Table S-1. Anadromous Fish Species: Potential CALFED Effects and Conservation Measures

Summary Effect of Implementing CALFED Actions and Conservation Measures on Anadromous Fish Species: The proposed actions and associated conservation measures of CALFED are expected to result in substantial improvement in anadromous fish populations and their habitat.

Associated Evaluated Species: Winter-run chinook salmon, Central Valley fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley Steelhead Evolutionarily Significant Unit (ESU), Central Coast Steelhead ESU, and green sturgeon.

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: Winter-run chinook salmon, Central Valley fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley Steelhead Evolutionarily Significant Unit (ESU), Central Coast Steelhead ESU, and green sturgeon.					
Summary Programmatic Action Outcomes E11, E13a, E16a, E17, E19, E24, W3, and W4 are likely to have no discernable effect on anadromous fish in the Delta Region.					

Table S-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.	E010101, E010102, E010103, E010104	An increase in the freshwater inflow in fall, winter, and spring would increase the area of freshwater and low-salinity migratory and juvenile rearing habitat in the Bay-Delta. Increased inflows would also improve cues for immigrating adult salmon and sturgeon (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. Steelhead are likely to be most adversely affected by flow re-allocations that enhance spring and fall flows. High summer flows help to reduce water temperatures for rearing juvenile steelhead. Reduced summer flow could also increase susceptibility of emigrating juvenile green sturgeon to entrainment in diversions (AE1).	Implement measures during extended droughts to protect water supplies dedicated to meet Delta inflow and outflow criteria deemed essential to maintain anadromous 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 suggested to minimize the potential adverse effects on the populations during extended droughts would ensure that positive effects outweigh potential negative effects.

Table S-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 food production and availability for juvenile salmonids (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, including bypasses, resulting in improved food supply and increased growth rates and survival of juvenile salmonids (BE4).			

Table S-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 and predation 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 anadromous fish to water diversions by decreasing the percent diverted and reducing negative flows in the lower San Joaquin River portion of the Delta (BE7).			

Table S-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 contaminants (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 using setback levees would increase shallow-water rearing habitat, which could increase survival and population levels (BE9).	Restricting cross-Delta transport of water in some channels and focusing transport to other selected channels may increase transport of fish toward south-Delta pumping plants in the selected channels and reduce water quality in other channels to a point that may reduce survival (AE2).	To the extent consistent with program objectives, construct and operate 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 the 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 migration 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 and appropriate balance of benefits for Sacramento and Sacramento tributary populations and east-Delta and San Joaquin tributary populations. Future adaptive-management activities relating to these actions would determine the extent of potential benefits.

Table S-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 Delta Cross Channel (DCC) from November through January could increase export losses of fish from east-Delta and San Joaquin River tributaries by increasing net upstream flows in the lower San Joaquin channel (i.e., negative QWEST flows) and diverting greater proportions of these tributary inflows and their downstream migrating juvenile fish to the south-Delta pumping plants (AE3).	To the extent consistent with program objectives, constrain the closure of the DCC from November through January as necessary to minimize the additional extent of fish exposure to the south-Delta pumping plants. Monitoring and testing would be necessary to provide the necessary balance between reducing loss of fish from the Sacramento River and the east-Delta and San Joaquin River tributaries (M3).	
		Restricting channel flow 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, particularly of downstream-migrating San Joaquin and east-Delta tributary fish toward the south-Delta pumping plants (BE10).			

Table S-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 reduce entrainment at south-Delta pumping plants (BE11). Closure of the DCC during winter could reduce straying of immigrating adult Sacramento River salmonids into the central Delta. Increasing the proportion of fish that migrate via the lower Sacramento River could reduce migration time and improve chances successful spawning in the Sacramento River and its tributaries (BE12). Operation of the barrier at the Head of Old River in the fall could benefit adult immigration of east-Delta and San Joaquin tributary salmon and steelhead to their spawning rivers (BE13).	Construction activities could result in mortality or harm of anadromous fish (AE4).	To the extent practicable, avoid inchannel construction activities during periods when anadromous fish are present in high abundance ore when life stages are present that are most susceptible to adverse affects that could be associated with implementing (M4). Avoid implementing development actions in habitat areas that currently support high densities of anadromous fish or in locations that would reduce connectivity among habitat patches (M5).	

Table S-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 in the fall would improve water quality in the eastern Delta, including the San Joaquin River channel near Stockton, which may improve fish escapement to spawning grounds (BE14). Improving and restoring Yolo Bypass channels and bypass drainage could reduce stranding losses of juvenile anadromous fish in the bypass, provide added rearing habitat, and improve foodweb productivity in the bypass and Delta (BE15).			
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 could increase tidal shallow-water rearing habitat for juvenile salmonids and improve foodweb productivity (BE16).	Reactivation of historic overflow basins may lead to stranding of anadromous fish if sufficient connectivity to main channels is not provided and flooding of agricultural lands could increase the loading of contaminants to the Sacramento River that adversely affect juvenile salmonids (AE5).	To the extent consistent with Program objectives, re-contour existing flood bypasses and design and construct new overflow basins from existing leveed lands in stages using construction design and operating schemes and procedures developed through pilot studies and project experience that 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.

Table S-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
		Control of non-native plants in Bay-Delta sloughs would improve 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 (BE17).	Non-native fish species may aggressively colonize enhanced and restored tidal and other aquatic habitats. Increased abundance of non-native species that compete with or prey upon anadromous fish may negate the habitat value of restored areas and could reduce survival and abundance of native anadromous fish (AE6). AE4.	To the extent consistent with Program objectives, design shallow-water areas to address the habitat needs of anadromous fish and avoid providing optimal conditions for non-native species (M7). M4. M5	
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 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 (BE18).	Removing levees and opening leveed lands to tidal action could have transient negative effects due to changes in hydraulics and reduced water quality (AE7).	Develop techniques that minimize potential effects on hydraulics and water quality from restoring subsided leveed lands to tidal wetlands (M8).	Properly designed and constructed tidal wetlands would provide maximum habitat benefits and would minimize negative effects that could occur from poor water quality and stranding. Overall, there could be a positive response in the populations to new wetland habitat.

Table S-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
			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) (AE8). New tidal wetlands may lead to stranding if the tidal drainage is unnatural or inefficient (AE9). AE4.	M8. M6. M4. M5	
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 rearing habitat as well as improve foodweb productivity, which, in turn, would increase survival and population abundance (BE19).	Filling Delta channels to create channel islands could result in the loss of small amounts of shallow-water habitat (AE10). AE4.	To the extent practicable, construct channel islands in locations that will minimize disruptions and degradation of existing shallow-water and SRA habitats and that will result in a net gain in the extent and connectivity of these habitats (M9). M4. M5	Foodweb and habitat improvements from restored channel islands should provide small benefits to populations through increased survival and population abundance.

Table S-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
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 rearing habitat and increase foodweb productivity, which, in turn, could increase survival and population abundance (BE20).	Likely to be no discernable adverse effects on anadromous fish habitat or populations (N/E).		Foodweb and habitat improvements from restored tidal sloughs should benefit populations through increased survival and population abundance.
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 migrating and rearing habitat in the Delta as well as foodweb productivity, which could lead to increased survival and population abundance (BE21). Potential for substantial increase and enhancement of SRA habitat, instream habitat, and stream temperature conditions for populations of native aquatic species (BE22).	Potential for temporary increase in turbidity resulting from implementing restoration actions (AE11). AE4.	None. M4. M5	Habitat and foodweb productivity improvements would lead to small increases in survival and population abundance.

Table S-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
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, juvenile survival and smolt production, and population abundance (BE23).	An increase in water diversions in winter to flood agricultural lands could lead to an increase in entrainment losses of juvenile salmonids (AE12).	To the extent consistent with Program objectives, confine additional winter pumping for flooding agricultural lands to times and areas of channels with low densities of anadromous fish (M10).	Small potential benefit to anadromous fish populations through improved juvenile growth from improved Delta foodweb productivity.
				To the extent practicable, install screens on diversion intakes to avoid entrainment of fish (M11).	
			An increase in agricultural water diversions in the Delta during winter in dry years could reduce net downstream transport of juvenile anadromous fish through the Delta (AE13).	To the extent consistent with Program objectives, confine additional winter diversions for flooding agricultural lands to non-dry years when water supplies are sufficient to minimize any effects on downstream transport, export pumping ratios, and foodweb productivity (M12).	
			An increase in agricultural water diversions in the Delta during winter could decrease Delta foodweb productivity (AE14).	M12.	

Table S-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
E20. Reduction in the adverse effects of dredging on estuarine aquatic habitats.	E015001, E015002, E015003, E015004	Avoiding dredging at times and places in the Delta when juvenile anadromous fish are present and feeding in abundance would help improve feeding habitats and potentially lead to improving juvenile survival and adult populations (BE24).	N/E	None.	Limiting dredging activity in the Delta could lead to potential improvements in juvenile survival 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	Reducing the abundance of non-native aquatic species may reduce competition and predation (BE25).	N/E	None.	Reducing the potential for non-native predators or competing organisms in the Delta would help maintain or increase juvenile survival 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 (BE26).	Consolidated larger and fewer diversions and positive-barrier bypass-screen systems could increase predation losses of anadromous fishes migrating through the Delta (AE15).	To the extent consistent with Program objectives, place consolidated intakes in areas with minimal numbers of juvenile anadromous fish (M13).	Additional screening and upgraded screen facilities could reduce loss of juvenile anadromous fish and therefore increase survival and adult populations.

Table S-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
				To the extent consistent with program objectives, design and construct a new fish-screen system at the entrance to Clifton Court Forebay to alleviate the loss of juvenile anadromous fish to predation in the forebay and to the existing ineffective fish-bypass and collection facility within the forebay (M14). To the extent consistent with program objectives, screen intakes or connect intakes of the Tracy Pumping Plant (Central Valley Project) to the screened Clifton Court Forebay to alleviate loss of fish at the Tracy Fish Protection Facility (M15). To the extent consistent with program objectives, screen all Delta diversions that may entrain juvenile anadromous fish (M16).	
E25. Reduction in the adverse effects of harvest on fish and wildlife populations.	E015801, E015802, E015803	Reduction in illegal net fishing and further limitations on the legal fisheries could reduce losses of juvenile and adult anadromous fish (BE27).	N/E	None.	Potential benefit to populations from reduced harvest in Delta.

Table S-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 (BE28).	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 (BE29).	N/E	None.	A small increase in survival and population levels could occur from improved SRA and channel habitats resulting from reduced boat wakes in some Delta channels.

Table S-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					
L1. Improvement and maintenance of Delta levees.	L010101, L010102, L010201, L010202, L010301	Enhanced levee stability would decrease levee failures and reduce potential loss of anadromous fish to stranding on flooded islands or to poor water quality (e.g., high water temperatures, increased turbidity, and increased salinity) (BE30). Proposed habitat improvements along upgraded levees (e.g., shallow slopes and vegetated berms) could improve rearing habitat and potentially increase smolt production and population levels (BE31).	Upgrading levees could degrade existing riparian, wetland, and SRA habitats along existing levees (AE16). AE4.	Restore or enhance 1-3 times the amount of aquatic habitat affected by levee upgrades near where impacts occur (M17). To the extent consistent with program objectives, include project design features that allow tor onsite reestablishment and long-term maintenance of aquatic, wetland, and riparian habitat following project construction (M18). 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 smolt production and adult population abundance. Potential for increases in anadromous fish habitat with implementation of conservation measures.

Table S-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
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	BE28.	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.	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 (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	BE28.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.

Table S-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.	Q010801	BE28.	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. (BE32).	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to Delta and Bay, which could improve anadromous fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher survival 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.	BE32.	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to the Delta and Bay, which could improve anadromous fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher survival and population abundance.

Table S-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 anadromous fish at project pumping plants or adverse habitat changes caused by water exports (BE33).	Further development of water transfers could lead to (1) a shift in water diversions from the Delta to periods with higher risk of losses to entrainment, or (2) changes in timing and location of diversions that could adversely affect migrating and rearing habitat in the Delta or elsewhere (AE18).	Water transfers should be conducted so as not to increase exports during times of the year when anadromous fish are more vulnerable to damage or loss at project facilities or when habitat may be adversely affected (M20).	Water transfers could be scheduled to reduce entrainment losses of anadromous fish and improve Delta habitat and foodweb productivity, which could improve survival 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.
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 migrating and rearing habitat, and reduced entrainment and salvage losses at south-Delta pumping plants (BE34).	Alteration of south-Delta channels could increase chances of some anadromous fish being drawn to and lost or damaged in south-Delta pumping plants (AE19).	To the extent consistent with program objectives, alteration of south-Delta channels should be designed to improve migrating, 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.

Table S-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
					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 anadromous fish to entrainment and salvage losses at the intakes of the facilities (BE35).		To the extent consistent with program objectives, alteration of south-Delta channels should be designed to minimize the extent to which anadromous 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 increased entrainment and salvage losses at the intake facilities or possibly adverse effects on migration and rearing habitat (AE20).	To the extent practicable, construction and operation of new conveyance features in the south Delta to the pumping plants should be such as to minimize losses of anadromous fishes (M23).	
			AE4.	M4. M5	

Table S-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
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 that could lead to improved survival and population levels of anadromous fishes (BE36).	The discharge of Sacramento River water into the interior Delta through Snodgrass Slough could result in some adult anadromous fishes bound for the Sacramento River and its tributaries being drawn into the central Delta and up to the discharge point during annual spawning migrations up the Sacramento River (AE21).	To the extent consistent with program objectives, time diversions of Sacramento River water into the interior Delta to minimize adverse effects on migrating anadromous fishes (M24).	An increased 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 anadromous fish production and population levels.
				To the extent consistent with program objectives, design the diversion so as to not block upstream-migrating fish headed for the Sacramento River (M25).	
			Diversion of Sacramento River water into Snodgrass Slough through a screened intake on the Sacramento River could lead to predation and impingement losses of young anadromous fish at the intake (AE22).	To the extent practicable, consider designing the diversion without pumps or other diversion facilities that would require screening and handling of fish (M26).	

Table S-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
			Diversion of Sacramento River water into Snodgrass Slough without screening could result in greater numbers of anadromous fish from the Sacramento River being drawn into the interior Delta where they may have poorer habitat, be delayed in migration to the ocean, or have a greater chance of being drawn to 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 migrating, rearing, and feeding habitat, as well as less chance of being drawn to the south-Delta pumping plants (M27)	
		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 east-Delta and San Joaquin tributary water and juvenile anadromous fish drawn to south-Delta pumping plants (BE37).	The increase in the flushing rate of the interior northern portion of the central Delta could alter foodweb productivity and tidal freshwater habitat conditions that such that it could limit production of anadromous fishes in the area (AE 24).	M27.	

Table S-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
		Improved habitat in Mokelumne River and other north-Delta channels could improve migrating, rearing, and feeding habitat, as well as foodweb productivity, which could increase survival and population abundance particularly of east-Delta tributary populations of anadromous fishes (BE38).	Construction and operation of north-Delta conveyance features could reduce habitat values and foodweb productivity (AE 25). AE4.	To the extent consistent with program objectives, design and operate north-Delta facilities to improve habitat and foodweb productivity (M28). M4. M5	North-Delta conveyance facilities could be designed and operated to enhance anadromous fish survival, production, and population abundance.
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 migrating, 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, especially for San Joaquin River salmonids (BE39).	An isolated conveyance facility could result in entrainment, predation, and impingement losses of Sacramento fish at the intake of the facility. Juvenile fish would be vulnerable to handling effects at intake screens and would lead to reduced flow rates in the mainstem Sacramento River below the point of diversion, and a greater proportion of this reduced flow would enter the central Delta (AE26).	To the extent consistent with program objectives, time water diversions from the north Delta to minimize potential involvement of large numbers of juvenile anadromous fish (M29).	An isolated facility could lead to substantial improvements in growth, survival, production, and population abundance of anadromous fishes.

Table S-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
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.
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: Winter-run chinook salmon, Central Valley fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead Evolutionarily Significant Unit (ESU), Central Coast steelhead ESU, and green sturgeon.					
Summary Programmatic Action Outcomes E12, E13b, E14, E16b, E30, W3, and W4 are likely to have no discernable effect on anadromous fish in the Bay 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.	E020101	BE1. BE2.	AE1.	M1.	Improved freshwater inflow to the Bay would lead to improved survival, production, and population abundance of anadromous fishes.

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Table S-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
		BE3. BE4. BE5. BE6.			
E5b. Restoration of at least 1,500 acres of tidal shallow-water habitat.	E020401, E020901, E021101, E025201	BE16. BE17.	AE5. AE6. AE4.	M6. M7. M4. M5	Increased tidal shallow-water habitat in the Bay would lead to improved survival, production, and population abundance of anadromous fishes.
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.	AE7. AE8. AE9.	M8. M8. M6.	Increased tidal emergent wetland habitat in the Bay would lead to improved survival, production, and population abundance of anadromous fishes.

Table S-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
			AE4.	M4. M5	
E10b. Restoration of 35-70 miles of tidal sloughs.	E021101	BE20.	N/E	None.	Increased tidal slough habitat in the Bay would lead to improved survival, production, and population abundance of anadromous 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	BE21.	AE11.	None.	Habitat and foodweb productivity improvements would lead to small increases in reproduction, survival, and population abundance.
		BE22.	AE4.	M4. M5	
E21. Reduction in the probability of introduction and establishment of non-native aquatic species into the Bay-Delta.	E025401, E025402	BE25.	N/E	None.	Reducing the potential for non-native predators or competing organisms in the Bay would help maintain or increase the anadromous fish production capacity in the Bay.

Table S-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	BE26.	AE15.	M13.	Additional screening and upgraded screen facilities could reduce loss of anadromous 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 (BE40).	N/E	None.	Potential for improvement of anadromous 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	BE27.	N/E	None.	Potential benefit to populations from reduced illegal harvest in the Bay.
E28. Reduction in the adverse effects of boat wakes on shoreline habitats and wildlife in sensitive habitat areas.	E026001, E026002, E026003	BE29.	N/E	None.	A small increase in production could occur from improved SRA and channel habitats resulting from reduced boat wakes in some Bay channels.

Table S-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.	BE30. BE31.	AE16. AE4.	M17. M18. M4. M5	Greater levee stability and fewer island flooding events, together with habitat improvements associated with upgraded levees, could result in increased rearing habitat, which could improve 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.	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.
Q4. Reduction of pesticide loadings in the aquatic environment.	Q020501	BE28.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.

Table S-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.	Q020801	BE28.	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 embankments) could increase foodweb productivity and improve spawning, rearing, and feeding habitats (BE41).	N/E	None.	A small potential benefit to fish production and population levels from lower sediment inputs to Bay waters.
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.	BE32.	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to the Delta and Bay, which could improve anadromous fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.

Table S-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.	BE32.	N/E	None.	Increased water-use efficiency could lead to greater freshwater inflow to the Delta and Bay, which could improve anadromous fish transport, foodweb productivity, and reduce entrainment losses, which could lead to higher production and population abundance.
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.	BE33.	N/E	None.	Water transfers could be scheduled to reduce entrainment losses of anadromous 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.

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Table S-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
Sacramento River Region					
Associated Evaluated Species: Winter-run chinook salmon, Central Valley fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead Evolutionarily Significant Unit (ESU), Central Coast steelhead ESU, and green sturgeon.					
Summary Programmatic Action Outcomes E13c, E16c, E18b, W3, W4, and S2 are likely to have no discernable effect on anadromous fish in the Sacramento 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.	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	BE3. BE4. BE5. BE6. BE7. BE8.	AE1.	M1.	More natural streamflow patterns could improve spawning, rearing, and migration habitat, which could lead to higher sustained population levels. 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 S-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
		More natural riverflows would improve spawning, rearing, and migrating habitat in the Sacramento River and tributaries (BE42).			
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 spawning, migrating, and rearing habitats (BE43).	AE4.	M4. M5	Improved spawning and rearing habitat in rivers and streams could improve survival, production, and population abundance.
E3. Maintenance of stream temperatures necessary to maintain anadromous fishes through management of reservoir releases or structural solutions (i.e., does not include the effect of restoration of riparian vegetation on maintaining stream temperatures).	E030501, E080501, E080502, E080503, E080504, E080505, E080506, E090501, E090502, E090503	N/A	N/A		Potential program effects cannot be evaluated.

Table S-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
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 (BE44).	AE4.	M4. M5	Improved spawning and early rearing habitat would increase survival, production, and population abundance.
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	BE21. BE22.	AE11. AE4.	None. M4.	Improved spawning and early rearing habitat would increase survival, production, and population abundance.

Table S-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
		Improved riparian habitat would improve spawning and early rearing habitat (BE45).		M5	
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	BE26.	N/E	None.	Additional screening and upgraded screen facilities could reduce loss and 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 could increase access to spawning and rearing areas (BE46).	N/E	None.	Improved access to spawning and rearing areas could increase production and population levels.
E24. Reduction in levels of predation on juvenile anadromous fish.	E035601, E084801	Potential for increasing numbers of juvenile anadromous fish successfully outmigrating to the Bay-Delta (BE47).	AE11.	None.	Reduced predation would increase survival and population abundance.
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 in rivers could increase the number adult spawners and reproductive success (BE48).	N/E	None.	Reduced harvest could increase production and population levels.

Table S-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
E26. Improved management of fish hatcheries to better maintain the genetic integrity of wild stocks of anadromous fishes.	E035901, E035902, E035903, E035904, E035905, E045901, E045902, E075901, E075902, E085902, E085903, E095901, E095902, E095903	Improvement in the genetic integrity of anadromous fish stocks could improve spawning success, juvenile survival, and adult homing success (BE49).	N/E	None.	Improvement in genetic integrity would increase production and population abundance of wild anadromous fish populations.
E27b. Reduction in the concentrations and loadings of contaminants in the aquatic environment.	E035702, E035703, E035704, E095701, E095702, E105701, E105702	BE28.	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.	Q090101	N/A	N/A		Potential program effects cannot be evaluated.
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	BE28.	AE11.	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.

Table S-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.	Q030501, Q040501, Q050501, Q060501, Q070501, Q080501, Q090501, Q100501	BE28.	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.	Q030801, Q040801, Q040802, Q050801, Q050802, Q060801, Q060802, Q070801, Q070802, Q080801, Q080801, Q090801, Q090802, Q100801, Q100802	BE28.	N/E	None.	A small potential benefit of increased juvenile production and a larger population would be expected from lower metal loadings.

Table S-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.	BE32.	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.	BE32.	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—051605

Table S-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.	BE33.	N/E	None.	Water transfers could be scheduled to reduce entrainment losses of anadromous 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 S-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: Winter-run chinook salmon, Central Valley fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead Evolutionarily Significant Unit (ESU), Central Coast steelhead ESU, and green sturgeon.					
Summary Programmatic Action Outcomes E13d, E18c, E29, W3, W4, and S2 are likely to have no discernable effect on anadromous 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	BE3.	AE1.	M1.	Increases in survival and population abundance would be expected for species that migrate into rivers 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.

D—051607

Table S-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
		BE4. BE5. BE6. BE7. BE8. BE42.			
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	BE43.	AE4.	M4. M5	Improved spawning and rearing habitat 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	BE44.	AE4.	M4. M5	Improved spawning and early rearing habitat would increase survival, production, and population abundance.

Table S-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	BE21. BE22. BE45.	AE11. AE4.	None. M4.	Improved spawning and early rearing habitat 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	BE26.	N/E	None.	Additional screening and upgraded screen facilities could reduce loss and could therefore increase production and population levels.

D—051609

Table S-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	BE46.	N/E	None.	Improved access to spawning and rearing areas could increase production and population levels.
E24. Reduction in levels of predation on juvenile anadromous fish.	E115601, E115602, E135601	BE47.	AE11.	None.	Reduced predation would increase survival and population abundance.
E25. Reduction in the adverse effects of harvest on fish and wildlife populations.	E115801, E115802, E135801, E135802	BE48.	N/E	None.	Reduced harvest could increase production and population levels.
E26. Improved management of fish hatcheries to better maintain the genetic integrity of wild stocks of anadromous fishes.	E115901, E115902, E115903, E135901, E135902	BE49.	N/E	None.	Improvement in genetic integrity would increase production and population abundance of wild anadromous fish populations.
E27b. Reduction in the concentrations and loadings of contaminants in the aquatic environment.	E115701, E115702, E115703, E125701, E125702	BE28.	N/E	None.	Potential direct (less toxic stress) and indirect (foodweb) effects could lead to greater production and population levels.

Table S-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 Quality Program					
Q1. Reduction of oxygen-depleting substances in the aquatic environment.	Q130101	BE28.	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.
Q4. Reduction of pesticide loadings in the aquatic environment.	Q120501, Q130501, Q140501, Q140502	BE28.	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.

Table S-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.	Q110801, Q110802, Q120801, Q120802, Q130801, Q130802, Q140801, Q140802	BE28.	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	BE41.	N/E	None.	A small potential benefit to fish production and population levels from lower sediment inputs to Bay waters.
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.	BE32.	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.

Table S-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.	BE32.	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.
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.	BE33.	N/E	None.	Water transfers could be scheduled to reduce entrainment losses of anadromous 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.

Table S-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
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.
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 Karl Halupka of the National Marine Fisheries Service.

Table S-2. Key to Table S-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 and low-salinity migratory and juvenile rearing habitat in the Bay-Delta. Increased inflows would also improve cues for immigrating adult salmon and sturgeon (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. Steelhead are likely to be most adversely affected by flow re-allocations that enhance spring and fall flows. High summer flows help to reduce water temperatures for rearing juvenile steelhead. Reduced summer flow could also increase susceptibility of emigrating juvenile green sturgeon to entrainment in diversions (AE1).	Implement measures during extended droughts to protect water supplies dedicated to meet Delta inflow and outflow criteria deemed essential to maintain anadromous 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 S-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 food production and availability for juvenile salmonids (BE2).	Restricting cross-Delta transport of water in some channels and focusing transport to other selected channels may increase transport of fish toward south-Delta pumping plants in the selected channels and reduce water quality in other channels to a point that may reduce survival (AE2).	To the extent consistent with program objectives, construct and operate 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 the 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).	Closure of the Delta Cross Channel (DCC) from November through January could increase export losses of fish from east-Delta and San Joaquin River tributaries by increasing net upstream flows in the lower San Joaquin channel (i.e., negative QWEST flows) and diverting greater proportions of these tributary inflows and their downstream migrating juvenile fish to the south-Delta pumping plants (AE3).	To the extent consistent with program objectives, constrain the closure of the DCC from November through January as necessary to minimize the additional extent of fish exposure to the south-Delta pumping plants. Monitoring and testing would be necessary to provide the necessary balance between reducing loss of fish from the Sacramento River and the east-Delta and San Joaquin River tributaries (M3).
Increased inflow, particularly in late winter and spring, would increase foodweb productivity in the Bay-Delta rearing habitats, including bypasses, resulting in improved food supply and increased growth rates and survival of juvenile salmonids (BE4).	Construction activities could result in mortality or harm of anadromous fish (AE4).	To the extent practicable, avoid inchannel construction activities during periods when anadromous fish are present in high abundance ore when life stages are present that are most susceptible to adverse affects that could be associated with implementing (M4).

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
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).	Reactivation of historic overflow basins may lead to stranding of anadromous fish if sufficient connectivity to main channels is not provided and flooding of agricultural lands could increase the loading of contaminants to the Sacramento River that adversely affect juvenile salmonids (AE5).	Avoid implementing development actions in habitat areas that currently support high densities of anadromous fish or in locations that would reduce connectivity among habitat patches (M5).
Increased spring inflow would reduce competition and predation 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).	Non-native fish species may aggressively colonize enhanced and restored tidal and other aquatic habitats. Increased abundance of non-native species that compete with or prey upon anadromous fish may negate the habitat value of restored areas and could reduce survival and abundance of native anadromous fish (AE6).	To the extent consistent with Program objectives, re-contour existing flood bypasses and design and construct new overflow basins from existing leveed lands in stages using construction design and operating schemes and procedures developed through pilot studies and project experience that 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 anadromous fish to water diversions by decreasing the percent diverted and reducing negative flows in the lower San Joaquin River portion of the Delta (BE7).	Removing levees and opening leveed lands to tidal action could have transient negative effects due to changes in hydraulics and reduced water quality (AE7).	To the extent consistent with Program objectives, design shallow-water areas to address the habitat needs of anadromous fish and avoid providing optimal conditions for non-native species (M7).
Increased spring inflow may reduce the concentrations of contaminants (BE8).	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) (AE8).	Develop techniques that minimize potential effects on hydraulics and water quality from restoring subsided leveed lands to tidal wetlands (M8).
Increasing channel area and cross section using setback levees would increase shallow-water rearing habitat, which could increase survival and population levels (BE9).	New tidal wetlands may lead to stranding if the tidal drainage is unnatural or inefficient (AE9).	To the extent practicable, construct channel islands in locations that will minimize disruptions and degradation of existing shallow-water and SRA habitats and that will result in a net gain in the extent and connectivity of these habitats (M9).

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Restricting channel flow 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, particularly of downstream-migrating San Joaquin and east-Delta tributary fish toward the south-Delta pumping plants (BE10).	Filling Delta channels to create channel islands could result in the loss of small amounts of shallow-water habitat (AE10).	To the extent consistent with Program objectives, confine additional winter pumping for flooding agricultural lands to times and areas of channels with low densities of anadromous fish (M10).
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 reduce entrainment at south-Delta pumping plants (BE11).	Potential for temporary increase in turbidity resulting from implementing restoration actions (AE11).	To the extent practicable, install screens on diversion intakes to avoid entrainment of fish (M11).
Closure of the DCC during winter could reduce straying of immigrating adult Sacramento River salmonids into the central Delta. Increasing the proportion of fish that migrate via the lower Sacramento River could reduce migration time and improve chances successful spawning in the Sacramento River and its tributaries (BE12).	An increase in water diversions in winter to flood agricultural lands could lead to an increase in entrainment losses of juvenile salmonids (AE12).	To the extent consistent with Program objectives, confine additional winter diversions for flooding agricultural lands to non-dry years when water supplies are sufficient to minimize any effects on downstream transport, export pumping ratios, and foodweb productivity (M12).
Operation of the barrier at the Head of Old River in the fall could benefit adult immigration of east-Delta and San Joaquin tributary salmon and steelhead to their spawning rivers (BE13).	An increase in agricultural water diversions in the Delta during winter in dry years could reduce net downstream transport of juvenile anadromous fish through the Delta (AE13).	To the extent consistent with Program objectives, place consolidated intakes in areas with minimal numbers of juvenile anadromous fish (M13).

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Operation of the barrier at the Head of Old River in the fall would improve water quality in the eastern Delta, including the San Joaquin River channel near Stockton, which may improve fish escapement to spawning grounds (BE14).	An increase in agricultural water diversions in the Delta during winter could decrease Delta foodweb productivity (AE14).	To the extent consistent with program objectives, design and construct a new fish-screen system at the entrance to Clifton Court Forebay to alleviate the loss of juvenile anadromous fish to predation in the forebay and to the existing ineffective fish-bypass and collection facility within the forebay (M14).
Improving and restoring Yolo Bypass channels and bypass drainage could reduce stranding losses of juvenile anadromous fish in the bypass, provide added rearing habitat, and improve foodweb productivity in the bypass and Delta (BE15).	Consolidated larger and fewer diversions and positive-barrier bypass-screen systems could increase predation losses of anadromous fishes migrating through the Delta (AE15).	To the extent consistent with program objectives, screen intakes or connect intakes of the Tracy Pumping Plant (Central Valley Project) to the screened Clifton Court Forebay to alleviate loss of fish at the Tracy Fish Protection Facility (M15).
Conversion of leveed lands to tidal waters, construction of setback levees along Delta channels, and construction of overflow basins in the Bay-Delta could increase tidal shallow-water rearing habitat for juvenile salmonids and improve foodweb productivity (BE16).	Upgrading levees could degrade existing riparian, wetland, and SRA habitats along existing levees (AE16).	To the extent consistent with program objectives, screen all Delta diversions that may entrain juvenile anadromous fish (M16).
Control of non-native plants in Bay-Delta sloughs would improve 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 (BE17).	Reductions in total organic loadings could reduce foodweb productivity (AE17).	Restore or enhance 1-3 times the amount of aquatic habitat affected by levee upgrades near where impacts occur (M17).
Additional tidal emergent wetland habitat would increase shallow-water 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 (BE18).	Further development of water transfers could lead to (1) a shift in water diversions from the Delta to periods with higher risk of losses to entrainment, or (2) changes in timing and location of diversions that could adversely affect migrating and rearing habitat in the Delta or elsewhere (AE18).	To the extent consistent with program objectives, include project design features that allow tor onsite reestablishment and long-term maintenance of aquatic, wetland, and riparian habitat following project construction (M18).

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Protection of existing islands and restoration of additional channel-island habitat would increase SRA habitat and shallow-water edge habitat, which could provide more rearing habitat as well as improve foodweb productivity, which, in turn, would increase survival and population abundance (BE19).	Alteration of south-Delta channels could increase chances of some anadromous fish being drawn to and lost or damaged in 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).
Improved slough and restored slough habitat would increase the area of aquatic habitat, including shallow-water and SRA habitats, which would provide additional rearing habitat and increase foodweb productivity, which, in turn, could increase survival and population abundance (BE20).	Alteration of conveyance features at south-Delta pumping plants could increase the pumping capacity, which could lead to increased entrainment and salvage losses at the intake facilities or possibly adverse effects on migration and rearing habitat (AE20).	Water transfers should be conducted so as not to increase exports during times of the year when anadromous fish are more vulnerable to damage or loss at project facilities or when habitat may be adversely affected (M20).
Improvements and restoration of riparian habitat along Delta channels could substantially improve migrating and rearing habitat in the Delta as well as foodweb productivity, which could lead to increased survival and population abundance (BE21).	The discharge of Sacramento River water into the interior Delta through Snodgrass Slough could result in some adult anadromous fishes bound for the Sacramento River and its tributaries being drawn into the central Delta and up to the discharge point during annual spawning migrations up the Sacramento River (AE21).	To the extent consistent with program objectives, alteration of south-Delta channels should be designed to improve migrating, rearing, and feeding habitat in the south Delta (M21).
Potential for substantial increase and enhancement of SRA habitat, instream habitat, and stream temperature conditions for populations of native aquatic species (BE22).	Diversion of Sacramento River water into Snodgrass Slough through a screened intake on the Sacramento River could lead to predation and impingement losses of young anadromous fish at the intake (AE22).	To the extent consistent with program objectives, alteration of south-Delta channels should be designed to minimize the extent to which anadromous fish would be drawn to the immediate vicinity of the south-Delta pumping-plant intakes (M22).

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Flooding and draining of agricultural lands could lead to an increase in Delta foodweb productivity, which could improve fish growth, juvenile survival and smolt production, and population abundance (BE23).	Diversion of Sacramento River water into Snodgrass Slough without screening could result in greater numbers of anadromous fish from the Sacramento River being drawn into the interior Delta where they may have poorer habitat, be delayed in migration to the ocean, or have a greater chance of being drawn to south-Delta pumping plants (AE23).	To the extent practicable, construction and operation of new conveyance features in the south Delta to the pumping plants should be such as to minimize losses of anadromous fishes (M23).
Avoiding dredging at times and places in the Delta when juvenile anadromous fish are present and feeding in abundance would help improve feeding habitats and potentially lead to improving juvenile survival and adult populations (BE24).	The increase in the flushing rate of the interior northern portion of the central Delta could alter foodweb productivity and tidal freshwater habitat conditions that such that it could limit production of anadromous fishes in the area (AE 24).	To the extent consistent with program objectives, time diversions of Sacramento River water into the interior Delta to minimize adverse effects on migrating anadromous fishes (M24).
Reducing the abundance of non-native aquatic species may reduce competition and predation (BE25).	Construction and operation of north-Delta conveyance features could reduce habitat values and foodweb productivity (AE 25).	To the extent consistent with program objectives, design the diversion so as to not block upstream-migrating fish headed for the Sacramento River (M25).
Consolidating diversions and upgrading fish screens and handling systems could reduce entrainment losses (BE26).	An isolated conveyance facility could result in entrainment, predation, and impingement losses of Sacramento fish at the intake of the facility. Juvenile fish would be vulnerable to handling effects at intake screens and would lead to reduced flow rates in the mainstem Sacramento River below the point of diversion, and a greater proportion of this reduced flow would enter the central Delta (AE26).	To the extent practicable, consider designing the diversion without pumps or other diversion facilities that would require screening and handling of fish (M26).

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Reduction in illegal net fishing and further limitations on the legal fisheries could reduce losses of juvenile and adult anadromous fish (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 migrating, rearing, and feeding habitat, as well as less chance of being drawn to the south-Delta pumping plants (M27)
Reduction in the levels of contaminants being released into Delta channels could increase foodweb productivity and improve survival (BE28).	Likely to be no discernable adverse effects on anadromous fish habitat or populations (N/E).	To the extent consistent with program objectives, design and operate north-Delta facilities to improve habitat and foodweb productivity (M28).
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 (BE29).		To the extent consistent with program objectives, time water diversions from the north Delta to minimize potential involvement of large numbers of juvenile anadromous fish (M29).
Enhanced levee stability would decrease levee failures and reduce potential loss of anadromous fish to stranding on flooded islands or to poor water quality (e.g., high water temperatures, increased turbidity, and increased salinity) (BE30).		
Proposed habitat improvements along upgraded levees (e.g., shallow slopes and vegetated berms) could improve rearing habitat and potentially increase smolt production and population levels (BE31).		
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. (BE32).		

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Further development of water transfers could lead to reductions in exports at high-risk times of year, which could reduce losses of anadromous fish at project pumping plants or adverse habitat changes caused by water exports (BE33). Alteration of channels in the south Delta could improve habitat in altered and other channels, which could lead to greater foodweb productivity, improved migrating and rearing habitat, and reduced entrainment and salvage losses at south-Delta pumping plants (BE34). Improvements to CVP-SWP conveyance features at south-Delta pumping plants (e.g., Joint Point of Diversion) could reduce vulnerability of anadromous fish to entrainment and salvage losses at the intakes of the facilities (BE35). 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 that could lead to improved survival and population levels of anadromous fishes (BE36). 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 east-Delta and San Joaquin tributary water and juvenile anadromous fish drawn to south-Delta pumping plants (BE37).		

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Improved habitat in Mokelumne River and other north-Delta channels could improve migrating, rearing, and feeding habitat, as well as foodweb productivity, which could increase survival and population abundance particularly of east-Delta tributary populations of anadromous fishes (BE38).		
An isolated conveyance facility could improve migrating, 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, especially for San Joaquin River salmonids (BE39).		
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 (BE40).		
Reduction of sediment into Bay wetlands and other shallow tidal waters (e.g., sloughs and embankments) could increase foodweb productivity and improve spawning, rearing, and feeding habitats (BE41).		
More natural riverflows would improve spawning, rearing, and migrating habitat in the Sacramento River and tributaries (BE42).		
Improved sediment supplies may improve spawning, migrating, and rearing habitats (BE43).		

Table S-2. Continued

Potential Beneficial Effects	Potential Adverse Effects	Conservation Measures Incorporated into the Program
Improved riverine aquatic habitats would improve spawning and early rearing habitat (BE44).		
Improved riparian habitat would improve spawning and early rearing habitat (BE45).		
Improvements to passage routes could increase access to spawning and rearing areas (BE46).		
Potential for increasing numbers of juvenile anadromous fish successfully outmigrating to the Bay-Delta (BE47).		
Reduction in the harvest in rivers could increase the number adult spawners and reproductive success (BE48).		
Improvement in the genetic integrity of anadromous fish stocks could improve spawning success, juvenile survival, and adult homing success (BE49).		
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).		