Table T-1. Estuarine Fish Species: Potential CALFED Effects and Conservation Measures

Summary Effect of Implementing CALFED Actions and Conservation Measures on Estuarine Fish Species: The proposed actions and associated conservation measures of the CALFED Bay-Delta Program are expected to result in substantial improvement in evaluated estuarine fish populations and their habitat.

Associated Evaluated Species: Tidewater goby, delta smelt, longfin smelt, Sacramento splittail, and Sacramento perch.

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Delta Region					
Associated Evaluated Species: Delta smelt, longfin smelt, Sacramento splittail, and Sacramento perch.					
Summary Programmatic Action Outcomes E13a, E16a, E17, E19, E24, W3, and W4 are likely to have no discernable effect on estuarine fish species in the Delta Region.					

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Ecosystem Restoration Program					
E1. Provide for more natural riverflows and Bay-Delta freshwater inflow peaks in fall, winter, and spring of all but critical years.	E010101, E010102, E010103, E010104	An increase in the freshwater inflow in fall, winter, and spring would increase the area of freshwater spawning and low salinity rearing habitat in the Bay-Delta, which in turn could lead to higher survival and population levels (BE1).	Reallocation of seasonal and multiyear water supplies to enhance spring and fall riverflows and Delta inflow could limit available water supply in other seasons and future years particularly during critical years and extended droughts, which could adversely affect survival at those times in the opposite manner as stated for benefits (AE1).	Implement measures during extended droughts to protect water supplies dedicated to meet Delta inflow and outfall criteria deemed essential in maintaining estuarine fish populations. Such measures would be implemented infrequently and would be used only to readjust water supplies to levels expected without this set of program actions. Measures may include additional dedicated surface or groundwater stored specifically for this purpose, special options for the purchase of needed additional supplies, or emergency provisions that would reduce other water supply demands. Another measure is to initially implement the actions to the extent feasible to determine potential effects on seasonal and critical-year water supplies, and develop a long-term water management plan that includes this and other actions to minimize effects of reallocation in other seasons and critical years (M1).	Increases in survival and population abundance would be expected for each of the species from benefits of increased inflows to the Delta. Such increases may also lead to higher sustained population levels in wet and critical years. The measures to minimize the potential adverse effects on the populations during extended droughts would ensure that positive effects outweigh potential negative effects.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		An increase in inflow in spring would increase the frequency of the low-salinity zone being located in more productive shallow bays of the Western Delta and North Bay rather than interior Delta channels, which could lead to higher estuarine food production and greater juvenile survival and higher population levels (BE2). An increase in inflow in late fall, winter, and spring would enhance migration, which could lead to higher survival and population levels (BE3). Increased inflow, particularly in late winter and spring, would increase foodweb productivity in the Bay-Delta rearing habitats, which could increase survival and population levels (BE4).			

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Increased spring inflow would increase river silt load and flood more shoreline vegetation, which may reduce predation through greater turbidity and more available escape habitat, which could increase survival and population abundance (BE5). Increased spring inflow would reduce competition from non-native species adversely affected by increased flows or seasonally lower Bay-Delta salinity levels (e.g., Asia clams), which could lead to greater survival and higher population levels (BE6). Increased spring and fall Bay-Delta inflow would reduce the loss of these estuarine fish to water diversions by decreasing the percent diverted and reducing negative flows in the lower San Joaquin River portion of the Delta, which could lead to greater survival and higher population levels (BE7).			

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Increased spring inflow may reduce the concentrations of toxins, which could lead to greater survival and higher population levels (BE8).			
E4. Provide more natural Delta hydraulic conditions (internal flow and velocity patterns) by altering channel configurations (e.g., setback levees) and physical barriers to channel flow.	E010601, E010602, E010603, E010604, E010605, E010606, E010607	Increasing channel area and cross section by setting levees back would increase shallow-water spawning and rearing habitat, which could increase survival and population levels (BE9).	Operation of a barrier at the Head of Old River during key periods could increase export losses of fish residing in the west, central, and south Delta (AE2).	Construct and operate inchannel barriers and restrictions to provide sufficient leeway to adjust hydraulics in various channels to ensure fish are not being drawn in greater numbers or proportions toward the pumps, or being affected by poor water quality. Monitoring and testing would be necessary to design, construct, and operate barriers and restrictions. Procedures and operating criteria would be developed for a barrier system to protect fish. Monitoring and testing would be necessary to ensure against excessive movement of fish toward the south-Delta pumping plants (M2).	Improved transport conditions and rearing habitat and reduced export losses could lead to increased survival and higher population levels. The Delta Cross Channel (DCC) and Head-of-Old-River barrier would be operated to ensure positive effects. Constraints on channel restrictions and DCC closure to protect water quality and limit exposure of fish to south-Delta export pumps may limit other benefits to some fish (e.g., north-Delta delta smelt). Future adaptive management activities relating to these actions would determine the extent of potential benefits.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Restricting flow toward the export pumps in some Delta channels will increase residence time of water, which could potentially improve foodweb productivity and reduce export losses of fish (BE10).		To the extent consistent with program objectives, constrain the operation of a barrier at the Head of Old River during key periods as necessary to minimize the extent of fish exposure to the south-Delta pumping plants. Monitoring and testing would be necessary to balance the loss of fish from the San Joaquin River and the west, central, and south Delta (M3).	
		Restricting channelflow to selected channels could improve the efficiency of cross-Delta flow of water from the north Delta and reduce the extent of negative net upstream flows in the lower San Joaquin channel, which could reduce movement of fish toward the south-Delta pumping plants (BE11).	Implementing actions could result in mortality, harm, or harassment of estuarine fish species (AE3).	To the extent practicable, avoid inchannel construction activities during periods when estuarine fish species would be most susceptible to adverse affects that could be associated with implementing proposed actions (M4).	

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Closure of the DCC, particularly from November through January, would increase net freshwater inflow into the western Delta from the Sacramento River, which could improve transport of Sacramento River fish to the shallow bays of the western Delta and Suisun Bay, improve habitat in those areas, and lessen their export at south-Delta pumping plants, which in turn, could improve survival and population abundance (BE12). Closure of the DCC during winter could reduce straying of Sacramento River fish into the interior Delta and confine their migration route to the lower Sacramento River, which could reduce migration time and improve chances of reaching spawning and rearing areas in the Sacramento River portion of the Delta (BE13).		To the extent practicable, avoid implementing proposed actions in occupied habitat areas that could have a substantial adverse effect on the distribution or abundance of estuarine fish species (M5).	

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Operation of the barrier at the Head of Old River from August through November could reduce the losses of fish moving from the Bay and western Delta toward the eastern Delta and lower San Joaquin channel to export pumps in the south Delta (BE14). Operation of the barrier at the Head of Old River from August through November would improve water quality in the eastern Delta, including the San Joaquin River channel near Stockton, which may improve fish survival and population abundance in that portion of the Delta (BE15). Improving and restoring Yolo Bypass channels and bypass draining could reduce stranding losses of fish in the bypass and provide added spawning and rearing habitat and improve foodweb productivity in the bypass and Delta, which could increase survival and population abundance (BE16).			

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E5a. Restoration of up to 7,500 acres of tidal shallow-water habitat.	E010401, E010402, E010403, E010404, E010405, E010406, E010407, E010901, E010902, E010903, E010904, E010905, E010906, E015201, E015202	Conversion of leveed lands to tidal waters, construction of setback levees along Delta channels, and construction of overflow basins in the Bay-Delta would increase tidal shallow-water habitat, which could increase spawning and rearing habitat and improve foodweb productivity, which, in turn, could lead to increased survival and population abundance (BE17).	Overflow basins may lead to stranding if sufficient drainage is not provided, which could reduce survival and population abundance (AE4).	To the extent consistent with program objectives, design and construct overflow basins from existing leveed lands in stages using construction design and operating schemes and procedures developed through pilot studies and project experience to minimize the potential for stranding as waters recede from overflow areas (M6).	Improved shallow-water rearing habitat in the Delta could lead to a general increase in survival and population abundance.
		Control of non-native plants in Bay-Delta sloughs would improve spawning and rearing habitat, which could increase survival and population abundance. Control of non-native plant and animal introductions could reduce the potential for future competition and predation (BE18).	Increased shallow-water area may increase abundance of non-native species by providing additional habitat. Non-native species may compete with or prey on these species, reducing survival and population abundance (AE5).	To the extent consistent with ERP objectives, design shallow-water areas to address the habitat needs of these species and avoid providing optimal conditions for non-native species (M7).	
			AE3.	M4. M5.	

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E8. Restoration of 30,000 to 45,000 acres of tidal fresh emergent wetland.	E010401, E010402, E010404, E010405, E010407, E010606, E011101, E011102, E011201, E011202, E011401, E011402, E011403, E011404, E011405, E015202	Additional tidal emergent wetland habitat would increase shallow-water spawning and rearing habitat, provide more abundant shaded riverine aquatic (SRA) cover, increase foodweb productivity, and potentially improve Delta water quality, which could increase survival and population abundance (BE19).	Removing levees and opening leveed lands to tidal action could have some short-term negative effects through changes in hydraulics, water quality, and habitat conditions (AE6).	To the extent consistent with program objectives, develop and implement restoration methods that minimize potential effects on hydraulics, water quality, and habitat on estuarine fish species when restoring tidal wetlands from subsided leveed lands (M8).	Properly designed and constructed tidal wetlands would provide maximum habitat benefits and would minimize negative effects of poor water quality and stranding. Overall, there could be a positive response in the populations to new wetland habitat.
			New tidal wetlands may affect water quality in ways that would have negative effects on these species (e.g., if wetlands increase water temperature sufficiently to reduce growth or survival) (AE7).	M8.	
			New tidal wetlands may lead to stranding if the tidal drainage is unnatural or inefficient, which could reduce survival and population abundance (AE8).	M6.	
			AE3.	M4. M5.	

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E9. Maintenance of existing and restoration of 200-800 acres of channel islands and associated habitats.	E011201, E011202, E015002, E016001, E016002	Protection of existing islands and restoration of additional channel-island habitat would increase SRA habitat and shallow-water edge habitat, which could provide more spawning and rearing habitat as well as improve foodweb productivity, which, in turn, would increase survival and population abundance (BE20).	Filling Delta channels to create channel islands could result in the loss of small amounts of shallow-water habitat (AE9). AE3.	To the extent consistent with program objectives, construct channel islands in sloughs that have relatively poor shallow-water and SRA habitats such that the net gain in these habitats is positive (M9). M4. M5.	Foodweb and habitat improvements from restored channel islands should provide small benefits to populations through increased survival and reproduction.
E10a. Restoration of 85-190 miles of tidal sloughs.	E015201, E015202, E011101, E011102	Improved slough and restored slough habitat would increase the area of aquatic habitat, including shallow-water and SRA habitats, which would provide additional spawning and rearing habitat and increase foodweb productivity, which, in turn, could increase reproduction, survival, and population abundance (BE21).	Likely to be no discernable adverse effects on hardhead populations or hardhead habitat areas (N/E).	None.	Foodweb and habitat improvements from restored tidal sloughs should benefit populations through increased reproduction, survival, and population abundance.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E11. Restoration of up to 19,600 acres of nontidal freshwater emergent wetland.	E010403, E010406, E011001, E011002, E011003, E011004, E011005, E011006, E011007, E011301, E011302, E011303, E011304, E011305	Overflow basins may provide additional spawning and rearing habitat in flood years that could increase reproduction, survival, and population levels (BE22).	Establishment of overflow basins could have some short-term negative effects on estuarine fish species as a result of changes in hydraulics, water quality, and habitat conditions (AE10). AE3.	M8. M4. M5.	Overflow basins may lead to an increase in reproduction, survival, and population abundance from improved habitat and foodweb productivity. Nontidal emergent wetlands in the Delta could be instrumental in raising seed populations of Sacramento perch for developing a more general Delta-wide population.
E15a. Restoration of 48–85 miles of riparian habitat along channels, restoration of riparian habitat in association with setback levees, protection of 500 acres of existing riparian forest, and reduction of current invasive riparian plants by 50%.	E010501, E010502, E010606, E011101, E011102, E011201, E011202, E011601, E011602, E011603, E011604, E011605, E011606, E011607, E011608, E011609, E014901, E015301, E015302, E015303	Improvements and restoration of riparian habitat along Delta channels could substantially improve spawning and rearing habitat in the Delta, as well as foodweb productivity, which could lead to increased survival and population abundance (BE23).	Potential for temporary increase in turbidity resulting from implementing restoration actions (AE11).	None.	Habitat and foodweb productivity improvements would lead to small increases in reproduction, survival, and population abundance.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Potential for substantial increase and enhancement of SRA habitat, instream habitat, and stream temperature conditions for populations of native aquatic species (BE24).	AE3.	M4. M5.	
E18a. Cooperative management of 40,000–75,000 acres of agricultural lands to enhance habitat values for waterfowl and other associated species.	E011901, E011902, E011903, E011904, E011905, E011906, E011907, E007101	Flooding and draining of agricultural lands could lead to an increase in Delta foodweb productivity, which could improve fish growth, survival, and production in Delta rearing habitat (BE25).	An increase in water diversions in winter to flood agricultural lands could lead to an increase in entrainment losses of adult and juvenile estuarine fish, which could reduce production and population size (AE12). An increase in agricultural water diversions in the Delta during winter could reduce net downstream transport of some estuarine larvae and juveniles through the Delta, which could reduce juvenile production and adult populations (AE13).	To the extent practicable, confine additional pumping to times and area channels with minimal concentrations of fish (M10). To the extent practicable, install screens on diversions to avoid entrainment of juvenile and adult estuarine fish (M11). To the extent consistent with program objectives, confine such winter diversions to non-dry years when water supplies are sufficient to minimize any effects on downstream transport, export pumping ratios, and foodweb productivity (M12).	Small potential benefit to the estuarine fish populations through improved juvenile growth from improved Delta foodweb productivity.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
			An increase in agricultural water diversions in the Delta during winter could decrease Delta foodweb productivity, which could reduce juvenile production and adult populations (AE14).	M12.	
E20. Reduction in the adverse effects of dredging on estuarine aquatic habitats.	E015001, E015002, E015003, E015004	Avoiding dredging at important times and places in the Delta would help improve estuarine fish feeding habitats and potentially lead to improved populations (BE26).	N/E	None.	Limiting dredging activity in the Delta could lead to potential improvements in juvenile production and adult populations through improved rearing habitat.
E21. Reduction in the probability of introduction and establishment of non-native aquatic species into the Bay-Delta.	E015401, E015402, E015403	Limiting abundance of non-native aquatic species may reduce competition and predation, and thus increase survival and population abundance (BE27).	N/E	None.	Reducing the potential for non-native predators or competing organisms in the Delta would help maintain or increase the estuarine fish production capacity in the Delta.
E22. Reduction in the adverse effects of diversions on fish.	E014701, E014702, E014703	Consolidating diversions and upgrading fish screens and handling systems could reduce entrainment losses and lead to an increase in survival and population levels (BE28).	Consolidated larger and fewer diversions and positive-barrier bypass-screen systems could increase entrainment, impingement, and predation losses of estuarine fishes and therefore decrease survival and population abundance (AE15).	To the extent consistent with program objectives, place consolidated intakes in areas with minimal numbers of estuarine fish, particularly delta smelt (M13).	Additional screening and upgraded screen facilities could reduce loss of estuarine fishes and could therefore increase production and population levels.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
				Design and construct a new fish-screen system at the entrance to Clifton Court Forebay to alleviate the loss of estuarine fish to predation in the forebay and to the existing fish-bypass and collection facility within the forebay (M14). Screen intakes or connect intakes of the Tracy Pumping Plant (Central Valley Project) to the screened Clifton Court Forebay to alleviate loss of estuarine fish at the Tracy Fish Protection Facility (M15). Screen all Delta diversions that may entrain estuarine fish (M16).	
E25. Reduction in the adverse effects of harvest on fish and wildlife populations.	E015801, E015802, E015803	Reduction in the loss of juvenile and adult fish to illegal net fishing and in the legal sport fishery in the Delta could increase the population levels (BE29).	N/E	None.	Potential for small benefit to populations from reduced illegal harvest in Delta.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E27a. Reduction in the concentrations and loadings of contaminants in the aquatic environment by 25%–50%.	E015701, E015702	Reduction in the levels of contaminants being released into Delta channels could increase foodweb productivity and improve survival, leading to increased production and higher population levels (BE30).	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
E28. Reduction in the adverse effects of boat wakes on shoreline habitats and wildlife in sensitive habitat areas.	E016001, E016002, E016003, E016004, E016005, E016006	Protection of riparian and emergent vegetation along Delta channels from boat wakes could improve survival in the Delta through improved cover and increased foodweb productivity, which could lead to greater production and population levels (BE31).	N/E	None.	A small increase in production could occur from improved SRA and channel habitats resulting from reduced boat wakes in some Delta channels.
Levee System Integrity Program					
L1. Improvement and maintenance of Delta levees.	L010101, L010102, L010201, L010202, L010301	Enhanced levee stability would decrease levee failures and reduce potential loss of estuarine fish to stranding on flooded islands or poor water quality (e.g., high water temperatures, increased turbidity, and increased salinity) (BE32).	Upgrading levees could degrade existing riparian, wetland, and SRA habitats along existing levees and potentially reduce survival and therefore decrease production and population levels (AE16).	Restore or enhance 1-3 times the amount of habitat affected by levee upgrades near where impacts are incurred (M17).	Greater levee stability and fewer island flooding events together with habitat improvements associated with upgraded levees could result in improved water quality, less stranding, and increased rearing habitat, which could improve production and population levels.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Proposed habitat improvements along upgraded levees (e.g., shallow slopes and vegetated berms) could improve rearing habitat and potentially increase production and population levels (BE33).	AE3.	Include project design features that allow for onsite reestablishment and long-term maintenance of aquatic, wetland, and riparian habitat following project construction (M18). M4. M5.	Potential for increases in estuarine fish habitat with implementation of conservation measures.
L2. Reduction in the risk to levee stability from subsidence.	L010401, L010402	Potential beneficial effects of the program are not analyzed. The type and magnitude of potential beneficial effects would depend on the type of specific program actions that are implemented (N/A).	Potential adverse effects of the program are not analyzed. The type and magnitude of potential adverse effects would depend on the type of specific program actions that are implemented (N/A).		Potential program effects cannot be evaluated.
Water Quality Program					
Q1. Reduction of oxygen-depleting substances in the aquatic environment.	Q010101, Q010102, Q010103, Q010104	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Q2. Maintain pathogen loadings at or below mandated levels and reduce levels of total organic carbon, bromide, and total dissolved solids to increase the availability of water for beneficial uses.	Q010201, Q010202, Q010203, Q010204, Q10205, Q010206	Likely to be no discernable beneficial effects for estuarine fish species or habitat areas (N/E).	Reductions in total organic loadings could reduce foodweb productivity, which could reduce production and population abundance (AE17).	Reductions in unnatural inputs of organic carbon could be replaced with increased natural organic inputs such as from restored tidal wetlands and riparian habitats (M19).	Implementation of the proposed actions would most likely have no discernable effect on the evaluation species' numbers or distribution.
Q4. Reduction of pesticide loadings in the aquatic environment.	Q010501	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Q7. Reduction of cadmium, copper, and zinc loadings to levels that do not adversely affect Bay-Delta species or beneficial uses of water.	Q010801	BE30.	N/E	None.	A small potential benefit of increased juvenile production and a larger population would be expected from lower metal loadings.
Water Use Efficiency Program					
W1. Support implementation of water management techniques that increase the effectiveness of water-use management and efficiency for agricultural uses.	None.	Potential benefit of increased freshwater inflow to Delta and Bay and reductions in exports and export-related losses of fish through water conservation if saved water is used to augment freshwater inflow to the Delta. (BE34).	N/E	None.	Increased water use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve estuarine fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
W2. Support implementation of measures that increase agricultural production per unit of water used, protect water quality, or increase environmental benefits while meeting agricultural needs.	None.	BE34.	N/E	None.	Increased water use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve estuarine fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.

D-051642

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Transfer Program					
T1. Implement a framework of actions, policies, and processes that will facilitate transfers and the further development of a statewide water-transfer market.	None.	Further development of water transfers could lead to reductions in exports at high risk times of year, which could reduce losses of estuarine fishes at project pumping plants or adverse habitat changes caused by water diversions (BE35).	Further development of water transfers could lead to a shift in water diversions from the Delta to periods with higher risk of losses to entrainment (AE18).	Water transfers should be conducted so as not to increase exports during critical times of year when estuarine fish are more vulnerable to damage or loss at project facilities (M20).	Water transfers could be scheduled to reduce entrainment losses of estuarine fish and improve Delta habitat and foodweb productivity, which could improve production and population abundance.
Watershed Management Program					
M1. Fund and implement watershed restoration, maintenance, conservation, and monitoring activities.	None.	N/A	N/A		Potential program effects cannot be evaluated.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Conveyance Facilities					
C1. Construct and operate modifications to existing south-Delta conveyance features.	C010101, C010102, C010103, C010104, C010105, C010106, C010107, C010108	Alteration of channels in the south Delta could improve habitat in altered and other channels, which could lead to greater foodweb productivity, improved spawning and rearing habitat, and reduced entrainment and salvage losses at south-Delta pumping plants (BE36).	Alteration of south-Delta channels could increase chances of some estuarine fish being drawn to and lost or damaged to south-Delta pumping plants (AE19).	Design alteration of south-Delta channels to improve spawning, rearing, and feeding habitat in the south Delta (M21).	Alteration of south-Delta channels, if appropriately designed, could lead to improved survival, production, and population levels. Alteration of south-Delta conveyance features at the south-Delta pumping plants could lead to improved survival, production, and population levels.
		Improvements to CVP-SWP conveyance features at south-Delta pumping plants (e.g., Joint Point of Diversion) could reduce vulnerability of estuarine fish to entrainment and salvage losses at the intakes of the facilities (BE37).		Design alteration of south-Delta channels to minimize the extent estuarine fish would be drawn to the immediate vicinity of the south-Delta pumping plant intakes (M22).	
			Alteration of conveyance features at south-Delta pumping plants could increase the pumping capacity, which could lead to increasing entrainment and salvage losses at the intake facilities (AE20).	Construct and operate new conveyance features in the south Delta to the pumping plants to minimize losses of estuarine fishes (M23).	

D—051644

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
			AE3.	M4. M5.	
C2. Construct and operate modifications to existing north-Delta conveyance features.	C020101, C020102, C020103	Increased freshwater inflow to the interior Delta through Snodgrass Slough could improve water quality and fish habitat conditions (e.g., foodweb productivity) in the interior north Delta such that it could lead to improved production and population levels of estuarine fishes (BE38).	The discharge of Sacramento River water into the interior Delta through Snodgrass Slough could result in some estuarine fishes (e.g., splittail) being drawn up to the discharge point during annual spawning migrations up the Sacramento River (AE21).	Time diversion of Sacramento River water into the interior Delta to minimize effects on migrating estuarine fishes (M24). Design the diversion so as to not block upstream-migrating fish headed for the Sacramento River (M25).	An increase in the conveyance of Sacramento River water into the interior Delta through Snodgrass Slough has the potential to improve habitat in the interior Delta, which could lead to higher estuarine fish production and population levels in the central Delta. North-Delta conveyance facilities could be designed and operated in a manner that would result in enhancement of estuarine fish survival, production, and population abundance.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		Increased cross-Delta flow of Sacramento River water to meet diversions demands from the south Delta could reduce entrainment and salvage losses at south-Delta pumping plants by reducing the amount of west-Delta and San Joaquin water being drawn to south-Delta pumping plants (BE39).	Diversion of Sacramento River water into Snodgrass Slough could lead to entrainment and salvage losses of estuarine fish diverted from the Sacramento River (AE22).	To the extent practicable, consider designing the diversion without pumps or other diversion facilities that would require screening and handling of fish (M26).	
		Improved habitat in Mokelumne River and other north-Delta channels could improve spawning, rearing, and feeding habitat as well as foodweb productivity, which could increase production and population abundance (BE40).	Diversion of Sacramento River water into Snodgrass Slough without screening could result in greater numbers of estuarine fish from the Sacramento River being drawn into the interior Delta where they may have poorer habitat and greater chance of being entrained or salvaged at south-Delta pumping plants (AE23).	Habitat conditions in the interior Delta could be improved such that fish that move into the interior Delta from the Sacramento River have good spawning, rearing, and feeding habitat, as well as less chance of being drawn to the south-Delta pumping plants (M27).	
			The increase in flushing rate of the interior northern portion of the central Delta could alter foodweb productivity and tidal freshwater habitat conditions that could limit production of estuarine fishes in the area (AE24).	M27.	

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
			Construction and operation of north-Delta conveyance features could reduce habitat values and foodweb productivity (AE25). AE3.	To the extent consistent with program objectives, construct and operate north-Delta facilities to improve habitat and foodweb productivity (M28). M4. M5.	
C3 Construct and operate an isolated conveyance facility from the Sacramento River along the east side of the Delta to Clifton Court Forebay.	C030101	An isolated conveyance facility could improve spawning, rearing, and feeding habitat, improve foodweb productivity, reduce losses to water diversions, and improve transport of juvenile fish to optimum rearing areas in the Delta and Bay (BE41).	An isolated conveyance facility could increase entrainment losses of north-Delta fishes into CVP and SWP project diversions. Larval fish in the Sacramento River near the proposed intake would be more vulnerable to entrainment. Juvenile and adult fish would be vulnerable to handling effects at intake screens (AE26). AE3.	To the extent consistent with program objectives, time water diversions from the north-Delta to minimize potential entrainment of eggs and larvae and handling of juvenile and adult north-Delta estuarine fish (M29). M4. M5.	An isolated facility could lead to substantial improvements in growth, survival, production, and population abundance of estuarine fishes.
Storage Facilities					
S1. Construct and operate enlarged or new surface storage facilities.	None.	N/A	N/A		Potential program effects cannot be evaluated.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Operations					
01. Implement operating criteria needed to improve water management for beneficial uses.	None.	N/A	N/A		Potential program effects cannot be evaluated.
02. Implement an Environmental Water Account to provide operational flexibility to achieve environmental benefits.	None.	N/A	N/A		Potential program effects cannot be evaluated.
Bay Region					
Associated Evaluated Species: tidewater goby, delta smelt, longfin smelt, and Sacramento splittail.					
Summary Programmatic Action Outcomes E12, E13b, E14, E16b, E30, W3, and W4are likely to have no discernable effect on estuarine fish species in the Bay Region.					

D-051648

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Ecosystem Restoration Program					
E1. Provide for more natural riverflows and Bay-Delta freshwater inflow peaks in fall, winter, and spring of all but critical years.	E020101	BE1. BE2. BE3. BE4. BE5. BE6. BE7. BE8.	AE1.	M1.	Increases in survival and population abundance would be expected for each of the species from benefits of increased inflows to the Delta. Such increases may also lead to higher sustained population levels in wet and critical years. The measures suggested to minimize the potential adverse effects on the populations during extended droughts would ensure that positive effects outweigh potential negative effects.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E5b. Restoration of at least 1,500 acres of tidal shallow-water habitat.	E020401, E020901, E021101, E025201	BE17. BE18.	AE4. AE5. AE3.	M6. M7. M4. M5.	Improved shallow-water rearing habitat in the Delta could lead to a general increase in survival and population abundance.
E7. Protection of 6,200 existing acres and restoration of 7,500–12,000 additional acres of tidal saline emergent wetland.	E020401, E020901, E021101, E027301, E027302, E027303, E023904, E023903, E023904, E027401, E027501, E027601, E025201	BE18.	AE6. AE7. AE8. AE3.	M8. M8. M6. M4. M5.	Properly designed and constructed tidal wetlands would provide maximum habitat benefits and would minimize negative effects of poor water quality and stranding. Overall there could be a positive response in the populations to new wetland habitat.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E10b. Restoration of 35-70 miles of tidal sloughs.	E021101	BE21.	N/E	None.	Increased tidal slough habitat in the Bay would lead to improved survival, production, and population abundance of estuarine fishes.
E15b. Restoration of 50-75 miles of riparian habitat along channels and reduction of populations of invasive non-native riparian plants by 50%.	E021601, E025301, E025302	BE23. BE24.	AE11. AE3.	None. M4. M5.	Habitat and foodweb productivity improvements would lead to small increases in reproduction, survival, and population abundance.
E21. Reduction in the probability of introduction and establishment of non-native aquatic species into the Bay-Delta.	E025401, E025402	BE27.	N/E	None.	Reducing the potential for non-native predators or competing organisms in the Delta would help maintain or increase the estuarine fish production capacity in the Delta.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E22. Reduction in the adverse effects of diversions on fish.	E024701	BE28.	AE15.	M13. M14.	Additional screening and upgraded screen facilities could reduce loss of estuarine fishes and could therefore increase production and population levels.
E24. Reduction in levels of predation on juvenile anadromous fish.	E025601	Managing aquatic habitats to reduce habitat for non-native predatory fish could potentially increase juvenile estuarine fish survival, which could increase production and population levels (BE42).	N/E	None.	Potential for small improvement of estuarine fish survival and production in the Bay from reduced predation.
E25. Reduction in the adverse effects of harvest on fish and wildlife populations.	E025801, E025802, E025803	BE29.	N/E	None.	Potential for small benefit to populations from reduced illegal harvest in Delta.
E28. Reduction in the adverse effects of boat wakes on shoreline habitats and wildlife in sensitive habitat areas.	E026001, E026002, E026003	BE31.	N/E	None.	A small increase in production could occur from improved SRA and channel habitats resulting from reduced boat wakes in some Delta channels.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Levee System Integrity Program					
L3. Enhancement of the level of flood protection provided by Suisun Marsh levees.	None.	BE32.	AE16. AE3.	M17. M4. M5.	Greater levee stability and fewer island flooding events together with habitat improvements associated with upgraded levees could result in improved water quality, less stranding, and increased rearing habitat, which could improve production and population levels. Potential for increases in estuarine fish habitat with implementation of conservation measures.
Water Quality Program					
Q2. Maintain pathogen loadings at or below mandated levels and reduce levels of total organic carbon, bromide, and total dissolved solids to increase the availability of water for beneficial uses.	Q020201, Q020202, Q020203, Q020204	N/E	AE17.	M19.	Implementation of the proposed actions would most likely have no discernable effect on the evaluation species' numbers or distribution.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Q4. Reduction of pesticide loadings in the aquatic environment.	Q020501	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Q7. Reduction of cadmium, copper, and zinc loadings to levels that do not adversely affect Bay-Delta species or beneficial uses of water.	Q020801	BE30.	N/E	None.	A small potential benefit of increased juvenile production and a larger population would be expected from lower metal loadings.
Q8. Reduction of sediment loadings to levels that do not adversely affect beneficial uses of surface water.	Q020901	Reduction of sediment into Bay wetlands and other shallow tidal waters (e.g., sloughs and embayments) could increase foodweb productivity and improve spawning, rearing, and feeding habitats (BE43).	N/E	None.	A small potential benefit to fish production and population levels from lower sediment inputs to Bay waters.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Use Efficiency Program					
W1. Support implementation of water management techniques that increase the effectiveness of water-use management and efficiency for agricultural uses.	None.	BE34.	N/E	None.	Increased water use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve estuarine fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.
W2. Support implementation of measures that increase agricultural production per unit of water used, protect water quality, or increase environmental benefits while meeting agricultural needs.	None.	BE34.	N/E	None.	Increased water use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve estuarine fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Transfer Program					
T1. Implement a framework of actions, policies, and processes that will facilitate transfers and the further development of a statewide water-transfer market.	None.	BE35.	N/E	None.	Water transfers could be scheduled to reduce entrainment losses of estuarine fish and improve Bay habitat and foodweb productivity, which could improve production and population abundance.
Watershed Management Program					
M1. Fund and implement watershed restoration, maintenance, conservation, and monitoring activities.	None.	N/A	N/A		Potential program effects cannot be evaluated.
Sacramento River Region					
Associated Evaluated Species: Delta smelt, longfin smelt, Sacramento splittail, and Sacramento perch.					
Summary Programmatic Action Outcomes E3, E13c, E16c, E18b, E24, E26, Q1, W3, W4, and S2 are likely to have no discernable effect on estuarine fish in the Sacramento River Region.					

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Ecosystem Restoration Program					
E1. Provide for more natural river flows and Bay-Delta freshwater inflow peaks in fall, winter, and spring of all but critical years.	E030101, E030102, E040101, E040102, E040103, E040104, E044701, E044703, E050101, E070101, E070102, E070103, E070104, E070105, E070106, E080101, E080102, E080103, E080104, E090101, E090102, E090103, E090104, E090105, E090106, E090107, E100101, E100102	BE1. BE2. BE3. BE4. BE5. BE6. BE7.	AE1.	M1.	Increases in survival and population abundance would be expected for species that migrate into rivers (e.g., splittail) from benefits of increased river and floodplain flows. Such increases may also lead to higher sustained population levels in wet and critical years. The measures suggested to minimize the potential adverse effects on the populations during extended droughts would ensure that positive effects outweigh potential negative effects.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		BE8.			
E2. Improvement in the supply of sediment to rivers and streams necessary for providing spawning gravels and rehabilitation of related ecological processes (e.g., stream meander) and floodplain habitats (e.g., riparian habitats).	E030201, E030202, E030301, E030302, E030303, E030604, E031602, E040201, E040202, E040203, E040301, E040402, E050201, E050202, E050203, E060401, E070201, E070202, E070203, E080201, E080202, E080203, E080303, E090201, E090401, E090403, E090404, E090407, E090409, E100201, E100202, E105101	Improved sediment supplies may improve floodplain spawning and rearing habitats for selected estuarine species (e.g., splittail), which could improve spawning and early rearing habitats (BE44).	AE3.	M4. M5.	Improved spawning and rearing habitat for splittail in river floodplains could improve survival, production, and population abundance.
E6. Restoration and maintenance of riverine aquatic habitats.	E031602, E030301, E030302, E030303, E030604, E040301, E040402, E050201, E050202, E050203, E050301, E050401, E050402, E050403, E050404, E050405, E060401, E070201, E070202, E070203, E080301, E080302, E080303, E080401, E080402, E090401, E090402, E090403, E090404, E090407, E090408, E090408, E091604, E091605, E090201	Improved riverine aquatic habitats would improve spawning and early rearing habitat for splittail (BE45).	AE3.	M4. M5.	Improved spawning and early rearing habitat of splittail would increase survival, production, and population abundance.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E15c. Protection and enhancement of 9,000–13,000 acres of riparian habitat in meander zones along the Sacramento River and its tributaries; protection, enhancement, and restoration of riparian habitat and shaded riverine aquatic (SRA) cover along other reaches of the Sacramento River and its tributaries; and reduction of populations of non-native invasive plants.	E031601, E031602, E031603, E031604, E031605, E030302, E030303, E030304, E035301, E035302, E040301, E040401, E041601, E041602, E041603, E051601, E051602, E051603, E061601, E065301, E071601, E071603, E071604, E080301, E080302, E080303, E080401, E081601, E081602, E081603, E090401, E090403, E090404, E090407, E091601, E091602, E091603, E091606, E095301, E101601, E101602, E101603, E101604, E105301	Improved riparian habitat would improve spawning and early rearing habitat for splittail (BE46).	AE3.	M4. M5.	Improved spawning and early rearing habitat of splittail would increase survival, production, and population abundance.
E22. Reduction in the adverse effects of diversions on fish.	E034701, E034702, E034703, E034704, E044701, E044702, E044703, E044801, E044802, E044803, E074701, E074702, E074703, E074704, E084701, E084703, E084704, E094701, E094702, E104701	BE28.	N/E	None.	Additional screening and upgraded screen facilities could reduce loss of splittail and could therefore increase production and population levels.
E23. Improvement in passage of anadromous fish to and from spawning areas and reduction in levels of fish straying as a result of reducing the effects of structural impediments to fish movement.	E034801, E034802, E044702, E044801, E044802, E044803, E044804, E044805, E074801, E074802, E074803, E074804, E074805, E074806, E080501, E084801, E084802, E084803, E104701	Improvements to passage routes in floodplains for splittail could increase access to spawning and rearing areas (BE47).	N/E	None.	Improved access to spawning and rearing areas could increase production and population levels.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E25. Reduction in the adverse effects of harvest on fish and wildlife populations.	E035801, E035802, E035803, E045801, E045802, E045803, E075801, E075802, E075803, E085801, E085802, E085803, E095801, E095802	Reduction in the harvest of splittail in rivers could increase adult numbers and reproductive success (BE48).			Reduced harvest could increase production and population levels.
E27b. Reduction in the concentrations and loadings of contaminants in the aquatic environment.	E035702, E035703, E035704, E095701, E095702, E105701, E105702	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Water Quality Program					
Q2. Maintain pathogen loadings at or below mandated levels and reduce levels of total organic carbon, bromide, and total dissolved solids to increase the availability of water for beneficial uses.	Q030201, Q040201, Q050201, Q060201, Q070201, Q080201, Q090201, Q090202	N/E	AE17.	M19.	Implementation of the proposed actions would most likely have no discernable effect on the evaluation species' numbers or distribution.
Q3. Reduction of mercury loadings in water and sediment.	Q030301, Q030302, Q040301, Q040302, Q050301, Q050302, Q060301, Q060302, Q070301, Q070302, Q080301, Q080302, Q090301, Q090302, Q100301, Q100302	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Q4. Reduction of pesticide loadings in the aquatic environment.	Q030501, Q040501, Q050501, Q060501, Q070501, Q080501, Q090501, Q100501	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.

D—051660

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Q7. Reduction of cadmium, copper, and zinc loadings to levels that do not adversely affect Bay-Delta species or beneficial uses of water.	Q030801, Q040801, Q040802, Q050801, Q050802, Q060801, Q060802, Q070801, Q070802, Q080801, Q080801, Q090801, Q090802, Q100801, Q100802	BE30.	N/E	None.	A small potential benefit of increased juvenile production and a larger population would be expected from lower metal loadings.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Use Efficiency Program					
W1. Support implementation of water management techniques that increase the effectiveness of water-use management and efficiency for agricultural uses.	None.	BE34.	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve estuarine fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.
W2. Support implementation of measures that increase agricultural production per unit of water used, protect water quality, or increase environmental benefits while meeting agricultural needs.	None.	BE34.	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve estuarine fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.

D—051662

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Transfer Program					
T1. Implement a framework of actions, policies, and processes that will facilitate transfers and the further development of a statewide water-transfer market.	None.	BE35.	N/E	None.	Water transfers could be scheduled to reduce entrainment losses of estuarine fish and improve river habitat and foodweb productivity, which could improve production and population abundance.
Watershed Management Program					
M1. Fund and implement watershed restoration, maintenance, conservation, and monitoring activities.	None.	N/A	N/A		Potential program effects cannot be evaluated.
Storage Facilities					
S1. Construct and operate enlarged or new surface storage facilities.	None.	N/A	N/A		Potential program effects cannot be evaluated.
Water Operations					
01. Implement operating criteria needed to improve water management for beneficial uses.	None.	N/A	N/A		Potential program effects cannot be evaluated.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
02. Implement an Environmental Water Account to provide operational flexibility to achieve environmental benefits.	None.	N/A	N/A		Potential program effects cannot be evaluated.
San Joaquin River Region					
Associated Evaluated Species: Sacramento splittail.					
Summary Programmatic Action Outcomes E13d, E18c, E24, E26, W3, W4, and S2 are likely to have no discernable effect on estuarine fish in the San Joaquin River Region.					
Ecosystem Restoration Program					
E1. Provide for more natural river flows and Bay-Delta freshwater inflow peaks in fall, winter, and spring of all but critical years.	E110101, E110102, E110103, E110104, E110105, E110106, E110107, E110108, E110109, E110110, E110205, E110502, E120101, E130103, E130101, E130102, E130104, E130105, E140101, E140102, E140103, E140104	BE1.	AE1.	M1.	Increases in survival and population abundance would be expected for species that migrate into rivers (e.g., splittail) from benefits of increased river and floodplain flows. Such increases may also lead to higher sustained population levels in wet and critical years. The measures suggested to minimize the potential adverse effects on the populations during extended droughts would ensure that positive effects outweigh potential negative effects.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
		BE2. BE3. BE4. BE5. BE6. BE7. BE8.			
E2. Improvement in the supply of sediment to rivers and streams necessary for providing spawning gravels and rehabilitation of related ecological processes (e.g., stream meander) and floodplain habitats (e.g., riparian habitats).	E110201, E110202, E110203, E110204, E110205, E110206, E110207, E110208, E110209, E130201, E130202, E130203, E130301, E130302, E130303, E130304, E130305, E130306, E130307, E130402, E135601, E140401, E140403	BE44.	AE3.	M4. M5.	Improved spawning and rearing habitat for splittail in river floodplains could improve survival, production, and population abundance.
E6. Restoration and maintenance of riverine aquatic habitats.	E110401, E110401, E130301, E130302, E130303, E130304, E130305, E130306, E130307, E130402, E135601, E131601, E131602, E131603, E140401, E140402, E140403	BE45.	AE3.	M4. M5.	Improved spawning and early rearing habitat of splittail would increase survival, production, and population abundance.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E15d. Restore up to 4,720 acres of riparian and shaded riverine aquatic habitat; protection and enhancement of up to 1,000 acres of riparian habitat in meander zones along San Joaquin River tributaries; restoration of up to 75 miles of riparian habitat along the San Joaquin River and its tributaries; protection, enhancement, and restoration of riparian habitat and SRA cover along other reaches of the San Joaquin River and its tributaries; and reduction of populations of non-native invasive plants along the northern tributaries to the San Joaquin River.	E110401, E111601, E111602, E111603, E111604, E111605, E111606, E111607, E111608, E111609, E111610, E111611, E111612, E111613, E111614, E111615, E115301, E121601, E121602, E121603, E124901, E130301, E130302, E130303, E130304, E130305, E130306, E130307, E130401, E131601, E131602, E131603, E134101, E134103, E140401, E140402, E140403, E141601	BE46.	AE3.	M4. M5.	Improved spawning and early rearing habitat of splittail would increase survival, production, and population abundance.
E22. Reduction in the adverse effects of diversions on fish.	E114701, E114702, E114703, E114704, E124701, E124702, E134701, E134702, E134703	BE28.	N/E	None.	Additional screening and upgraded screen facilities could reduce loss of splittail and could therefore increase production and population levels.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
E23. Improvement in passage of anadromous fish to and from spawning areas and reduction in levels of fish straying as a result of reducing the effects of structural impediments to fish movement.	E114801, E114802, E114803, E114804, E134801, E134802	BE47.	N/E	None.	Improved access to spawning and rearing areas could increase production and population levels.
E25. Reduction in the adverse effects of harvest on fish and wildlife populations.	E115801, E115802, E135801, E135802	BE48.			Reduced harvest could increase production and population levels.
E27b. Reduction in the concentrations and loadings of contaminants in the aquatic environment.	E115701, E115702, E115703, E125701, E125702	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Water Quality Program					
Q1. Reduction of oxygen-depleting substances in the aquatic environment.	Q130101	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Q2. Maintain pathogen loadings at or below mandated levels and reduce levels of total organic carbon, bromide, and total dissolved solids to increase the availability of water for beneficial uses.	Q120201, Q130201, Q140201, Q140202, Q140203, Q140204, Q140205	N/E	AE17.	M19.	Implementation of the proposed actions would most likely have no discernable effect on the evaluation species' numbers or distribution.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Q4. Reduction of pesticide loadings in the aquatic environment.	Q120501, Q130501, Q140501, Q140502	BE30.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.
Q5. Management of salinity levels in the aquatic environment to improve water quality.	Q120601, Q120602, Q130601, Q130602, Q140601, Q140602	N/A	N/A		Potential program effects cannot be evaluated.
Q6. Reduction in selenium concentrations and loadings to the aquatic environment.	Q140701, Q140702, Q140703, Q140704, Q140705, Q140706, Q140707	N/A	N/A		Potential program effects cannot be evaluated.
Q7. Reduction of cadmium, copper, and zinc loadings to levels that do not adversely affect Bay-Delta species or beneficial uses of water.	Q110801, Q110802, Q120801, Q120802, Q130801, Q130802, Q140801, Q140802	BE30.	N/E	None.	A small potential benefit of increased juvenile production and a larger population would be expected from lower metal loadings.
Q8. Reduction of sediment loadings to levels that do not adversely affect beneficial uses of surface water.	Q130901, Q130902	BE43.	N/E	None.	A small potential benefit to fish production and population levels from lower sediment inputs to Bay waters.

D—051668

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Use Efficiency Program					
W1. Support implementation of water management techniques that increase the effectiveness of water-use management and efficiency for agricultural uses.	None.	BE34.	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to rivers, which could improve fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.
W2. Support implementation of measures that increase agricultural production per unit of water used, protect water quality, or increase environmental benefits while meeting agricultural needs.	None.	BE34.	N/E	None.	Increased water use efficiency could lead to greater freshwater inflow to rivers, which could improve fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.

D-051669

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
Water Transfer Program					
T1. Implement a framework of actions, policies, and processes that will facilitate transfers and the further development of a statewide water-transfer market.	None.	BE35.	N/E	None.	Water transfers could be scheduled to reduce entrainment losses of estuarine fish and improve river habitat and foodweb productivity, which could improve production and population abundance.
Watershed Management Program					
M1. Fund and implement watershed restoration, maintenance, conservation, and monitoring activities.	None.	N/A	N/A		Potential program effects cannot be evaluated.
Storage Facilities					
S1. Construct and operate enlarged or new surface storage facilities.	None.	N/A	N/A		Potential program effects cannot be evaluated.
Water Operations					
01. Implement operating criteria needed to improve water management for beneficial uses.	None.	N/A	N/A		Potential program effects cannot be evaluated.

Table T-1. Continued

Summary Programmatic Action Outcomes	Applicable Programmatic Actions	Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program	Overall Effect of Summary Programmatic Action Outcomes with Conservation Measures
02. Implement an Environmental Water Account to provide operational flexibility to achieve environmental benefits.	None.	N/A	N/A		Potential program effects cannot be evaluated.

Contributors to the development of this table: Tom Cannon, Warren Shaul, and Pete Rawlings of Jones & Stokes Associates, and Michael Fris of the U.S. Fish and Wildlife Service.

Table T-2. Key to Table T-1 Potential Beneficial Effects, Potential Adverse Effects, and Conservation Measures Codes

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
An increase in the freshwater inflow in fall, winter, and spring would increase the area of freshwater spawning and low salinity rearing habitat in the Bay-Delta, which in turn could lead to higher survival and population levels (BE1).	Reallocation of seasonal and multiyear water supplies to enhance spring and fall riverflows and Delta inflow could limit available water supply in other seasons and future years particularly during critical years and extended droughts, which could adversely affect survival at those times in the opposite manner as stated for benefits (AE1).	Implement measures during extended droughts to protect water supplies dedicated to meet Delta inflow and outfall criteria deemed essential in maintaining estuarine fish populations. Such measures would be implemented infrequently and would be used only to readjust water supplies to levels expected without this set of program actions. Measures may include additional dedicated surface or groundwater stored specifically for this purpose, special options for the purchase of needed additional supplies, or emergency provisions that would reduce other water supply demands. Another measure is to initially implement the actions to the extent feasible to determine potential effects on seasonal and critical-year water supplies, and develop a long-term water management plan that includes this and other actions to minimize effects of reallocation in other seasons and critical years (M1).

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
An increase in inflow in spring would increase the frequency of the low-salinity zone being located in more productive shallow bays of the Western Delta and North Bay rather than interior Delta channels, which could lead to higher estuarine food production and greater juvenile survival and higher population levels (BE2).	Operation of a barrier at the Head of Old River during key periods could increase export losses of fish residing in the west, central, and south Delta (AE2).	Construct and operate inchannel barriers and restrictions to provide sufficient leeway to adjust hydraulics in various channels to ensure fish are not being drawn in greater numbers or proportions toward the pumps, or being affected by poor water quality. Monitoring and testing would be necessary to design, construct, and operate barriers and restrictions. Procedures and operating criteria would be developed for a barrier system to protect fish. Monitoring and testing would be necessary to ensure against excessive movement of fish toward the south-Delta pumping plants (M2).
An increase in inflow in late fall, winter, and spring would enhance migration, which could lead to higher survival and population levels (BE3).	Implementing actions could result in mortality, harm, or harassment of estuarine fish species (AE3).	To the extent consistent with program objectives, constrain the operation of a barrier at the Head of Old River during key periods as necessary to minimize the extent of fish exposure to the south-Delta pumping plants. Monitoring and testing would be necessary to balance the loss of fish from the San Joaquin River and the west, central, and south Delta (M3).
Increased inflow, particularly in late winter and spring, would increase foodweb productivity in the Bay-Delta rearing habitats, which could increase survival and population levels (BE4).	Overflow basins may lead to stranding if sufficient drainage is not provided, which could reduce survival and population abundance (AE4).	To the extent practicable, avoid inchannel construction activities during periods when estuarine fish species would be most susceptible to adverse affects that could be associated with implementing proposed actions (M4).
Increased spring inflow would increase river silt load and flood more shoreline vegetation, which may reduce predation through greater turbidity and more available escape habitat, which could increase survival and population abundance (BE5).	Increased shallow-water area may increase abundance of non-native species by providing additional habitat. Non-native species may compete with or prey on these species, reducing survival and population abundance (AE5).	To the extent practicable, avoid implementing proposed actions in occupied habitat areas that could have a substantial adverse effect on the distribution or abundance of estuarine fish species (M5).

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Increased spring inflow would reduce competition from non-native species adversely affected by increased flows or seasonally lower Bay-Delta salinity levels (e.g., Asia clams), which could lead to greater survival and higher population levels (BE6).	Removing levees and opening leveed lands to tidal action could have some short-term negative effects through changes in hydraulics, water quality, and habitat conditions (AE6).	To the extent consistent with program objectives, design and construct overflow basins from existing leveed lands in stages using construction design and operating schemes and procedures developed through pilot studies and project experience to minimize the potential for stranding as waters recede from overflow areas (M6).
Increased spring and fall Bay-Delta inflow would reduce the loss of these estuarine fish to water diversions by decreasing the percent diverted and reducing negative flows in the lower San Joaquin River portion of the Delta, which could lead to greater survival and higher population levels (BE7).	New tidal wetlands may affect water quality in ways that would have negative effects on these species (e.g., if wetlands increase water temperature sufficiently to reduce growth or survival) (AE7).	To the extent consistent with ERP objectives, design shallow-water areas to address the habitat needs of these species and avoid providing optimal conditions for non-native species (M7).
Increased spring inflow may reduce the concentrations of toxins, which could lead to greater survival and higher population levels (BE8).	New tidal wetlands may lead to stranding if the tidal drainage is unnatural or inefficient, which could reduce survival and population abundance (AE8).	To the extent consistent with program objectives, develop and implement restoration methods that minimize potential effects on hydraulics, water quality, and habitat on estuarine fish species when restoring tidal wetlands from subsided leveed lands (M8).
Increasing channel area and cross section by setting levees back would increase shallow-water spawning and rearing habitat, which could increase survival and population levels (BE9).	Filling Delta channels to create channel islands could result in the loss of small amounts of shallow-water habitat (AE9).	To the extent consistent with program objectives, construct channel islands in sloughs that have relatively poor shallow-water and SRA habitats such that the net gain in these habitats is positive (M9).
Restricting flow toward the export pumps in some Delta channels will increase residence time of water, which could potentially improve foodweb productivity and reduce export losses of fish (BE10).	Establishment of overflow basins could have some short-term negative effects on estuarine fish species as a result of changes in hydraulics, water quality, and habitat conditions (AE10).	To the extent practicable, confine additional pumping to times and area channels with minimal concentrations of fish (M10).

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Restricting channelflow to selected channels could improve the efficiency of cross-Delta flow of water from the north Delta and reduce the extent of negative net upstream flows in the lower San Joaquin channel, which could reduce movement of fish toward the south-Delta pumping plants (BE11).	Potential for temporary increase in turbidity resulting from implementing restoration actions (AE11).	To the extent practicable, install screens on diversions to avoid entrainment of juvenile and adult estuarine fish (M11).
Closure of the DCC, particularly from November through January, would increase net freshwater inflow into the western Delta from the Sacramento River, which could improve transport of Sacramento River fish to the shallow bays of the western Delta and Suisun Bay, improve habitat in those areas, and lessen their export at south-Delta pumping plants, which in turn, could improve survival and population abundance (BE12).	An increase in water diversions in winter to flood agricultural lands could lead to an increase in entrainment losses of adult and juvenile estuarine fish, which could reduce production and population size (AE12).	To the extent consistent with program objectives, confine such winter diversions to non-dry years when water supplies are sufficient to minimize any effects on downstream transport, export pumping ratios, and foodweb productivity (M12).
Closure of the DCC during winter could reduce straying of Sacramento River fish into the interior Delta and confine their migration route to the lower Sacramento River, which could reduce migration time and improve chances of reaching spawning and rearing areas in the Sacramento River portion of the Delta (BE13).	An increase in agricultural water diversions in the Delta during winter could reduce net downstream transport of some estuarine larvae and juveniles through the Delta, which could reduce juvenile production and adult populations (AE13).	To the extent consistent with program objectives, place consolidated intakes in areas with minimal numbers of estuarine fish, particularly delta smelt (M13).
Operation of the barrier at the Head of Old River from August through November could reduce the losses of fish moving from the Bay and western Delta toward the eastern Delta and lower San Joaquin channel to export pumps in the south Delta (BE14).	An increase in agricultural water diversions in the Delta during winter could decrease Delta foodweb productivity, which could reduce juvenile production and adult populations (AE14).	Design and construct a new fish-screen system at the entrance to Clifton Court Forebay to alleviate the loss of estuarine fish to predation in the forebay and to the existing fish-bypass and collection facility within the forebay (M14).

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Operation of the barrier at the Head of Old River from August through November would improve water quality in the eastern Delta, including the San Joaquin River channel near Stockton, which may improve fish survival and population abundance in that portion of the Delta (BE15).	Consolidated larger and fewer diversions and positive-barrier bypass-screen systems could increase entrainment, impingement, and predation losses of estuarine fishes and therefore decrease survival and population abundance (AE15).	Screen intakes or connect intakes of the Tracy Pumping Plant (Central Valley Project) to the screened Clifton Court Forebay to alleviate loss of estuarine fish at the Tracy Fish Protection Facility (M15).
Improving and restoring Yolo Bypass channels and bypass draining could reduce stranding losses of fish in the bypass and provide added spawning and rearing habitat and improve foodweb productivity in the bypass and Delta, which could increase survival and population abundance (BE16).	Upgrading levees could degrade existing riparian, wetland, and SRA habitats along existing levees and potentially reduce survival and therefore decrease production and population levels (AE16).	Screen all Delta diversions that may entrain estuarine fish (M16).
Conversion of leveed lands to tidal waters, construction of setback levees along Delta channels, and construction of overflow basins in the Bay-Delta would increase tidal shallow-water habitat, which could increase spawning and rearing habitat and improve foodweb productivity, which, in turn, could lead to increased survival and population abundance (BE17).	Reductions in total organic loadings could reduce foodweb productivity, which could reduce production and population abundance (AE17).	Restore or enhance 1-3 times the amount of habitat affected by levee upgrades near where impacts are incurred (M17).
Control of non-native plants in Bay-Delta sloughs would improve spawning and rearing habitat, which could increase survival and population abundance. Control of non-native plant and animal introductions could reduce the potential for future competition and predation (BE18).	Further development of water transfers could lead to a shift in water diversions from the Delta to periods with higher risk of losses to entrainment (AE18).	Include project design features that allow for onsite reestablishment and long-term maintenance of aquatic, wetland, and riparian habitat following project construction (M18).

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Additional tidal emergent wetland habitat would increase shallow-water spawning and rearing habitat, provide more abundant shaded riverine aquatic (SRA) cover, increase foodweb productivity, and potentially improve Delta water quality, which could increase survival and population abundance (BE19).	Alteration of south-Delta channels could increase chances of some estuarine fish being drawn to and lost or damaged to south-Delta pumping plants (AE19).	Reductions in unnatural inputs of organic carbon could be replaced with increased natural organic inputs such as from restored tidal wetlands and riparian habitats (M19).
Protection of existing islands and restoration of additional channel-island habitat would increase SRA habitat and shallow-water edge habitat, which could provide more spawning and rearing habitat as well as improve foodweb productivity, which, in turn, would increase survival and population abundance (BE20).	Alteration of conveyance features at south-Delta pumping plants could increase the pumping capacity, which could lead to increasing entrainment and salvage losses at the intake facilities (AE20).	Water transfers should be conducted so as not to increase exports during critical times of year when estuarine fish are more vulnerable to damage or loss at project facilities (M20).
Improved slough and restored slough habitat would increase the area of aquatic habitat, including shallow-water and SRA habitats, which would provide additional spawning and rearing habitat and increase foodweb productivity, which, in turn, could increase reproduction, survival, and population abundance (BE21).	The discharge of Sacramento River water into the interior Delta through Snodgrass Slough could result in some estuarine fishes (e.g., splittail) being drawn up to the discharge point during annual spawning migrations up the Sacramento River (AE21).	Design alteration of south-Delta channels to improve spawning, rearing, and feeding habitat in the south Delta (M21).
Overflow basins may provide additional spawning and rearing habitat in flood years that could increase reproduction, survival, and population levels (BE22).	Diversion of Sacramento River water into Snodgrass Slough could lead to entrainment and salvage losses of estuarine fish diverted from the Sacramento River (AE22).	Design alteration of south-Delta channels to minimize the extent estuarine fish would be drawn to the immediate vicinity of the south-Delta pumping plant intakes (M22).

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Improvements and restoration of riparian habitat along Delta channels could substantially improve spawning and rearing habitat in the Delta, as well as foodweb productivity, which could lead to increased survival and population abundance (BE23).	Diversion of Sacramento River water into Snodgrass Slough without screening could result in greater numbers of estuarine fish from the Sacramento River being drawn into the interior Delta where they may have poorer habitat and greater chance of being entrained or salvaged at south-Delta pumping plants (AE23).	Construct and operate new conveyance features in the south Delta to the pumping plants to minimize losses of estuarine fishes (M23).
Potential for substantial increase and enhancement of SRA habitat, instream habitat, and stream temperature conditions for populations of native aquatic species (BE24).	The increase in flushing rate of the interior northern portion of the central Delta could alter foodweb productivity and tidal freshwater habitat conditions that could limit production of estuarine fishes in the area (AE24).	Time diversion of Sacramento River water into the interior Delta to minimize effects on migrating estuarine fishes (M24).
Flooding and draining of agricultural lands could lead to an increase in Delta foodweb productivity, which could improve fish growth, survival, and production in Delta rearing habitat (BE25).	Construction and operation of north-Delta conveyance features could reduce habitat values and foodweb productivity (AE25).	Design the diversion so as to not block upstream-migrating fish headed for the Sacramento River (M25).
Avoiding dredging at important times and places in the Delta would help improve estuarine fish feeding habitats and potentially lead to improved populations (BE26).	An isolated conveyance facility could increase entrainment losses of north-Delta fishes into CVP and SWP project diversions. Larval fish in the Sacramento River near the proposed intake would be more vulnerable to entrainment. Juvenile and adult fish would be vulnerable to handling effects at intake screens (AE26).	To the extent practicable, consider designing the diversion without pumps or other diversion facilities that would require screening and handling of fish (M26).
Limiting abundance of non-native aquatic species may reduce competition and predation, and thus increase survival and population abundance (BE27).	Potential adverse effects of the program are not analyzed. The type and magnitude of potential adverse effects would depend on the type of specific program actions that are implemented (N/A).	Habitat conditions in the interior Delta could be improved such that fish that move into the interior Delta from the Sacramento River have good spawning, rearing, and feeding habitat, as well as less chance of being drawn to the south-Delta pumping plants (M27)

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Consolidating diversions and upgrading fish screens and handling systems could reduce entrainment losses and lead to an increase in survival and population levels (BE28).	Likely to be no discernable adverse effects on hardhead populations or hardhead habitat areas (N/E).	To the extent consistent with program objectives, construct and operate north-Delta facilities to improve habitat and foodweb productivity (M28).
Reduction in the loss of juvenile and adult fish to illegal net fishing and in the legal sport fishery in the Delta could increase the population levels (BE29).		To the extent consistent with program objectives, time water diversions from the north-Delta to minimize potential entrainment of eggs and larvae and handling of juvenile and adult north-Delta estuarine fish (M29).
Reduction in the levels of contaminants being released into Delta channels could increase foodweb productivity and improve survival, leading to increased production and higher population levels (BE30).		
Protection of riparian and emergent vegetation along Delta channels from boat wakes could improve survival in the Delta through improved cover and increased foodweb productivity, which could lead to greater production and population levels (BE31).		
Enhanced levee stability would decrease levee failures and reduce potential loss of estuarine fish to stranding on flooded islands or poor water quality (e.g., high water temperatures, increased turbidity, and increased salinity) (BE32).		
Proposed habitat improvements along upgraded levees (e.g., shallow slopes and vegetated berms) could improve rearing habitat and potentially increase production and population levels (BE33).		

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Potential benefit of increased freshwater inflow to Delta and Bay and reductions in exports and export-related losses of fish through water conservation if saved water is used to augment freshwater inflow to the Delta (BE34). Further development of water transfers could lead to reductions in exports at high risk times of year, which could reduce losses of estuarine fishes at project pumping plants or adverse habitat changes caused by water diversions (BE35). Alteration of channels in the south Delta could improve habitat in altered and other channels, which could lead to greater foodweb productivity, improved spawning and rearing habitat, and reduced entrainment and salvage losses at south-Delta pumping plants (BE36). Improvements to CVP-SWP conveyance features at south- Delta pumping plants (e.g., Joint Point of Diversion) could reduce vulnerability of estuarine fish to entrainment and salvage losses at the intakes of the facilities (BE37). Increased freshwater inflow to the interior Delta through Snodgrass Slough could improve water quality and fish habitat conditions (e.g., foodweb productivity) in the interior north Delta such that it could lead to improved production and population levels of estuarine fishes (BE38).		

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Increased cross-Delta flow of Sacramento River water to meet diversions demands from the south Delta could reduce entrainment and salvage losses at south-Delta pumping plants by reducing the amount of west-Delta and San Joaquin water being drawn to south-Delta pumping plants (BE39).		
Improved habitat in Mokelumne River and other north-Delta channels could improve spawning, rearing, and feeding habitat as well as foodweb productivity, which could increase production and population abundance (BE40).		
An isolated conveyance facility could improve spawning, rearing, and feeding habitat, improve foodweb productivity, reduce losses to water diversions, and improve transport of juvenile fish to optimum rearing areas in the Delta and Bay (BE41).		
Managing aquatic habitats to reduce habitat for non-native predatory fish could potentially increase juvenile estuarine fish survival, which could increase production and population levels (BE42).		
Reduction of sediment into Bay wetlands and other shallow tidal waters (e.g., sloughs and embayments) could increase foodweb productivity and improve spawning, rearing, and feeding habitats (BE43).		

Table T-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Improved sediment supplies may improve floodplain spawning and rearing habitats for selected estuarine species (e.g., splittail), which could improve spawning and early rearing habitats (BE44). Improved riverine aquatic habitats would improve spawning and early rearing habitat for splittail (BE45). Improved riparian habitat would improve spawning and early rearing habitat for splittail (BE46). Improvements to passage routes in floodplains for splittail could increase access to spawning and rearing areas (BE47). Reduction in the harvest of splittail in rivers could increase adult numbers and reproductive success (BE48). Potential beneficial effects of the program are not analyzed. The type and magnitude of potential beneficial effects would depend on the type of specific program actions that are implemented (N/A). Likely to be no discernable beneficial effects for estuarine fish species or habitat areas (N/E).		