle? Do any of these benefit from additional measurement/sampling in relation to Suisun Gates flow management action? Can other ongoing studies be leveraged?
		• *EXAMPLE - Laboratory experiments on response of cultured Delta Smelt to Delta waters was included in 3-year plan Possible action-related enhancement (example assumes conceptual basis can be established – engage Contaminants PWT for input)*
		    o *Collect water for these experiments across the gradients influenced by the action, before/after?*
		    o *Identify contaminant mixtures and spatial/temporal variation*
			CAMT, Action Champions, Science Program Manager, other experts, e.g., FLOAT PWT

		o *Consider testing cultured Delta Smelt response to those mixtures (and associated temperature/salinity conditions)*
		• *EXAMPLE – Ongoing research study on the use of metabarcoding for identifying zooplankton community composition*
		Possible action-related enhancement (example only – developed through SPM dialog with investigator)
		    o *Collect additional samples in areas where action is expected to influence zooplankton community e.g.., influx of Pseudodiaptomus sp. from central Delta)*
		    o *Test of metabarcoding in parallel with planned action-based sampling*
		
		<u>*What are the unresolved issues emerging from last time the management action was taken?*</u>
		• *EXAMPLE - Low catches of Delta Smelt limited the ability to document the benefit of the action to the species*
		Are there scientific activities which could be operationalized this year (i.e., which are ready to do and are likely to be permitted) which could alleviate this issue this year if it occurs?
		    • *EXAMPLE – Deployment of cultured smelt in cages across the salinity gradient could be used to document gradients in growth, use of food resources etc.*
		
		<u>*What are the confounding factors that could limit the success of the management action?*</u>
		• *EXAMPLE – high water temperatures in the year prior to the action could reduce the spawning window, impact early survival*
		What information needs to be collected to identify the effects of this factors?
		    • *EXAMPLE - Sufficient water temperature monitoring stations are currently in place, combined with physical modeling these will be adequate to explore the role of water temperature*	

		b. Determine level of resources available to support year-specific scientific activities	CSAMP/CAMT
		c. Prepare for annual supplement e.g., identify resources for predictive modeling, updates from investigators in relation to previously prepared concept proposals. *Can the Suisun Gates-related activities be readily mobilized (e.g., sampling gear, permits) once year specific conditions are known? What resources would be required? What efficiencies could be gained? Develop options and costs for add-ons to studies (beyond those covered by the ongoing work) for consideration*	Science Program Manager working with investigators

February - March	Step 2 – Draft Annual Supplement	a. Specify flow-related management actions expected	Agencies/Action Champions
		b. Conduct modeling to determine temporal and spatial extent of effects c. Identify (see **Error! Reference source not found.** for additional considerations): *What is the temporal and spatial scale of the change expected with the action?* *d. EXAMPLE - Conduct model simulations with expected operations (work with action champion) predict: [note this assumes models that predict biotic response are not yet available]* *Are there interactions among other flow-related management actions in space and time? What is the expected magnitude and duration of change in abiotic conditions associated with flow-related management actions? Are there potentially important gradients in abiotic conditions within the influence area e.g., hot spots of potentially desirable or undesirable conditions, places where changes in abiotic conditions might interact with structural habitat features to produce beneficial/less desirable effects?* • *EXAMPLE – modeling shows extensive changes in conditions occur in shallow water areas and throughout the marsh dominated parts of the system. Expert discussion of how these patterns interact with potential food sources/competitors for food.* *Do existing monitoring programs provide sufficient temporal and spatial coverage?* *a. Overlay existing distribution of survey/monitoring stations and sensors with predicted patterns of change in abiotic conditions. Are the potential areas/periods of interest adequately covered?* *What else could be added?* *b. Consider the potential activities identified in Step 1*	Science Program Manager, CAMT, appropriate IEP science managers, investigators
		d. Select initial list of science activities based on those identified in Three-Year Science Plan	Science Program Manager
		e. Estimate resource needs based on initial list and identify shortcomings –	Science Program Manager
		f. Prioritize activities for available funding and document rationale. This is based on the scientific information that could be generated and the management priority for that information • *EXAMPLE – an agency is really interested in further development of non-take detection techniques and prioritizes the enhancement to the ongoing study of eDNA as it leverages existing investment in the ongoing study and provides a real-world example to test utility. Funding is made available.* • *EXAMPLE – research and studies underway as part of a separate program (e.g., EcoRestore) is exploring the role*	CAMT, Science Program Manager

		of wetland dominated areas of Suisun in generating Delta Smelt prey resources. Studies related to this action are therefore not moved forward.	
		g. Develop draft timeline for actions and expected outputs i. Review contracting mechanisms, availability of personnel and equipment	Science Program Manager
April	Step 3 – Finalize Annual Supplement	a. Develop plan i. Document suite of scientific activities to be undertaken including field sampling, laboratory analyses, with timeline for intermediate deliverables from each and final reporting ii. Describe expected scientific outcomes – hypotheses being tested, questions that will be informed/resolved iii. Detailed timeline 1. Activities 2. Delivery of information 3. Reporting	Science Program Manager, investigators
		b. Present to CAMT for comments, refine and finalize	Science Program Manager
		c. Present to CSAMP for approval	Science Program Manager
		d. Disseminate	Science Program Manager