

- Bush 2012: Using isotopic analysis of otoliths from over a thousand Delta Smelt, Bush (2012) found the species exhibits partial migration through three different life history phenotypes, which include a freshwater resident fish, a brackish water resident fish, and a migratory phenotype, hatching in fresh water then occurring in brackish water during the juvenile and sub-adult stage. The relative abundance of each life history phenotype varied inter-annually with the latter most abundant, but not always dominant, in all years studied. The yearly contributions from each phenotype were found to vary with freshwater flows and temperature.
- CAMT Delta Smelt Entrainment Studies: New research shows that when Delta Smelt salvage is analyzed independently for SWP and CVP fish facility data, OMR flow has smaller explanatory influence on salvage than some other variables (Grimaldo et al. 2017). Population abundance, as indexed by the CDFW FMWT program, and turbidity have high explanatory power for adult Delta Smelt salvage at the SWP and CVP, particularly during the era of OMR management per the 2008 USFWS Biological Opinion. The basis for OMR flow management partially stems for earlier work showing that adult Delta Smelt salvage (Grimaldo et al. 2009) and proportional losses (Kimmerer 2008) increased as net OMR flow increased southward towards the Projects. New statistical techniques suggests a number of factors to minimize salvage or entrainment risk. However, given the correlation of OMR and SWP and CVP models, salvage and entrainment risk could be achieved through management of either indexes of the hydrodynamic influence from Project exports. It is worth noting that the ultimate objective for managing Delta Smelt entrainment should not focus on observed salvage. Rather, the management objective should be to target entrainment losses, in a traditional fisheries sense, to sustainable levels that do not compromise population growth rates (Maunder and Deriso 2011; Rose et al. 2013). New research performed under CAMT, can help scientists and resource managers identify circumstances when those large entrainment losses are likely to occur, which can ultimately be used to develop population risk assessment models (Grimaldo et al. 2017; Gross et al. 2018; Korman et al. 2018; Smith et al. 2018). The question about whether the Delta Smelt population can rebound from record-low abundances, even with improved entrainment management during the winter, remains outstanding given the importance of other factors at play (i.e., poor food supply, growth, water temperatures; see Maunder and Deriso 2011; Rose et al. 2013).

4.9 Proposed Action by Basin

Table 4-6 shows each of the components of the proposed action for this consultation, including both operational changes and non-flow habitat and facility improvements. The table shows whether each action is covered at a site-specific or a programmatic level in this biological assessment and whether the action is part of the Core Water Operations of the CVP and SWP, subject to periodic review after implementation, or whether it is an action to be coordinated prior to implementation (i.e., adaptively managed). The actions identified as a conservation measure represent firm commitments believed necessary to address adverse effects of the ongoing operation of the CVP and SWP and are indicated by an asterisk in the table below. Conservation measures may include habitat restoration, facility improvements, or intervention measures—hands on measures to affect fish directly, rather than affecting their habitat. Completed consultations with existing biological opinions that address the effects of long-term operations, and do not trigger reinitiation under this consultation are identified by “NCO” (Not Consulted On).

Table 4-6. Components of the Proposed Action

Title	Site Specific or Programmatic?	Core Operation or Adaptive Management?
CVP/SWP Wide		
Divert and store water consistent with obligations under water rights and decisions by the State Water Resources Control Board	Site-specific	Core
Shasta Critical Determinations and Allocations to Water Service and Water Repayment Contractors	Site-specific	Core
2018 Revised Coordinated Operations Agreement	NCO	NCO
Upper Sacramento		
Seasonal Operations	Site-specific	Core
Spring Pulse Flows	Site-specific	AM
Shasta Cold Water Pool Management	Site-specific	Core
Fall and Winter Refill and Redd Maintenance	Site-specific	Core
Operation of a Shasta Dam Raise	Site-specific	Core
Rice Decomposition Smoothing*	Site-specific	Core
Spring Management of Spawning Locations*	Site-specific	AM
Cold Water Management Tools (e.g., Battle Creek Restoration, Intake Lowering near Wilkins Slough, Shasta TCD Improvements)*	Programmatic	AM
Spawning and Rearing Habitat Restoration*	Programmatic	AM
Small Screen Program*	Programmatic	AM
Winter-Run Conservation Hatchery Production*	Programmatic	AM
Adult Rescue*	Programmatic	AM
Juvenile Trap and Haul*	Programmatic	AM

Title	Site Specific or Programmatic?	Core Operation or Adaptive Management?
Trinity		
Seasonal Operations	Site-specific	Core
Trinity River Record of Decision	NCO	NCO
Long-Term Plan to Protect Adult Salmon in the Lower Klamath River	NCO	NCO
Grass Valley Creek Flows from Buckhorn Dam	Site-specific	Core
Whiskeytown Reservoir Operations	Site-specific	Core
Clear Creek Flows	Site-specific	Core
Spring Creek Debris Dam	Site-specific	Core
Clear Creek Restoration Program*	NCO	NCO
Feather River		
FERC Project #2100-134	NCO	NCO
American River		
Seasonal Operations	Site-specific	Core
2017 Flow Management Standard Releases and “Planning Minimum”	Site-specific	Core
Spawning and Rearing Habitat Restoration*	Programmatic	AM
Drought Temperature Facility Improvements*	Programmatic	AM
Stanislaus		
Seasonal Operations	Site-specific	Core
Stanislaus Stepped Release Plan	Site-specific	Core
Alteration of Stanislaus DO Requirement	Site-specific	Core
Spawning and Rearing Habitat Restoration*	Programmatic	AM
Temperature Management Study*	Programmatic	AM

Title	Site Specific or Programmatic?	Core Operation or Adaptive Management?
San Joaquin		
San Joaquin River Restoration Program	NCO	NCO
Lower SJR Habitat*	Programmatic	AM
Bay-Delta		
Seasonal Operations	Site-specific	Core
Minimum Export Rate	Site-specific	Core
Delta Cross Channel Operations	Site-specific	Core
Agricultural Barriers	Site-specific	Core
Contra Costa Water District Rock Slough Operations	Site-specific	Core
North Bay Aqueduct	Site-specific	Core
Water Transfers	Site-specific	Core
Clifton Court Aquatic Weed Removal	Site-specific	Core
Suisun Marsh Preservation Agreement	NCO	NCO
OMR Management	Site-specific	Core
Tracy Fish Collection Facility*	Site-specific	Core
Skinner Fish Facility*	Site-specific	Core
Operations		
Suisun Marsh Salinity Control Gates Operation*	Site-specific	Core
Fall Delta Smelt Habitat*	Site-specific	AM
Clifton Court Predator Management*	Site-specific	Core
San Joaquin Basin Steelhead Telemetry Study*	Site-specific	AM
Sacramento Deepwater Ship Channel Food Study*	Programmatic	AM
North Delta Food Subsidies/Colusa Basin Drain Study*	Programmatic	AM

Title	Site Specific or Programmatic?	Core Operation or Adaptive Management?
Suisun Marsh Roaring River Distribution System Food Subsidies Study*	Programmatic	AM
Habitat Restoration		
Tidal Habitat Restoration (Complete 8,000 acres from 2008 BiOp)*	Programmatic	AM
Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project*	NCO	NCO
Predator Hot Spot Removal*	Programmatic	AM
Facility Improvements		
Delta Cross Channel Gate Improvements*	Programmatic	AM
Tracy Fish Facility Improvements*	Programmatic	AM
Skinner Fish Facility Improvements*	Programmatic	AM
Small Screen Program*	Programmatic	AM
Fish Intervention		
Reintroduction efforts from Fish Conservation and Culture Laboratory*	Site-specific	AM
Delta Fish Species Conservation Hatchery*	Programmatic	AM
*Denotes a Conservation Measure		

The proposed action for each basin is described in more detail below. These sections give some background for context along with a description of the proposed seasonal operations and proposed action.

4.9.1 Upper Sacramento River (Shasta and Sacramento Divisions)

Reclamation operates the CVP Shasta Division for flood control, navigation, agricultural water supplies, M&I water supplies, fish and wildlife, hydroelectric power generation, Delta water quality, and water quality in the upper Sacramento River. Water rights, contracts, and agreements specific to the Upper Sacramento include SWRCB Decisions 990, 90-5, 91-1, and 1641, Settlement Contracts, Exchange Contract, and Water Service Contracts. Facilities include the Shasta Dam, Lake (4.552 MAF capacity), and Power Plant; Keswick Dam, Reservoir, and Power Plant, and the Shasta TCD. The Sacramento Division includes the Red Bluff Pumping Plant, the Corning Pumping Plant, and the Corning and