Delta Smelt Resiliency Strategy
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CALIFORNIA natural resources AGENCY

Contents

Delta Smelt Resiliency Strategy

Introduction

The Delta Smelt Resiliency Strategy (Strategy) is a science-based document that has been prepared by the State of California (State) to voluntarily address both immediate and near-term needs of Delta Smelt, to promote their resiliency to drought conditions as well as future variations in habitat conditions. The Strategy relies on the MAST Report and Conceptual Models (IEP 2015) to articulate a suite of actions that can be implemented in the next few years that are intended to benefit Delta Smelt. Although the feasibility and effectiveness of each action included in the Strategy requires further exploration and study, the Strategy is an aggressive approach to implementing any actions that can be implemented in the near term, can be implemented by the State with minimal involvement of other entities, and have the potential to benefit Delta Smelt. State agencies that could implement this Strategy include Department of Water Resources (DWR), Department of Fish and Wildlife (DFW), and Division of Boating and Waterways (DBW). Several of the actions identified in this Strategy could also benefit other species, and coordination across various resource management agencies as appropriate may allow for benefits beyond Delta Smelt. All of the actions will be in compliance with applicable laws, including the Federal Endangered Species Act, California Endangered Species Act, California Environmental Quality Act, National Environmental Policy Act, and the Federal Clean Water Act. The Collaborative Science and Adaptive Management Program (CSAMP) will be used to determine the appropriate research approach to designing and assessing the outcomes of these management actions individually and synergistically. Additionally, it is expected that the Bureau of Reclamation (Reclamation) would participate in the implementation of this Strategy, including providing enhanced outflows in 2016, as described below.

Objective

The primary objective of this Strategy is to improve the status of Delta Smelt (e.g., generating a Delta Smelt population growth rate >1). The relatively positive response of the Delta Smelt population in 2011 suggests that it retains some ability to respond to improved conditions (Interagency Ecological Program 2015). The specific goals to achieve the primary objective consist of the following.

Goal 1: Improved Delta Smelt vital rates, including:

- Higher growth rates.
- Higher fecundity levels.

Goal 2: Improved habitat conditions, including:

- Increased spawning and rearing habitat area
- Improved habitat quality.
- Increased food resources.
- Higher turbidity.
- Reduced levels of invasive species (e.g., aquatic weeds, nonnative predators).

- Reduced levels of harmful algal blooms.

Conceptual Models

The Strategy is based on detailed CMs developed by the MAST Team (Interagency Ecological Program 2015) that are consistent with several other Delta Smelt CMs developed to date (e.g., Miller 2011). The CMs have a tiered structure with Delta Smelt performance (e.g., survival, growth, condition, fecundity) determined by Habitat Attributes, Environmental Drivers, and Landscape Attributes. Additionally, there are individual models for each Delta Smelt life history stage. Goal 1 of this Strategy is based on Tier 1, Delta Smelt Performance, of these CMs, and Goal 2 is based on Tier 3, Habitat Attributes. The following figures (45 through 49) are taken from the MAST report, and provide the basis for assessing management actions relevant to improvement of Delta Smelt status in the near-term (Interagency Ecological Program 2015).

Figure 45. Delta Smelt general life cycle conceptual model.

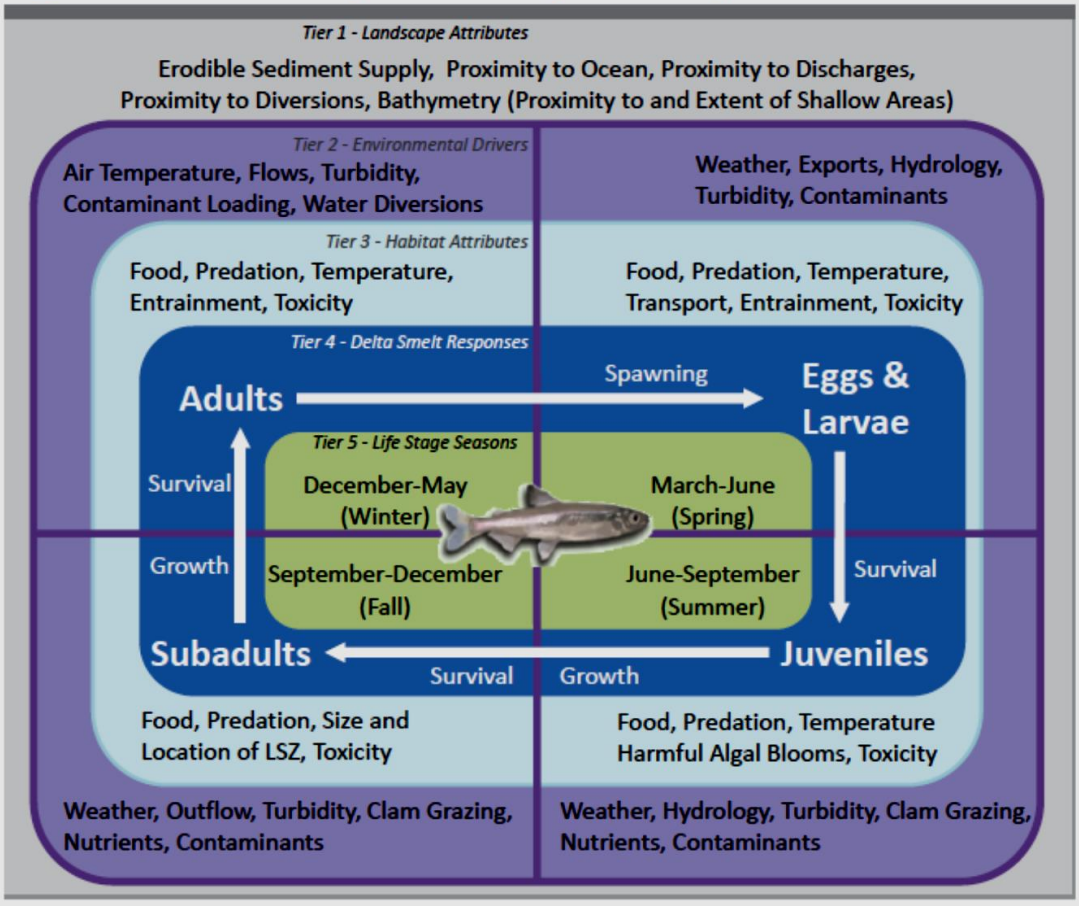


Figure 46. Conceptual model of drivers affecting the transition from Delta Smelt adults to larvae. Hypotheses addressed in Chapter 7 are indicated by the "H-number" combinations.

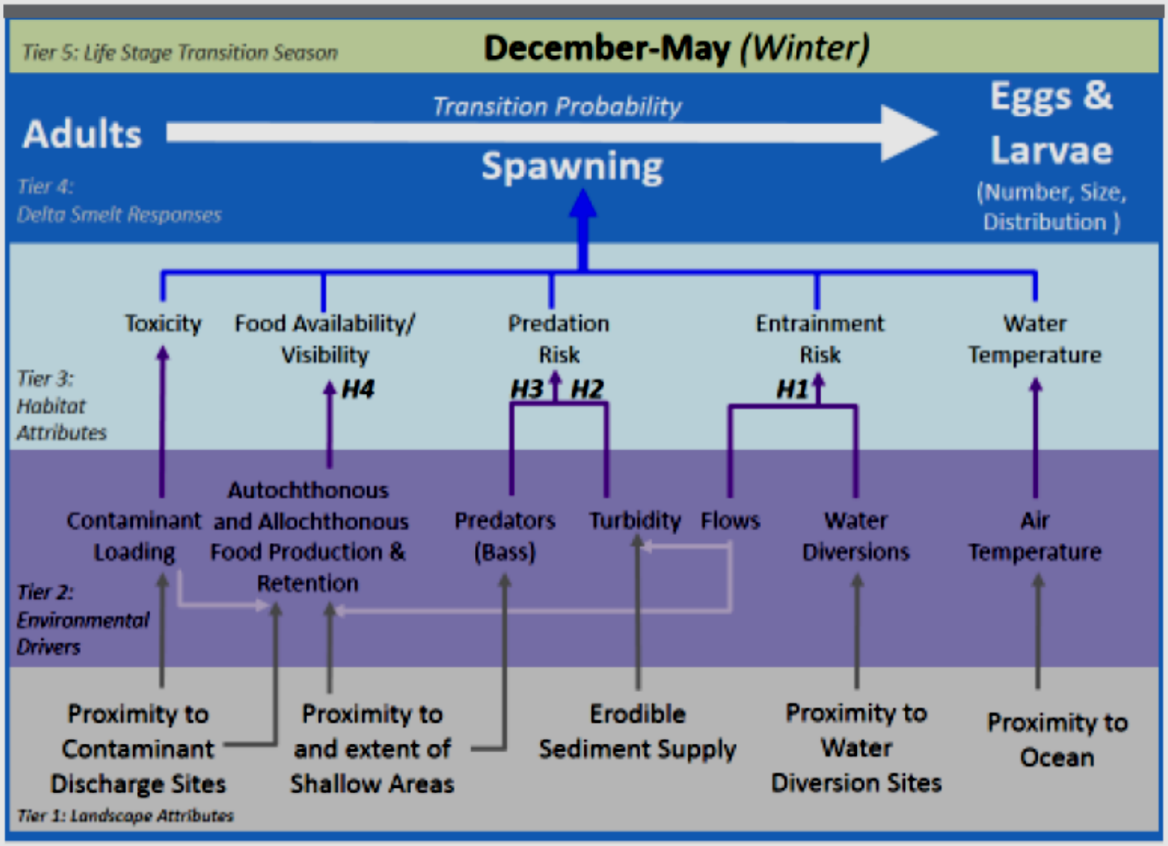


Figure 47. Conceptual model of drivers affecting the transition from Delta Smelt larvae to juveniles. Hypotheses addressed in Chapter 7 are indicated by the "H-number" combinations.

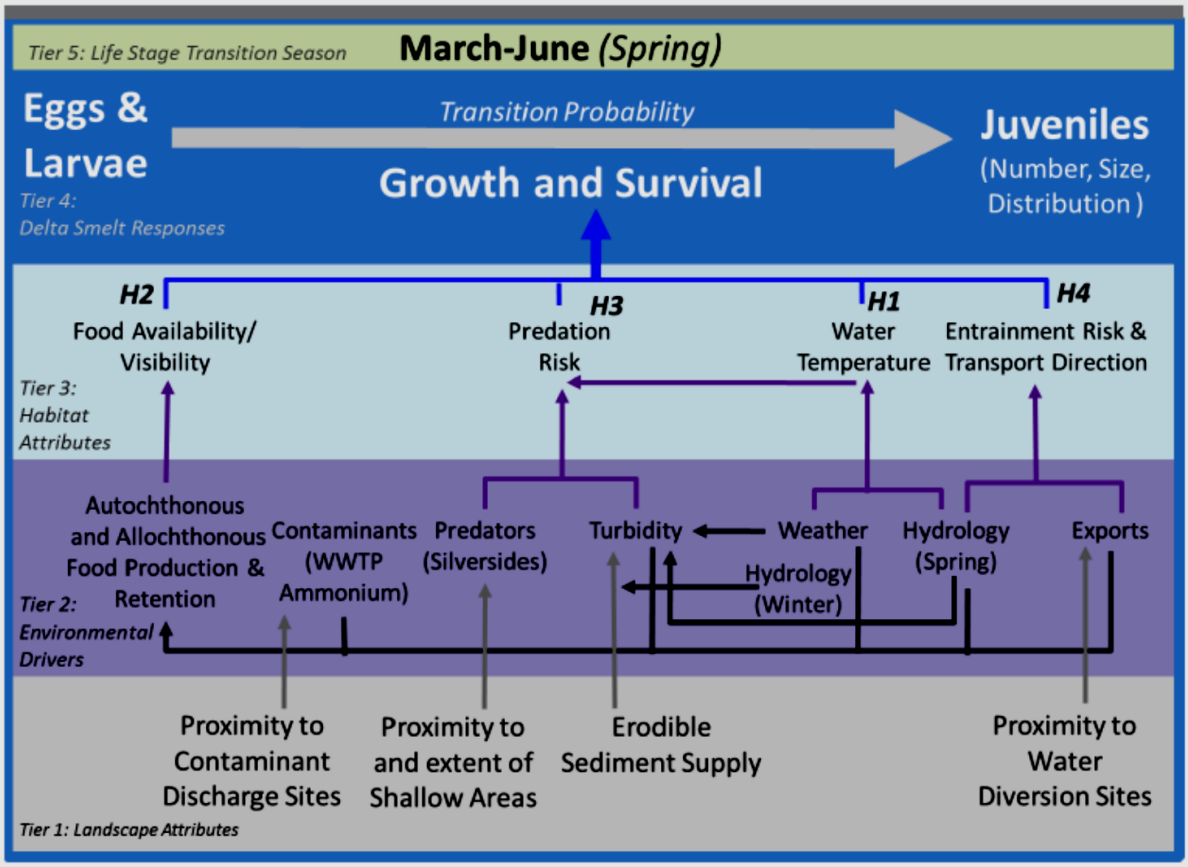


Figure 48. Conceptual model of drivers affecting the transition from Delta Smelt juveniles to subadults. Hypotheses addressed in Chapter 7 are indicated by the "H-number" combinations.

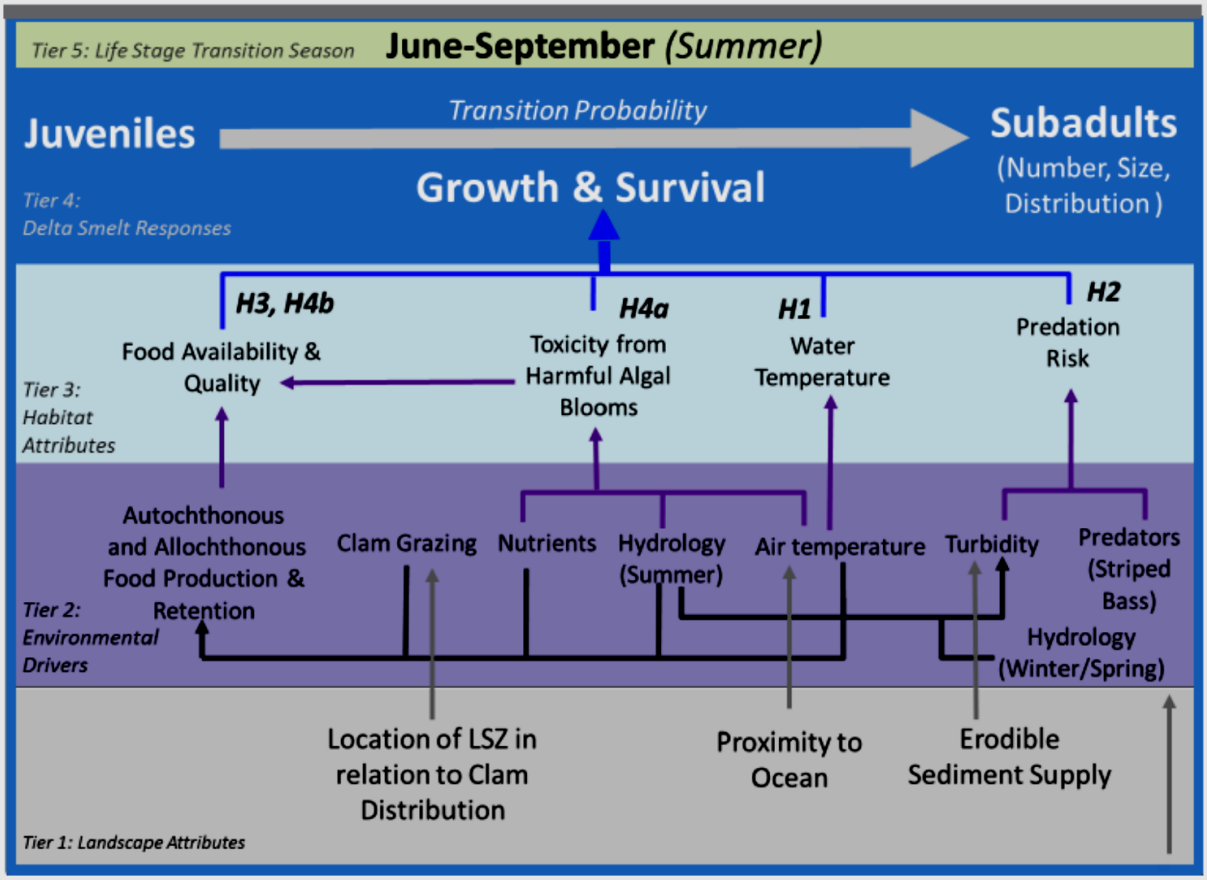
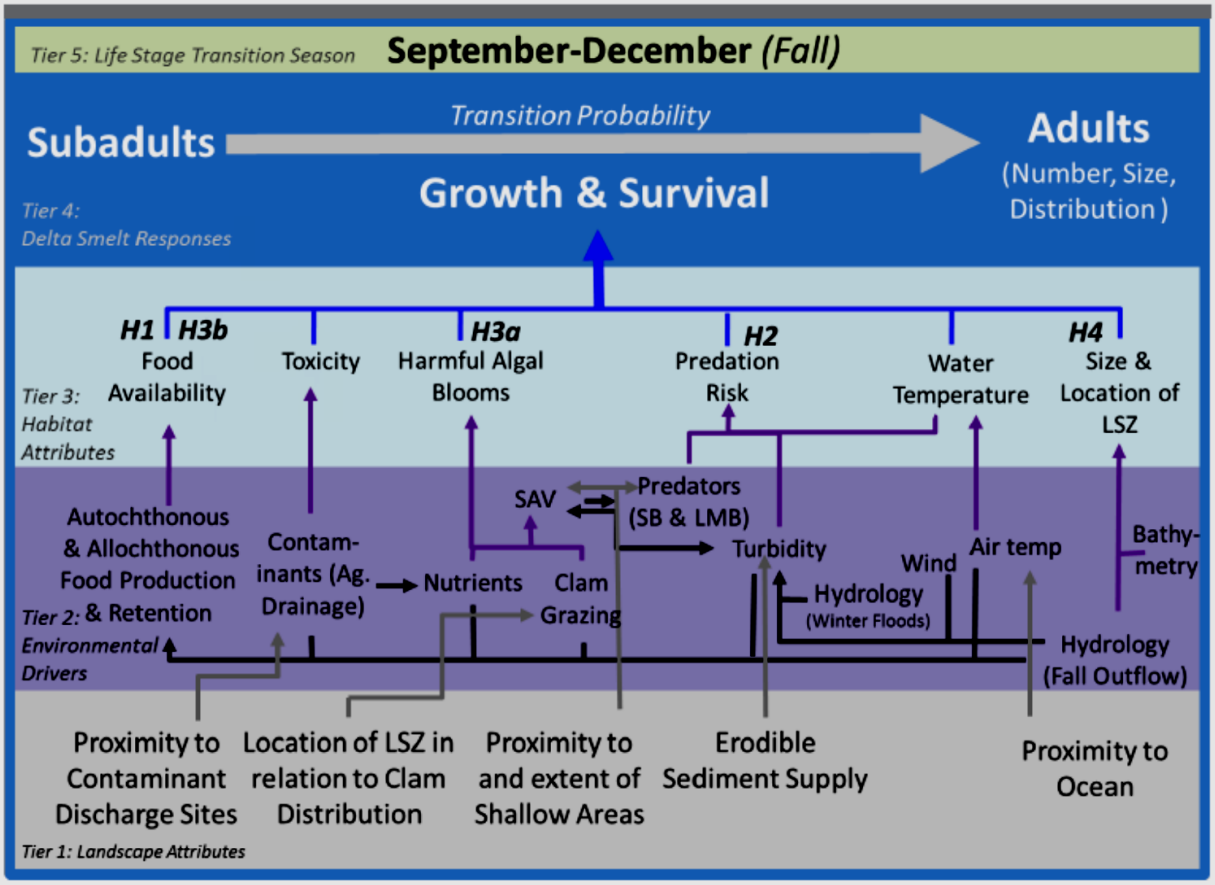


Figure 49. Conceptual model of drivers affecting the transition from Delta Smelt subadults to adults. Hypotheses addressed in Chapter 7 are indicated by the "H-number" combinations.



Determining the Suite of Management Actions

Not all of the Environmental Drivers included in the CMs can be influenced through management actions (Figures 45–49 above). For example, weather and air temperature cannot be controlled. Similarly, water temperatures are driven by atmospheric temperatures and can only be affected by operations for a limited amount of time and require substantial water to do so. Some drivers are not well-understood or monitored and therefore have substantial uncertainty associated with management actions intended to address them. However, this Strategy is meant to address as many Environmental Drivers as possible to achieve the objective and goals described above, with acknowledgement that some management actions may not yield expected results. The linkage to the CM and objectives are articulated for all management actions.

Proposed Actions

The following lists, in no particular order, the proposed management actions meant to address as many Environmental Drivers and Habitat Attributes in the MAST CMs as possible. A brief summary of each management action is provided below, and the life stages, Environmental Drivers, and Habitat Attributes affected are also noted.

Aquatic Weed Control

Linkage to Conceptual Models: This management action would benefit all life stages and the Environmental Drivers affected would include Turbidity and Predators.

Summary of Action: DWR will coordinate with DBW to increase the treatment of aquatic weeds in the Delta to ensure the Strategy would provide maximum benefits to Delta Smelt habitat. The action will take place during 2017–2018 in locations permitted by U.S. Fish and Wildlife Service (USFWS) and determined to be beneficial to Delta Smelt. In addition to Franks Tract, likely treatment areas would include Sherman Lake, Decker Island, and Cache Slough Complex.

North Delta Food Web Adaptive Management Projects

Linkage to Conceptual Models: This management action would benefit juvenile and sub-adult life stages and the Habitat Attributes that would be affected include Food Availability and Quality.

Summary of Action: DWR will augment flow in the Yolo Bypass by closing Knights Landing Outfall Gates and route water from Colusa Basin into Yolo Bypass in July 2016 and in July and/or September in 2017 and 2018 to promote food production and export into areas where Delta Smelt are known to occur. Food web enhancement flows will also be considered for additional months in ways that will not conflict with agricultural and waterfowl management actions based on the availability of water to augment flows in the Yolo Bypass. DWR will also explore options for increasing outflow from the Yolo Bypass during the spring.

Outflow Augmentation

Linkage to Conceptual Models: The CMs suggest that seasonally augmented outflows could affect two Environmental Drivers: Turbidity and Hydrology. Habitat Attributes that could be affected include Predation Risk, Harmful Algal Blooms, and Food Availability and Quality. This management action would also test the recent hypothesis that the location of the Low Salinity Zone (LSZ) is important at times of year besides fall. The extent to which these Environmental Drivers and Habitat Attributes can be positively affected through outflow augmentation will be the subject of a targeted research action.

Summary of Action: This adaptive management effort will occur in the spring and summer of 2017 and 2018. In 2016, Reclamation will provide 85 thousand acre-feet (TAF) to 200TAF additional outflow above what is required under D-1641 for release in the summer. In the spring and summer of 2017 and 2018, DWR and/or Reclamation will provide up to an additional 250TAF of outflow above D-1641 requirements. A variety of methods may be used to augment outflow, including transfers from willing sellers, changes in export or other CVP/SWP Delta operations, and/or storage releases. These flows must be consistent with the 2009 salmon biological opinion as determined by NMFS and CDFW.

Reoperation of the Suisun Marsh Salinity Control Gates

Linkage to Conceptual Models: This management action is proposed as an alternative to the *Summer Outflow Augmentation* action described above and would benefit juvenile and sub-adult life stages. The primary Habitat Attribute that would be affected is Food Availability.

Summary of Action: DWR will operate the Suisun Marsh Salinity Control Gates to reduce salinity in the Suisun Marsh during summer months. This management action may attract Delta Smelt into the high-quality Suisun Marsh habitat and reduce their use of the less food-rich Suisun Bay habitat. This management action would need to be monitored closely to ensure it does not result in unintended salinity changes in Suisun Bay and the confluence area.

Sediment Supplementation in the Low Salinity Zone

Linkage to Conceptual Models: This management action would benefit all life stages and the primary Environmental Driver that would be affected is Turbidity.

Summary of Action: DWR will assess the feasibility of sediment supplementation in the LSZ to promote turbidity corresponding to outflow actions (described above for *Outflow Augmentation*). If this management action is determined to be feasible, DWR will implement sediment supplementation activities in 2017 and 2018 as a pilot project to evaluate its effectiveness and its potential as a long-term management program.

Spawning Habitat Augmentation

Linkage to Conceptual Models: The CMs do not include spawning substrates; however, spawning substrate is a component of the USFWS-designated critical habitat for Delta Smelt. Therefore, this management action could benefit spawning adults and eggs.

Summary of Action: DWR will evaluate the availability of suitable spawning substrates in Suisun Marsh and Cache Slough in 2016. If suitable substrate is determined to be absent or limiting, DWR will introduce sand and other likely-favored spawning substrates in key areas of Suisun Marsh and Cache Slough (i.e., where pre-spawning adults have been found in higher densities than in other parts of the estuary). This management action will be monitored to assess its effectiveness.

Roaring River Distribution System Food Production

Linkage to Conceptual Models: This management action would benefits juvenile and sub-adult life stages and the primary Environmental Driver that would be affected is Food Production.

Summary of Action: DWR will install drain gates on the western end of the Roaring River Distribution System that can be used for most months of the year to drain food-rich water from the canal into Grizzly Bay to augment Delta Smelt food supplies in that area. This area is also adjacent to the Tule Red Restoration Project, which is proposed to begin construction in 2016 as discussed below for *Near-term Delta Smelt Habitat Restoration*. In addition to new drain gates, DWR will repair of the existing outfall gate/water control structure on Montezuma Slough which, in addition to a new gate onto Grizzly Bay, would further increase operational flexibility to maximize export of productivity to adjacent open water habitat used by Delta Smelt.

Coordinate Managed Wetland Flood and Drain Operations in Suisun Marsh

Linkage to Conceptual Models: This management action would benefit all life stages and the primary Environmental Driver that would be affected is Contaminants and the Habitat Attribute that would be affected in Food.

Summary of Action: Based on the findings of a current study on Joice Island, DWR will coordinate with the Suisun Resource Conservation District and DFW to develop a management plan for managed wetland flood and drain operations that can promote food export from the managed wetlands to adjacent tidal sloughs and bays.

Adjust Fish Salvage Operations during Summer and Fall

Linkage to Conceptual Models: This management action would benefit all life stages and the primary Environmental Driver that would be affected is Predation.

Summary of Action: DWR and Reclamation will adjust summer salvage operations beginning in 2016 so that non-native salvaged fish will not be returned to the Delta. Collection and counting will still occur. Normal fish salvage operations will resume when monitoring indicates that juvenile Chinook salmon and steelhead are entering the Delta in the fall. In addition, USFWS will coordinate with DFW on an outreach program to ensure recreational anglers understand the benefit of catch, without release, of fish that prey on Delta Smelt.

Stormwater Discharge Management

Linkage to Conceptual Models: This management action would benefit all life stages. The Environmental Driver that would be affected is Contaminant Loading and the Habitat Attribute that would be affected is Toxicity.

Summary of Action: The State will provide funding to entities such as the Sacramento Stormwater Quality Partnership, and/or counties and cities whose stormwater discharges to Delta waterways under National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System stormwater permits. The funding would enable the entities to implement additional actions to reduce contaminant loading in the Delta.

Rio Vista Research Station and Fish Technology Center

Linkage to Conceptual Models: This management plan would benefit all life stages. Although no specific Environmental Drivers would be affected, this management action would help guard the Delta Smelt population (Tier 1 in the MAST CM) against extinction by creating an additional refuge population.

Summary of Action: A new Delta field station in Rio Vista that will consolidate existing IEP Delta Smelt monitoring and research activities, and will include a new Fish Technology Center (FTC) is expected to be completed in 2019. The FTC will be designed to house a refuge population for Delta Smelt to be used for species conservation and research. Until construction, the primary activity will be to conduct technical studies to identify the potential uses of the refuge population as part of a conservation strategy for Delta Smelt. This information is a key data gap for a future management plan for a potential future conservation hatchery.

Near-term Delta Smelt Habitat Restoration

Linkage to Conceptual Models: This management action would benefit all life stages. The primary Environmental Drivers affected is Food Production and Predators, which affects two Habitat Attributes, Food Availability/Visibility and Predation Risk.

Summary of Action: DWR and other state agencies are planning restoration projects that are likely to benefit Delta Smelt, and are very close to breaking ground (Table 1). Construction of each project will take 1–4 years. Details on the timing and characteristics can be found at http://resources.ca.gov/ecorestore. In addition to these projects, the State's EcoRestore program, which includes the projects listed in Table 1, has committed to implementing restoration of 9,000 acres of inter-tidal wetland habitat in the Delta and Suisun Marsh by the end of 2018 and to initiate of work to enhance fish habitat in the Yolo Bypass.

Table 1. Summary of Near-Term (2016–2019) Tidal Restoration Actions that Will Benefit Delta Smelt

Restoration Site	Tidal Wetland (acres)	Construction Begins
Tule Red	600	2016
Dutch Slough	660	2016
Hill Slough	750	2016
Decker Island	140	2017
Lower Yolo Ranch	1,600	2017
Bradmoor Island	280	2018
Prospect Island	1,500	2019
TOTAL	**5,530**	

Franks Tract Restoration Feasibility Study

Linkage to Conceptual Models: This management action would benefit all life stages. The primary Environmental Driver that would be affected is Food Production and Predators, which would affect two Habitat Attributes, Food Availability/Visibility and Predation Risk.

Summary of Action: Franks Tract is located near the confluence of the Sacramento and San Joaquin Rivers, and could support LSZ habitat. DFW will conduct a conceptual plan and feasibility study for restoring Franks Tract to reduce invasive aquatic weeds, reduce predation on Delta Smelt, increase turbidity, and improve food webs. The conceptual plan will be completed by the spring of 2017. If this management action is found to be feasible, the restoration of Franks Tract could begin as early as 2018.

Summary

The Strategy proposes a suite of near-term management actions that would address predation, turbidity, food availability and quality. Strategy implementation would also provide outflow augmentation that may interact with other actions to improve conditions such as contaminant exposure, food availability and quality, water temperatures, and salinity. The extent to which these Environmental Drivers and Habitat Attributes can be positively affected through outflow augmentation will be the subject of a targeted research program, which will be coordinated through the CSAMP. Other activities implemented by the Federal government, non-governmental organizations, and/or other stakeholders may complement the State's proposed management actions identified in this Strategy. Additionally, the State may opt to include additional management actions in this strategy on the basis of scientific information gleaned from implementation of this near-term Strategy.

Collaborative Science and Adaptive Management Program

The CSAMP will be used to determine the appropriate research approach to designing and assessing the outcomes of these management actions individually and synergistically. The CSAMP forum will oversee implementation and the synthesis of the results to inform subsequent management actions.

References Cited

Interagency Ecological Program. 2015. An updated conceptual model of Delta Smelt biology: our evolving understanding of an estuarine fish. Available: http://www.water.ca.gov/iep/docs/Delta_Smelt_MAST_Synthesis_Report_January%202015.pdf Accessed: July 7, 2016.

Miller, W.J. 2011. Revisiting assumptions that underlie estimates of proportional entrainment of delta smelt by State and federal water diversions from the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science, 9(1). Available: http://escholarsh ip.ucop.edu/uc/item/5941x1h8.Miller 2011. Accessed: July 7, 2016