7.3 FISHERIES RESOURCES

7.3 FISHERIES RESOURCES

7.3.1 INTRODUCTION

7.3.1.1 Content

This section describes the SWP-related fisheries resources of the Feather, American, Sacramento, and San Joaquin rivers, the Sacramento-San Joaquin River Delta (Delta),[1] the mid-system regulating reservoir (San Luis Reservoir), and two terminal reservoirs (Lake Perris and Castaic Lake).

This section focuses on those elements of the SWP facilities that could be affected by the proposed project. It does not address the bulk of the SWP conveyance system. The remaining reservoirs, including Pyramid Lake, Lake Silverwood, the aqueduct sections, pipelines, and afterbays would not be affected. Fish found in the California aqueduct, the other reservoirs, and the forebays and afterbays would be unaffected by the proposed project. Amphibian resources are covered in Section 7.4 – Terrestrial Biological Resources. Specific hydrologic or water quality changes that could result from the proposed project are covered in Section 7.1 – Surface Water Hydrology, Water Quality, and Water Supply. This EIR section addresses issues related to the fisheries resources within the estuary, rivers, and reservoirs of the Central Valley and the Delta. Elements of the proposed project that could potentially affect fisheries are listed in Table 7.3-1.

TABLE 7.3-1

IMPACTS OF THE PROPOSED PROJECT ELEMENTS ON FISHERIES RESOURCES

Proposed Project Element	Potentially Affected Environmental Resources	Impact Number
Monterey Amendment		
Altered water allocation procedures	Flow and water quality in rivers and delta, water levels in reservoirs, availability and quality of water	7.3-1, 7.3-2, 7.3-3, 7.3-4, 7.3-5, 7.3-6, 7.3-7, 7.3-8, and 7.3-9.
Permanent Table A transfers and retirements	Flow and water quality in rivers and delta, water levels in reservoirs, availability and quality of water	7.3-1, 7.3-2, 7.3-3, 7.3-4, 7.3-5, 7.3-6, 7.3-7, 7.3-8, and 7.3-9.
Transfer of Kern Fan Element lands	Local development of the kern water bank (part of article 52 provisions)	7.3-5
Water supply management practices	Flow in delta, water levels in reservoirs, groundwater levels, availability and quality of water	7.3-1, 7.3-3, 7.3-5, 7.3-6, 7.3-7, 7.3-8, and 7.3-9.
Restructured financial arrangements	NA	NA
Settlement Agreement		
Substitute Table A for entitlement	NA	NA
Disclosure of SWP delivery capabilities	NA	NA
Guidelines on permanent transfers	NA	NA
Guidelines on public participation	NA	NA
Restrictions on Kern Fan Element lands	NA	NA
Watershed forum and restoration in Plumas County	NA	NA
Amendment of Plumas SWP contract water shortage provision	NA	NA
Funding for plaintiffs	NA	NA

Note:
NA – Not Applicable.

Comments received in response to the Notice of Preparation pertinent to fisheries resources are summarized here. The full text of comment letters is available in Appendix B. Most comments reflected concerns about the state of fisheries resources within the streams potentially affected by the SWP, including the Delta estuary. These same comments requested an analysis of impacts from changes in water exports under pre-Monterey (baseline) conditions, and potential impacts under proposed project conditions. Other comments requested a detailed analysis of the transfer of water through the Delta. There were requests to evaluate potential impacts to fisheries resources in streams not directly influenced by SWP operations. Other comments requested that the EIR project into the future in relation to water use, export, and SWP operations.

7.3.1.2 Analytical Method

The proposed project can affect flows in the Delta and rivers upstream of the Delta, and in storage at some of the SWP reservoirs. This section describes the analyses that identify river flow and reservoir storage changes, quantifies their magnitude, and lays the groundwork for identifying other impacts caused by such flow and storage changes. The analyses also focus on potential mechanisms that might cause operational changes and thereby trigger impacts.

These flow and storage changes can in turn affect fishery resources. Analytical methods used to ascertain fisheries conditions include analysis of current and historical data, discussions with agency fish biologists, and model simulation that includes post-processing analyses of SWP operations.

Flow and Storage Analyses

Three methods were used to examine the effects of the proposed project on river and Delta flows and reservoir storage: 1) CALSIM II simulations and post-processing of CALSIM results, 2) analysis of historical data, and 3) extrapolation from historical data. The CALSIM II model directly simulates the effects of the Table A transfers and retirements, and a post-processing analysis of CALSIM II output enables determination of the effects of the altered water allocation procedures. Since CALSIM II does not model the water supply management practices, these provisions were analyzed using an analysis of historical data.

Modeling Data

CALSIM II was used to estimate the annual amount of water available for delivery to the SWP contractors over the 73-year period of hydrologic record used in the model (the analysis in Chapter 6 used the 1928-1994 time period, while the Fisheries Resources section uses the 1922-1994 time period). The total amount of water available each year was then allocated to the SWP contractors in accordance with pre-Monterey Amendment allocation procedures (baseline scenario) and post-Monterey Amendment allocation procedures (proposed project), considering the Table A transfers and retirements that are a part of the proposed project. Monterey Amendment-induced changes in deliveries to individual contractors located north of the Delta have the potential to alter flow in the Feather and Sacramento rivers, and Delta inflow. Also, Monterey Amendment-induced changes in deliveries to contractors located south of the Delta have the potential to alter Delta exports. Changes in Delta inflow and exports can affect Delta outflow. The effects of the Table A transfers and retirements and the altered water allocation procedures on river flow, Delta exports, and Delta outflow were determined by using spreadsheet analysis. The spreadsheet analysis tabulated the proposed project and the baseline scenarios under 2003 and 2020 conditions, the changes in allocations to the five contractors north of the Delta and determined the effect of these changes on Feather and Sacramento river flows and Delta inflow (see Appendix H). The analysis used 1922-1994 river flow estimates, and made the comparisons by year type on an annual and monthly basis. The delivery estimates for the 1922-1994 were made based on 2020 SWP demand estimates. The analysis also determined changes in annual deliveries to contractors located south of the Delta, which affects Delta exports, by year type.

The changes to Plumas County allocations are excluded from the analysis because the mechanisms for delivery to Plumas from Lake Davis affect Feather River flows in a different manner.

Historical Analyses

An estimate of the actual effects of the proposed project on Delta exports in the period 1996 to 2004 was determined in a historical operations analysis, based on actual operations and delivery data. This analysis included nearly all of the provisions of the Monterey Amendment, including Table A retirements and the water supply management practices.

Because CALSIM II does not simulate operation of the water supply management practices, it was necessary to perform a separate analysis of these provisions. This water supply management practices analysis was also based on historical data from 1996 through 2004, since these practices were employed during that time. The effects of the water supply management practices between 2003 and 2020 were estimated by extrapolation of results of the water supply management practices analysis, based on the known effects of the practices between 1996 and the present.

The Monterey Amendment contains provisions, other than the altered water allocation procedures, transfers, and retirement of Table A amounts, which have the potential to affect streamflow and Delta outflow. Article 54 allows some contractors, under certain conditions, to borrow water from Castaic Lake and Lake Perris. Article 56 gives prior California Department of Water Resources (Department) approval for contractors to store SWP water outside their service areas for later use within their service areas. This could include storage in groundwater banks or in San Luis Reservoir. Another provision of Article 56 establishes an annual turnback pool. Each of these water supply management practices, as well as the two historical analyses mentioned above, are described in Chapter 6.

Castaic Lake and Lake Perris are terminal reservoirs for the SWP at the end of the East and West Branches of the California Aqueduct. The borrowing of water from these reservoirs under Article 54 may affect the storage in these reservoirs. For historical perspective, the actual storage patterns experienced between 1996 and 2005, which included several actual borrowing and pay back events, were evaluated. To evaluate the potential effect on storage in these reservoirs, the maximum withdrawal permitted under Article 54 (approximately 50 percent of storage capacity) was evaluated.

<u>Fishery Analyses</u>

The Monterey Amendment and the Settlement Agreement were put into place in different years (see Chapter 5 for a discussion of the baseline conditions). Determination of conditions for the environmental setting in 1995 presented a challenge. While some data on fish salvage and distribution within the Delta exist for the years prior to 1996, data from 1996 on are more complete and reliable, and therefore most of the fisheries data presented within this section come from documents published after 1995. The discussion of special-status species is based on populations known from before and after 1995. State and federally listed species and species of concern are discussed if they were listed in 1995 or earlier. Also, State and federally listed species and species of concern that were listed as of 2003 are discussed (Green Sturgeon's listing status as of 2006 is used in this document). State and federal species of concern are typically treated as rare, threatened, or endangered within CEQA documents because they meet the definitions within CEQA Guidelines § 15380 which defines these terms. Collectively, all species listed under the California Endangered Species Act (CESA), the Federal Endangered Species Act (FESA), or listed as a Species of Concern by California Department of Fish and Game (CDFG), the US Fish and Wildlife Service (USFWS), or the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (also known as NOAA Fisheries) are considered special-status species within this document.

Unfortunately, when a species is designated a Species of Concern by one of the regulatory agencies, there is not a listing date associated with this action that could be used to sort species into the appropriate timeframe discussion. Because of this, the species categorized as Class 1 or Class 2 in *Fish Species of Special Concern in California,*[2] are considered to represent the State and Federal Species of Concern for the 1995 environmental setting. The 2003 environmental setting utilizes the 2003 list published by CDFG that contains both State and Federal Special Status species.[3] The California Natural Diversity Database (CNDDB) was queried for the U.S. Geological Survey 7.5-minute quadrangles that contained the reservoirs to determine if any special status species had been reported from these locations.[4] A query of the CNDDB was also run for those counties that contain SWP facilities.[5] This query resulted in a list of 25 species of fishes that would be considered special status. Most of these are found in areas not influenced by the proposed project. These include: the Colorado River which supports bonytail (*Gila elegans,* probably extirpated from California), Colorado pikeminnow (*Ptychocheilus lucius*, extirpated from California), and razorback sucker (*Xyrauchen texanus*); the Mohave River which support Mohave tui chub (*Gila bicolor mohavensis*); desert habitats in which all species of pupfish (*Cyprinodon* spp.) may be found; and streams within the Los Angeles Basin that do not have a connection to the SWP such as the Santa Ana rivers. Those species with some potential to be found within SWP facilities in 1995 are discussed in Section 7.3.2.2.

Although there are no reproducing populations of special-status species located in the reservoirs that are discussed in this section, the fisheries are of relevance as gamefish. Local-area representatives from CDFG were contacted by telephone and asked for information on the fisheries assemblages within the following reservoirs: San Luis Reservoir, Lake Perris, Castaic Lake, and Lake Oroville. Site-specific data for these reservoirs were scarce and routine survey information is generally not available. For this reason, fisheries assemblages and conditions were assumed to be the same in 1996 and 2003 for the reservoirs. Any changes that occurred between 1996 and 2003 are noted in Section 7.3.2.3.

Reservoirs

There are four main reservoirs that are analyzed in this section: Lake Oroville, San Luis Reservoir, Castaic Lake, and Lake Perris. Thresholds for evaluating significance of operation changes on reservoir fisheries depend on the species present and management goals of the reservoir. Many of the fish listed in the reservoirs associated with the SWP are the target of anglers. The use of this resource varies depending on factors such as access, productivity, and nearby population centers. This recreational fishery is of primary concern when discussing fisheries resources within these reservoirs. For Lake Oroville and San Luis Reservoir, modeling data from the proposed projects were compared to baseline data. Changes in monthly reservoir elevation were compared to the baseline elevations. For Castaic Lake and Lake Perris, actual reservoir elevations were compared to baseline elevations for 1996 through 2005, and a worst-case withdrawal scenario was used to evaluate potential future impacts. An increase in elevation reduces the solar warming of spawning grounds. As refuge habitat is flooded, it exposes young fish to higher rates of predation. Depending on various biotic and abiotic characteristics of the reservoir, a drop in reservoir levels may dewater nests, create overcrowding, or increase predation by birds and other animals.

Sacramento-San Joaquin Delta

The fisheries resources of the Delta are extensive and complex. The relationship between streamflows and tidal flows at various locations and the movement patterns of fish varies depending on the species being evaluated. For example, reductions in flows can delay upstream migration of adult salmon. Modifications in pumping patterns can change the flow patterns of the Delta and movement patterns of many species altering both upstream and downstream movement of fish. Flow changes in the Delta also can affect entrainment risk of young fishes.

In general, modeled baseline data was compared to the proposed project. The model output of the proposed project was compared to the modeled baseflow data. The percent change attributable to the project was calculated and averaged for a particular month and water year type following the methods previously discussed. Reductions in flow could impact a number of species depending on the magnitude of change and time of year.

Streams and Rivers

Fish rely on streams and rivers to provide living space. Within these streams and rivers, there is a relationship between abiotic factors, such as water flows, channel morphology, and toxins; and biotic factors, such as riparian vegetation, food availability, predator presence, on habitat quantity and quality. Water flow increases, decreases, and abrupt flow changes can create issues for fisheries depending on the abiotic and biotic characteristics. The Monterey Amendment has the potential to affect water flows in certain rivers at certain times of the year. Depending on the other related biotic and abiotic factors, increases in flow could result in reductions in available habitat for different life cycle stages of fish. For example, salmon fry require relatively shallow low-velocity areas in which to rear. Because an increase in flow typically results in increased velocities and depths, it may result in reductions in available habitat for salmon fry. Spawning habitat also may decrease with increased flow as depths and velocities change. Conversely, decreases in water flow could also have negative impacts on salmon. Decreases in flow could limit the availability of spawning sites, make upstream and downstream fish passage more difficult to impossible, increase the likelihood of predation, create conditions for high temperatures that are lethal to salmonids, increase infestation of pathogens, increase opportunities for poaching, etc.

7.3.1.3 Standards of Significance

The following standards of significance are based on the sample questions presented in CEQA Guidelines Appendix G, CEQA Guidelines §§ 15065 and 15380, and standards previously developed and used by the Department. Implementation of the project could have a potentially significant effect on the environment if it will:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as endangered, rare, or threatened, as listed in Title 14 of the California Code of Regulations (Section 670.2 or 670.5) or Title 50 of the Code of Federal Regulations (Sections 17.11 or 17.12);
- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the USFWS, CDFG, or NOAA Fisheries;
- Substantially degrade the quality of the environment (CEQA § 15065);
- Substantially reduce the habitat of a fish or wildlife species (CEQA § 15065);
- Cause a fish or wildlife population to drop below self-sustaining levels (CEQA § 15065);
- Threaten to eliminate a plant or animal community (CEQA § 15065);
- Substantially reduce the number or restrict the range of an endangered, rare, or threatened species (CEQA § 15065);
- Reduce the area or habitat value of critical habitat areas designated under FESA (Essential Fish Habitat);
- Have a substantial adverse effect on any riparian habitat or other sensitive natural communities identified in local or regional plans, policies, regulations, or by USFWS, CDFG, or NOAA Fisheries;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources;
- Substantially degrade structural characteristics or processes of the aquatic ecosystem; or
- Substantially reduce populations of fish species having economic or social value.

Impacts in any of the above categories would be considered potentially unavoidable significant effects of the projects if they could not be (a) eliminated, (b) avoided or minimized by redesign or relocation of some components of the proposed project, (c) reduced to a less-than-significant level, or (d) compensated for by replacement of equal habitat extent and value.

7.3.2 ENVIRONMENTAL SETTING

The SWP stretches from the Upper Feather River Lakes in Plumas National Forest to Lake Perris and Castaic Lake at the terminal ends in the south. The SWP contains a series of reservoirs and conveys water through natural river channels that support many species of fish, including species of special concern. While its main purpose is to store and distribute water to urban and agricultural contractors, the SWP also must comply with environmental regulations intended to protect and restore fish species, populations, and evolutionary significant units/discrete population segments. The following discussion includes a description of fish found within the SWP, the environmental regulations protecting them, and the changes in both that have occurred from 1996 to 2003.

7.3.2.1 Life Histories of Fish Species of Concern through 2003

The following paragraphs highlight the species of concern that live in waterways that may be affected by the proposed project.

Note: Fish species of concern involved with the Pelagic Organism Decline in the San Francisco Estuary (longfin smelt, delta smelt, and splittail) are discussed in section 7.3.2.4.

Green Sturgeon (*Acipenser medirostris*)

Green sturgeon are found from the Bearing Sea south to northern Mexico with the Sacramento River supporting the southern-most spawning population.[6] Historically this species spawned in much of the Sacramento River and potentially the San Joaquin River. The USFWS and NOAA Fisheries group Green sturgeon into two distinctive populations of fish. The two populations are the northern (spawns in the Klamath and Rogue rivers) and the southern (spawns in the Sacramento River). Adult sturgeon move into the Sacramento River presumably between February and May[7] and have been observed in the mainstem Sacramento River near Red Bluff.[8] Juveniles migrate to the ocean in the summer and fall following their second year in freshwater rivers or streams.[9] Juveniles have been captured in the Delta indicating that this area may be used as rearing habitat. Currently, the Sacramento River appears to support the only spawning population in the Central Valley (70 FR 17386). There are confirmed reports of adult green sturgeon in the Feather River, but young fish have never been observed.[10]

Chinook Salmon (*Oncorhynchus tshawytscha*)

Chinook salmon adults and juveniles move through the Delta on their way to and from the ocean. The different runs of adults enter the rivers at different times throughout the year. Some juvenile Chinook rear in the Delta for varying time periods on their way to the ocean. There are no spawning areas within the Delta suitable for use by adult salmon. The USFWS and NOAA Fisheries group Chinook in distinct populations of fish. Refer to Tables 7.3-2, 7.3-3, and 7.3-4 for Chinook salmon spawner populations. A discussion of the individual runs follows.

<u>Winter-Run</u> – Winter-run Chinook return to the upper Sacramento River between December and July but do not spawn until the spring and summer months (April-August).[11] Juveniles spend five to nine months in the river and Sacramento-San Joaquin Estuary before entering the ocean.[12] This fish was relatively abundant prior to the construction of Keswick Dam, Lake Shasta, and the Red Bluff Diversion Dam (RBDD) on the upper Sacramento River. Adult population estimates have been made annually since 1970 at the RBDD (Table 7.3-3). Since 1970, winter-run numbers were on a general decline up to 1997. Winter-run population estimate in 1994 hit an all time low of 144 fish. From 1997 up to 2005, winter-run numbers at the RBDD have been increasing. The population of returning adults in 2005 was 15,730. Part of this increase may be attributable to the resumption of stocking in 1998.[13] Over 250,000 juvenile hatchery stock winter-run Chinook were released into the Sacramento-San Joaquin System in 2002.[14]

<u>Spring-run</u> – Spring-run Chinook enter the Sacramento River between March and September. They move upstream into tributary headwaters where they hold in pools until they spawn between August and October.[15] Juveniles emigrate from the tributaries from mid-November through June; however, some juveniles spend a year in the streams and emigrate as yearlings the following October through May.[16] Population estimates for spring-run Chinook in Mill Creek range from a low of 61 in 1993, to a high of 3,500 in 1975. Compared to the 1990s, spring-run

TABLE 7.3-2

CHINOOK SALMON SPAWNERS POPULATIONS IN SELECTED SACRAMENTO RIVER TRIBUTARIES

	Yuba River	Battle Creek		Big Chico	Butte Creek		Clear Creek		Mill creek		Feather River*2		American River*2
Year	Fall Run	Fall Run	Late Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run
1952	N/D	15,000	N/D	N/D	N/D	N/D	N/D	N/D	16,000	N/D	N/D	N/D	25,000
1953	6,000	16,000	N/D	N/D	N/D	N/D	1,500	N/D	10,000	N/D	28,000	N/D	28,000
1954	5,000	12,000	N/D	N/D	N/D	N/D	3,000	N/D	7,000	N/D	68,000	N/D	29,000
1955	2,000	26,000	N/D	N/D	N/D	N/D	500	N/D	3,000	N/D	86,000	N/D	17,000
1956	5,000	21,108	N/D	N/D	N/D	N/D	2,650	N/D	896	N/D	18,200	N/D	6,437
1957	1,205	5,330	N/D	N/D	N/D	N/D	330	N/D	5,316	N/D	10,750	N/D	7,707
1958	7,900	29,243	N/D	N/D	N/D	N/D	1,600	N/D	4,340	N/D	34,650	N/D	26,871
1959	10,000	30,233	N/D	N/D	N/D	N/D	775	N/D	837	N/D	80,150	N/D	31,143
1960	20,400	23,805	N/D	N/D	N/D	8,700	900	N/D	940	2,368	83,300	N/D	54,366
1961	9,200	19,856	N/D	N/D	N/D	3,082	N/D	N/D	1,689	1,245	43,700	N/D	25,509
1962	34,300	13,057	N/D	200	N/D	1,750	5,400	N/D	4,384	1,692	19,050	N/D	27,053
1963	37,000	17,514	N/D	500	N/D	6,100	10,000	0	1,286	1,315	33,900	600	41,021
1964	34,900	15,875	N/D	100	N/D	600	2,500	0	450	1,539	38,352	2,908	59,171
1965	10,200	9,194	N/D	50	0	1,000	2,500	0	150	N/D	23,235	738	38,569
1966	7,800	3,300	N/D	50	0	80	900	0	500	N/D	20,850	297	26,696
1967	23,500	5,210	N/D	150	N/D	180	370	N/D	500	N/D	11,956	146	23,147
1968	7,000	6,476	N/D	175	N/D	280	800	0	750	N/D	18,144	208	31,333
1969	5,230	5,826	N/D	200	N/D	830	1,240	0	1,700	N/D	60,578	348	47,265
1970	13,830	6,832	N/D	N/D	N/D	285	N/D	N/D	690	1,500	61,525	235	37,309
1971	5,650	5,289	N/D	0	615	470	N/D	N/D	980	1,000	47,041	481	51,790
1972	9,258	4,852	N/D	N/D	450	150	N/D	N/D	631	500	46,835	256	24,501
1973	24,119	8,135	N/D	50	N/D	300	N/D	N/D	420	1,700	73,577	205	94,777
1974	17,809	3,901	N/D	100	200	150	N/D	N/D	944	1,500	65,766	198	61,796
1975	5,641	4,857	N/D	N/D	1000	650	N/D	N/D	1,208	3,500	43,000	691	39,544
1976	3,779	5,444	N/D	N/D	640	46	1,013	N/D	245	N/D	62,000	699	28,374
1977	8,722	10,848	914	100	N/D	100	1,362	N/D	318	460	46,452	185	48,473
1978	7,416	3,652	N/D	N/D	20	128	60	N/D	300	925	37,759	204	21,091
1979	12,430	13,159	N/D	N/D	N/D	10	N/D	N/D	810	N/D	32,505	250	47,666
1980	12,406	14,443	N/D	N/D	N/D	226	N/D	N/D	320	500	35,295	669	49,802
1981	14,025	17,205	147	N/D	N/D	250	3,133	N/D	1,020	N/D	53,020	1,000	64,055
1982	39,367	26,795	43	N/D	N/D	534	785	N/D	1,290	700	55,519	2,000	43,898
1983	13,756	13,983	105	N/D	1000	50	N/D	N/D	200	N/D	30,522	1,702	35,300
1984	9,665	29,893	N/D	0	N/D	23	4,000	N/D	5,800	191	51,057	1,562	39,696

TABLE 7.3-2

CHINOOK SALMON SPAWNERS POPULATIONS IN SELECTED SACRAMENTO RIVER TRIBUTARIES

	Yuba River	Battle Creek		Big Chico	Butte Creek		Clear Creek		Mill creek		Feather River*2		American River*2
Year	Fall Run	Fall Run	Late Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run	Spring Run	Fall Run
1985	13,042	39,808	181	0	100	254	700	N/D	3,840	121	56,002	1,632	65,213
1986	19,328	31,252	197	N/D	N/D	1,371	N/D	N/D	574	291	55,471	1,433	55,067
1987	18,518	24,249	349	N/D	N/D	14	N/D	N/D	282	90	77,846	1,213	46,143
1988	9,000	67,475	53	N/D	N/D	1,290	4,453	N/D	1,487	572	49,036	6,833	33,514
1989	7,622	31,048	65	N/D	N/D	1,300	2,153	N/D	1,565	563	48,119	5,078	28,924
1990	N/D	21,088	92	0	N/D	250	1,011	N/D	N/D	844	6,126	1,893	10,239
1991	14,008	17,241	161	N/D	N/D	N/D	2,026	N/D	N/D	319	42,062	4,303	25,211
1992	6,362	12,708	344	0	N/D	730	600	N/D	999	237	40,545	1,497	11,267
1993	6,703	18,616	528	38	N/D	650	1,246	1	1,975	61	42,914	4,672	39,410
1994	10,890	43,265	598	2	N/D	474	2,546	0	1,081	723	53,584	3,641	40,087
1995	14,237	83,192	323	200	445	7,500	9,298	2	N/D	320	72,061	5,414	86,828
1996	27,900	73,587	1,337	2	500	1,413	5,922	N/D	N/D	253	65,277	6,381	82,396
1997	25,948	101,414	4,578	2	800	635	8,569	N/D	478	200	65,675	3,653	57,845
1998	31,090	98,308	3,079	369	500	20,259	4,259	47	546	424	18,889	6,746	66,580
1999	24,230	119,899	7,075	27	N/D	3,679	8,003	N/D	N/D	560	12,927	3,731	65,099
2000	14,955	75,106	4,194	27	714	4,118	6,687	19	N/D	544	132,863	3,657	110,219
2001	23,392	125,686	3,327	39	N/D	9,605	10,865	N/D	N/D	1,104	203,515	4,135	147,134
2002	24,051	463,296	2,669	N/D	3,415	8,785	16,071	66	2,611	1,594	125,670	4,189	134,069
2003	28,316	153,045	2,797	81	3,310	4,398	9,475	25	2,426	1,426	104,922	8,662	178,629
2004	14390	92,090	5,098	0	2,456	7,390	6,365	98	1,192	998	72,921	4,202	122,513
2005	15048	165,259	6,435	37	4,255	10,625	14,824	69	2,426	1,150	69,704	1,835	75,349
2006	N/D	N/D	N/D	299	N/D	4579	N/D	N/D	N/D	1,002	N/D	0	N/D

Notes:
*1 Includes Salmon from the mainstem population that were trapped at Keswick Dam and transported to Coleman National Fish Hatchery (CNFH).
*2 Includes Salmon that are wild spawners as well as hatchery spawned fish.
N/D = No Data.
Source: GrandTab, CDFG, Fisheries Branch, 2006.

TABLE 7.3-3

SACRAMENTO RIVER AT RED BLUFF DIVERSION DAM CHINOOK SALMON SPAWNER POPULATIONS

Year	Fall Run*1	Late Fall Run*1	Winter Run	Spring Run
1960	218,940	N/D	N/D	N/D
1961	140,181	N/D	N/D	N/D
1962	127,837	N/D	N/D	N/D
1963	138,881	N/D	N/D	N/D
1964	142,584	N/D	N/D	N/D
1965	101,876	N/D	N/D	N/D
1966	111,881	N/D	N/D	N/D
1967	82,490	N/D	N/D	N/D
1968	98,429	N/D	N/D	N/D
1969	115,652	N/D	N/D	20,000
1970	65,142	N/D	40,409	3,652
1971	53,888	16,741	53,089	5,830
1972	33,958	31,559	35,929	7,038
1973	41,129	21,781	22,651	7,175
1974	47,019	6,083	18,536	3,800
1975	53,129	19,261	22,579	10,234
1976	45,753	15,908	33,029	25,095
1977	16,176	9,210	16,470	11,545
1978	32,235	12,479	24,735	5,669
1979	47,758	10,284	2,339	2,856
1980	21,961	9,093	1,142	9,363
1981	29,212	6,571	19,795	20,655
1982	17,966	3,981	1,233	23,156
1983	26,226	14,984	1,827	3,854
1984	36,965	6,540	2,662	7,823
1985	52,120	8,136	3,686	10,200
1986	68,821	7,820	2,566	15,948
1987	76,562	16,222	2,068	10,911
1988	63,998	12,507	2,129	9,601
1989	48,968	12,807	635	5,131
1990	32,109	6,892	384	3,896
1991	20,523	6,611	177	766
1992	23,914	9,356	1,159	371
1993	33,471	739	369	391
1994	44,729	291	144	862
1995	53,385	166	1,159	349
1996	71,725	48	1,012	378
1997	98,765	N/D	836	126
1998	5,718	38,239	2,831	1,115
1999	133,365	8,683	3,264	N/D
2000	87,793	8,632	1,263	71
2001	57,792	18,351	8,085	711
2002	45,523	36,004	7,348	273
2003	66,476	5,346	8,105	N/D
2004	34,050	8,824	7,784	395
2005	44,950	9,565	15730	N/D

Notes:
*1 Includes Salmon from the mainstem population that were trapped at Keswick Dam and transported to Coleman National Fish Hatchery.
N/D = No Data.
Source: GrandTab, CDFG, Fisheries Branch, 2006.

TABLE 7.3-4

SAN JOAQUIN RIVER TRIBUTARY CHINOOK SALMON SPAWNER POPULATIONS

Year	Cosumnes River Fall Run	Merced River Fall Run	Tuolumne River Fall Run	Stanislaus River Fall Run	Mokelumne River Fall Run
1960	1,400	350	45,000	8,300	2,205
1961	N/D	50	500	1,900	137
1962	900	60	250	315	230
1963	1,500	20	100	200	481
1964	2,200	35	2,100	3,700	2,210
1965	800	90	3,200	2,231	1,300
1966	600	45	5,100	2,872	689
1967	500	600	6,800	11,885	3,000
1968	1,500	550	8,600	6,385	1,707
1969	4,400	600	32,200	12,327	2,685
1970	600	4,800	18,400	9,297	5,000
1971	500	3,651	21,885	13,621	5,200
1972	1,600	2,648	5,100	4,298	1,102
1973	900	1,172	1,989	1,234	2,600
1974	285	2,000	1,150	750	1,422
1975	725	2,400	1,600	1,200	1,900
1976	N/D	1,900	1,700	600	473
1977	N/D	1,011	450	0	250
1978	100	625	1,300	50	1,086
1979	150	2,147	1,183	110	1,507
1980	200	3,006	559	100	3,231
1981	N/D	10,415	14,253	1,000	4,954
1982	N/D	3,263	7,126	N/D	9,372
1983	200	18,248	14,836	500	15,861
1984	1,000	29,749	13,689	11,439	8,298
1985	220	16,052	40,322	13,473	7,682
1986	N/D	7,439	7,404	6,497	7,167
1987	0	4,126	14,751	6,292	1,630
1988	100	4,592	5,779	10,212	528
1989	N/D	427	1,275	1,510	280
1990	N/D	82	96	480	497
1991	N/D	119	77	394	410
1992	N/D	986	132	255	1,645
1993	N/D	1,678	471	677	3,157
1994	N/D	3,589	506	1,031	3,157
1995	N/D	2,922	827	619	5,517
1996	N/D	4,432	4,362	168	7,921
1997	N/D	3,660	7,146	5,588	10,175
1998	300	4,091	8,910	3,087	7,213
1999	N/D	4,766	8,232	4,349	5,333
2000	N/D	9,133	17,873	8,498	7,423
2001	N/D	9,660	8,782	7,033	8,035
2002	N/D	10,638	7,173	7,787	10,753
2003	N/D	3,079	2,163	5,902	10,239
2004	N/D	4,050	1,700	5,000	11,904
2005	N/D	2,921	500	3,500	18,680

Note:
N/D = No Data.
Source: GrandTab, CDFG, Fisheries Branch, 2006.

numbers in Mill Creek from 2000 to 2005 have been greater. Feather River and Butte Creek have shown a similar trend of increasing spring-run numbers since 1995 as compared to years prior to 1995. The Feather River supports the spring-run Chinook population with spawning both in the river and at the Feather River hatchery. Cottonwood Creek, Big Chico Creek, Battle Creek, and Clear Creek also have runs of spring-run Chinook, but are fewer in numbers. Spring-run numbers in the Sacramento River at the RBDD have diminished in the 1990s and the early part of the 2000's when compared to the numbers in the 1970s and 1980s. The San Joaquin River population of spring-run Chinook was extirpated by the construction of Friant Dam in 1948 which blocked access to upstream spawning habitat. For spring-run Chinook salmon numbers relevant to this EIR, see Tables 7.3-2, and 7.3-3.

Late fall-run – Adult late fall-run Chinook salmon migrate from October through April, with peak migration occurring in December.[17] Adults move through the SWP project area into spawning habitats of the Sacramento River. Salmon fry move downstream, and smolts emigrate to the ocean when spring freshets increase river flow, increase turbidity, and decrease temperatures in their natal tributaries.[18] Late fall-run Chinook spawn in the upper Sacramento River. Since 1971, the greatest number of late fall-run Chinook at the RBDD occurred in 1998 at 38,239 fish, the lowest occurred in 1996 at 48 fish. The late fall-run Chinook salmon numbers at the RBDD during the early part of the 2000s are comparable to the 1990s, 1980s, and 1970s. Battle Creek also supports a late fall-run. Numbers of late fall-run Chinook salmon in Battle Creek have trended upward since 1995. It is likely that the San Joaquin River also once supported a late fall-run, but it is now believed extirpated.[19] For late fall-run Chinook salmon numbers relevant to this EIR, see Tables 7.3-2, and 7.3-3.

Fall-run – Historically, fall-run Chinook were in Central Valley streams that had enough water during the fall. Fall-run salmon generally spawned in streams on the valley floor and in foothill reaches below 500-feet elevation.[20] Typically, fall-run Chinook salmon enter the Sacramento-San Joaquin River system from July through December. Spawning occurs in October, November, and December. Extant runs of Chinook in the San Joaquin River system are fall-run fish that spawn in the Tuolumne, Merced, Cosumnes, Mokelumne, and Stanislaus rivers.[21,22,23] For fall-run numbers in the above five rivers, refer to Table 7.3-4. In the San Joaquin River, the fall-run population is generally less than 10,000 fish.[24] The Sacramento and San Joaquin River systems are heavily supplemented with hatchery raised fall-run Chinook. Fall-run Chinook salmon is the most abundant run at the RBDD. The highest total at RBDD since 1970 occurred in 1999 with 133,365 fish, the lowest occurred in 1998 with 5,718 fish. Fall-run totals at the RBDD during the 2000's have been comparable to the 1970's, 1980's, and 1990's. Yuba River, Battle Creek, Butte Creek, Clear Creek, Mill Creek, Feather River, and the American River, also all support fall-run Chinook salmon. For fall-run Chinook salmon numbers relevant to this EIR, see Tables 7.3-2, 7.3-3, and 7.3-4.

Steelhead (*Oncorhynchus mykiss*)

Steelhead begin their migration from the ocean when winter rains provide large amounts of cold water for migration and spawning. Juvenile steelhead generally spend 1-3 years in freshwater before migrating to the ocean.[25]

Before water development during the last century, steelhead were more common in the Central Valley than they are today. Both hatchery and natural steelhead have declined in the Sacramento River system. Dams and other structures have blocked steelhead access to miles of rearing and spawning habitat. There is little history regarding steelhead distribution in the San Joaquin River system. Based on historical documentation of known Chinook salmon distribution, we can assume that steelhead were present from Kings River north.[26] Steelhead numbers in the San Francisco Bay area have also declined. Most of the streams in the San Francisco Bay area flow through heavily urbanized areas. These streams have been channelized, are associated with limited riparian vegetation, and generally have poor water quality.

In 1996, about 10 to 30 percent of adults returning to spawn were of natural origin,[27] down from an average of 88 percent for the 1953-1954 and 1958-1959 seasons.[28] The size of the steelhead run in the American River in the 1971-1972 and 1973-1974 season was 19,583 and 12,274, respectively.[29] Run sizes of 300, 1,500, and 250 were estimated for the 1990-1991 through 1992-1993 seasons, respectively.[30] Small numbers of wild fish remain, primarily in upper Sacramento River tributaries such as Deer, Mill, and Antelope Creeks and the Yuba River.[31] In 2003, populations of steelhead were found in the lower Stanislaus and Tuolumne rivers.[32] CDFG has identified the following Central Valley streams with potential to maintain self-sustaining wild runs of steelhead: Clear, Big Chico, Cow, Cottonwood, Battle, Mill, Deer, Antelope, and Butte Creeks, and the Yuba River.

Sacramento-San Joaquin roach (*Hesperoleucus symmetricus symmetricus*)

Sacramento-San Joaquin roach are found in a wide array of habitats in the Sacramento and San Joaquin river systems from the headwaters to the lower reaches of streams. Roach are often found in warmer streams because they are capable of surviving high water temperatures and low levels of dissolved oxygen.[33] However, they are also found in cooler-water higher elevation streams. They are relatively sensitive to elevated levels of salinity; a fact which precludes their use of much of the Delta and could limit movement between watersheds. Omnivorous, they feed by both grazing on the bottom and catching drifting prey. Roach mature after two to three years and spawning takes place in shallow flowing water over small gravel and is triggered by water temperatures over 16°C.[34]

River Lamprey (*Lampetra ayresi*)

River lamprey are found in several larger rivers and streams along the Pacific Coast including the Delta and several other streams that flow into the San Francisco Bay.[35] Adults move into the rivers to spawn in late spring and early summer. Spawning occurs on gravel substrates often well upstream from the estuary. Within the San Joaquin River System, spawning takes place primarily in the Tuolumne and Stanislaus rivers. Juveniles spend three to five years in freshwater before migrating to the ocean.

Pacific Lamprey (*Lampetra tridentata*)

Pacific lampreys are found in most of the larger rivers and streams along the Pacific Coast. Adults move into the rivers in late winter through spring. Spawning occurs in late spring and early summer on gravel substrates well upstream from the estuary. Juveniles spend five to seven years in freshwater before migrating to the ocean.

Hardhead (*Mylopharodon conocephalus*)

Hardhead can be found in some of the reservoirs in the Sierra foothills and larger mainstream rivers like the Feather, American, and Sacramento. Hardhead are one of the larger native minnows that can be found in the low- to mid-elevation streams of the Central Valley. Spawning behavior is poorly documented but presumably occurs over gravel substrates of riffles between April and May.

Striped Bass (*Morone saxatilis*)

This species is not considered a species of concern, but is included here as an example of a recreationally important that has been introduced into the habitats of the native fish species listed in the Fisheries Resources section. Striped bass are predacious on delta smelt and salmonids.

The San Francisco Estuary population of striped bass supports an important recreational fishery. Striped bass are not native to California. They were first introduced in 1879 and again in 1882.[36] Striped bass are facultatively anadromous. They spawn in tidal and non-tidal freshwaters of the Sacramento and San Joaquin rivers, and probably other suitable locations such as the Napa River and Suisun Marsh. Most spawning occurs between April and June, though spawning can occur before and after the peak period. Eggs and larvae drift downstream and larvae generally have population epicenters near those of delta smelt, about 20 km upstream of the two parts per thousand isohaline boundary (X2). Juvenile and adult striped bass rear in fresh to marine waters throughout San Francisco Estuary and the adjacent coastal ocean. The abundance of young-of-year San Francisco Estuary striped bass historically fluctuated in response to Sacramento-San Joaquin river outflows, being higher in years of high spring flow.[37] The flow versus abundance relationship for young-of-year striped bass changed coincident with the invasion of overbite clam, *Corbula amurensis*; a recent analysis by Department staff showed young-of-year abundance no longer responds to X2 variation. The CDFG Fall Mid-Water Trawl (FMWT) has monitored young-of-year striped bass population trends since 1967. The maximum abundance index (20,038) was recorded in 1967. The indices averaged 5,823 per year for the pre-overbite clam period, 1967-1986. Since then, the indices have averaged 741 per year, with a maximum of only 2,045 in 1992. Even after the overbite clam invasion, striped bass larvae were the third most numerous species collected during the first seven years of the CDFG survey of post-larval fishes. This suggests young striped bass still comprise a substantial portion of spring pelagic fish biomass in the upper estuary and Delta.

7.3.2.2 Physical Setting in 1995

The following discussion focuses on special-status fish species up to 1995.

Special Status Fish Species in 1995

The Sacramento-San Joaquin River system dominates the hydrology of Central California. Over the years, alteration in flow patterns, access barriers, diversion, and development have reduced the distribution and populations of many native fishes. In 1995, only two species, winter-run Chinook and delta smelt were State or federally protected. An additional four species and two runs of Chinook (spring-run and late fall-run) are considered special-status species by the USFWS, CDFG, or NOAA Fisheries (Table 7.3-5). The special-status fish list is compiled from *Fish Species of Special Concern in California*.[38]

The delta smelt was listed as a threatened species in March 1993 (58 FR 12854). Critical habitat for the species was designated in December 1994 and includes all of the Delta and Suisun Bay/Marsh (59 FR 65256). In 1995, green sturgeon were considered by the State to be suitable for listing as threatened[39] and are therefore considered a species of concern.

TABLE 7.3-5

SPECIAL STATUS FISH SPECIES AND DESIGNATED CRITICAL HABITAT WITHIN THE SACRAMENTO-SAN JOAQUIN DELTA IN 1995 AND 2003

Species	1995 Status (date) (source)	2003 Status (date) (source)	Critical Habitat
River Lamprey *Lampetra ayresi*	Class 3 (1)	State and Federal Species of Concern (2)	
Pacific Lamprey *Lampetra tridentata*	Class 4 (1)[B]	Federal Species of Concern (2)	
Kern Brook Lamprey *Lampetra hubbsi*	Class 2 (1)	State and Federal Species of Concern (2)	
Green Sturgeon *Acipenser medirostris*	Class 1-T (1)	State Species of Concern (2)	
Chinook *Oncorhynchus tshawytscha*			
Winter Run	Endangered (1/94) (59 FR 440)	Endangered	6/93 (58 FR 33212)
Spring Run	Class 1-E (1)	Threatened (9/99) (64 FR 57399)	
Fall/Late Fall Run	Fall Run: Class 4 (1) Late Fall: Class 2 (1)	Listing Not Warranted - Candidate (9/99) (64 FR 57399)	
Central Valley Steelhead *Oncorhynchus mykiss*	Class 4 (1)[C]	Threatened (3/98) (63 FR 13347)	
Delta Smelt *Hypomesus transpacificus*	Threatened (3/93) (58 FR 12854)	No Change	12/94 (59 FR 65256)
Longfin Smelt *Spirinchus thaleichthys*	Class 1 (1)	Species of Concern (2)	
Sacramento Splittail *Pogonichthys macrolepidotus*	Proposed for listing as threatened (64 FR 5963)	Threatened status remanded (9/03) (68 FR 55140)	

Notes:
A. From Moyle et al. (1995):
Class 1-E: Those species that meet the State or federal definitions as endangered.
Class 1-T: Those species that meet the State or federal definitions as threatened.
Class 2: Species of special concern. These are species with scattered or very localized populations. Considered equivalent of the 2003 Species of Special Concern status.
Class 3: A "watch list" designation for species whose range is much restricted in comparison to historic conditions.
Class 4: Populations that are apparently secure.
B. Noted as being in decline (Moyle et al. 1995).
C. "Winter steelhead" were noted as being in decline and probably deserving of being Class 3 (Moyle et al. 1995).
Sources:
1. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.
2. CDFG (California Department of Fish and Game) 2003d. Special Animals list, July 2003. Available online at: http://www.dfg.ca.gov/hcpb/species/lists.shtml.

Population estimates put the green sturgeon at less than 2,000 adults.[40] Although steelhead were not formally considered a species of concern in 1995, NOAA Fisheries was conducting a status review of steelhead populations indicating that the species status was of concern.[41] Because of this, steelhead are considered a species of concern in 1995. Longfin smelt, due to its low numbers, was considered a species of concern in 1995. Sacramento splittail was proposed for listing as threatened under the FESA in January 1994 (64 FR 5963) because of their declining numbers and restricted distribution.

Winter-run Chinook salmon were listed as endangered in January 1994 under the FESA (59 FR 440). They were listed as endangered in September 1989 under the CESA.[42] Spring-run Chinook were considered suitable for listing as endangered in the mid-1990s;[43] however, because they were not listed in 1995, they were not considered a species of concern in 1995. Late fall-run Chinook are considered a species of concern. The population of fall-run fish was presumed to be stable in 1995.[44]

Feather and American River Fish

In 1995 the Feather River supported spring-run and fall-run Chinook (Table 7.3-2) and steelhead. Other species that were considered special status in 1995 that likely occurred within the Feather River include green sturgeon, Sacramento splittail, and striped bass. Sacramento splittail and striped bass can also be found within the American River. In 1995, The American River supported fall-run Chinook (Table 7.3-2).

Sacramento River Fish

The Sacramento River supports populations of several species of fish. The area between RBDD and the upper limits of the Delta are home to fish species that in 1995 were considered special status (Table 7.3-6). These include winter, late-fall, and spring-run Chinook, steelhead, green sturgeon, Sacramento splittail, and from the city of Sacramento downstream, delta smelt.

TABLE 7.3-6

1995 OCCURRENCE OF SPECIAL STATUS FISH SPECIES WITHIN THE RIVERS POTENTIALLY INFLUENCED BY THE PROPOSED PROJECT

Species	Sacramento River	Feather River	American River	San Joaquin River	Sacramento-San Joaquin Delta
Green Sturgeon	Present	Likely	Absent	Absent	Present
Chinook					
Winter-run	Present	Absent	Absent	Absent	Present
Spring-run	Present	Present	Absent	Absent	Present
Central Valley Steelhead	Present	Present	Present	Present	Present
Delta Smelt	Present	Absent	Absent	Absent	Present
Longfin Smelt	Present	Absent	Absent	Absent	Present
Sacramento Splittail	Present	Present	Likely	Present	Present

Sources:
1. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.
2. Moyle, 2002. Inland Fisheries of California, 2nd Edition. University of California Press.
3. Anadromous Fish Restoration Program, 2006. California Department of Fish and Game. Online at http://www.delta.dfg.ca.gov/afrp/watersheds.asp.
4. California Department of Water Resources. 2007. Draft Environmental Impact Report. Oroville Facilities Relicensing. May 2007.

San Joaquin River Fish

Special status species of fish in the San Joaquin River include Kern River brook lamprey found well upstream in the system. Some wild steelhead and splittail may occur in the San Joaquin River upstream of tidal influence (Table 7.3-6), and fall-run Chinook occurs in the tributaries.

Sacramento-San Joaquin Delta Fish

The fisheries of the Delta are complex and change seasonally. Of the species discussed above, delta smelt's distribution is limited to brackish waters of the Delta. Three runs of

Chinook that were considered special status in 1995 can be found in the Delta, including the federally endangered winter-run, and the spring and late fall-run which are both species of concern. Other special-status fish species found in the Delta include steelhead, Sacramento splittail, green sturgeon, and longfin smelt (Tables 7.3-5 and 7.3-6).

Lake Oroville Fish

Lake Oroville's fishery is made of fish species that inhabited the Feather River and were impounded when the lake and dam were constructed in the 1960's. It also includes fish species that were intentionally or accidentally introduced to the lake. Bass fishing is very popular at the lake, with its excellent habitat and special angling regulations. Lake Oroville is recognized as one of the best bass fisheries in the western United States.

Lake Oroville supports both coldwater and warmwater fisheries. The warmwater fishery is made up primarily of spotted bass (*Micropterus punctulatus),* largemouth bass (*Micropterus salmoides*), redeye bass (*Micropterus coosae*), smallmouth bass (*Micropterus dolomieu)*, bluegill (*Lepomis macrochirus)*, green sunfish (*Lepomis cyanellus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis)*, channel catfish (*Ictalurus punctatus)*, and white catfish (*Ameiurus catus).* The coldwater fishery consists mainly of brown trout (*Salmo trutta)* and Chinook salmon. Starting in 2002, the Department began to stock Coho in Lake Oroville. A total of 178,529 Coho were stocked in 2002, consisting of a combination of fingerling and yearling size fish.

San Luis Reservoir Fish

The fishery of San Luis Reservoir is relatively complex when compared to other reservoirs in the SWP. Because of its proximity to the Delta pumping facilities, any species that is found in the Delta can be found in San Luis Reservoir.[45] The reservoir supports an excellent sport fishery for striped bass. Other species present include threadfin shad (*Dorosoma petenense*), golden shiner (*Notemigonus crysoleucas*), starry flounder (*Platichthys stellatus*), and kokanee (landlocked sockeye salmon, *Oncorhynchus nerka*).

Lake Perris Fish

This reservoir supports a warm water sport fishery consisting of largemouth bass, spotted bass, green sunfish, and channel catfish. The spotted bass were originally planted in 1974 as an alternative to the standard Florida-strain largemouth bass because they are more successful at spawning in fluctuating reservoirs.[46] Rainbow trout are planted by CDFG during the cooler months each year.[47] In 1994, 63,900 catchable size trout were planted.[48] Inland silversides (*Menidia beryllina*), threadfin shad, bluegill, and red-ear sunfish (*Lepomis microlophus*) provide forage for the gamefish. The bluegill in Lake Perris can reach 2-3 lbs and support a fishery of their own. There are no special-status fish species within the reservoir.[49]

Castaic Lake Fish

Castaic Lake supports a warm water bass fishery. The primary target species of Castaic Lake are striped bass and largemouth bass. A forage base of bluegill and assorted minnows in addition to providing its own fishery, supplies ample food for bass. A rainbow trout fishery is maintained by CDFG. In 1994, 43,800 catchable trout were stocked in Castaic Lake.[50] There are no special-status species reported from this reservoir.

Other Recreationally Important Fish

In the Delta, the striped bass index in 1994 was 1,247; down from typical highs of approximately 4,000 in the 1980's.[51] The all-time high striped bass index was in 1967, when it was over 20,000. The Delta also supports an important largemouth bass fishery, as well as catfish.

7.3.2.3 Changes in Physical Setting between 1996 and 2003

The following discussion focuses on changes to special-status fish species from 1996 to 2003.

Special Status Fish Species

The following discussion and list of special-status fish species within the rivers potentially influenced by the proposed project in this period (Table 7.3-7) is very similar to that presented for 1995 (Table 7.3-6), but there are some notable exceptions. First, in the Central Valley two species (spring-run Chinook and steelhead) considered species of concern in 1995 were listed as threatened under the FESA (steelhead in 1998 and Chinook in 1999). Second, Sacramento splittail was listed as a federally threatened species in 1999, but that status was remanded. On June 23, 2000, the Federal Eastern District Court of California remanded the threatened determination for Sacramento splittail and had the USFWS re-evaluate their decision. Subsequently, the USFWS removed the Sacramento splittail from the list of threatened species and moved it to the species of concern list.[52] Third, one watch list species and one secure species are now both species of concern (river and Pacific lamprey). Additional taxonomic work has resulted in the proposed division of the California roach (*Hesperoleucus symmetricus*) into several subspecies. One of these, the San Joaquin roach (*Hesperoleucus symmetricus symmetricus*) is considered a species of special concern by CDFG. The respective life history details for these species have been presented in Section 7.3.2.1.

Central Valley steelhead were federally listed as a threatened species in March 1998 (63 FR 13347) and include all wild spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries. As was the case in 1995, these populations continue to be supported by hatchery releases. The delta smelt remained listed as threatened in the FESA and CESA in 2003.

There has been no change in the listing status of winter-run Chinook since 1995. Spring-run Chinook were listed as threatened under the CESA in February 1999[53] and as threatened under FESA in September 1999 (64 FR 50394). Listing actions were taken following an extensive review period that indicated populations of this fish continued to decline. Following a formal status review process, NOAA Fisheries determined that the fall-run and late fall-run Chinook did not warrant listing (64 FR 50393). However, they did determine that the fall-run and late fall-run Chinook should be designated as candidates for listing under FESA (64 FR 50393). Fall and late fall-run Chinook are also listed by CDFG as a Species of Concern.

Sacramento splittail, while not a federally listed species, is a California species of concern and is therefore included in the following analysis.[54]

As of 2003, green sturgeon were considered by the State to be suitable for listing as threatened[55] and were therefore considered a species of concern. Population estimates put the green sturgeon at less than 2,000 adults.[56] As of July 6, 2006, the southern green sturgeon federal listing status changed to threatened. The northern green sturgeon federal listing status remains as a species of concern. A combination of reasons have led to this decision, including

TABLE 7.3-7

2003 OCCURRENCE OF SPECIAL STATUS FISH SPECIES WITHIN THE RIVERS POTENTIALLY INFLUENCED BY THE PROPOSED PROJECT

Species	Sacramento River	Feather River	American River	San Joaquin River	Sacramento-San Joaquin Delta
River Lamprey	Present	Present	Unknown	Present	Present
Pacific Lamprey	Present	Present	Present	Present	Present
Green Sturgeon	Present	Likely	Unknown	Unlikely	Present
Chinook					
Winter-run	Present	Absent	Absent	Absent	Present
Spring-run	Present	Present	Absent	Absent	Present
Fall/Late Fall-run	Present	Present	Present	Present	Present
Central Valley Steelhead	Present	Present	Present	Present	Present
Delta Smelt	Absent	Absent	Absent	Absent	Present
Longfin Smelt	Absent	Absent	Absent	Absent	Present
Sacramento Splittail	Present	Present	Likely	Present	Present
Hardhead	Present	Present	Present	Present	Absent
San Joaquin Roach	Present	Present	Present	Present	Absent
Striped Bass	Present	Present	Present	Present	Present

Sources:
1. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.
2. Moyle, 2002. Inland Fisheries of California, 2nd Edition. University of California Press.
3. Anadromous Fish Restoration Program, 2006. California Department of Fish and Game. Online at http://www.delta.dfg.ca.gov/afrp/watersheds.asp.

an increase in sport-fishing pressure, declining populations statewide, and limited biological information.

River lamprey are considered a State and federal species of concern, primarily because so little is known about their natural history and large areas of potential habitat have been lost upstream of dams.[57] Pacific lamprey was considered secure (not in danger of extinction) but noted as being in decline in 1995.[58] Their decline continued through the 1990s and into the early 2000s. This decline has placed the Pacific lamprey as a federal species of concern because the large populations that were once common along the California coast are significantly diminished.[59] Longfin smelt are a State and federal species of concern.[60] Their status is primarily a result of their long-term population decline similar to the decline of the delta smelt. Hardhead are a California species of concern primarily because a combination of loss of cool, clear mid-elevation stream habitat and invasive sunfish has reduced populations.[61] San Joaquin roach are considered a species of concern because habitat degradation and fragmentation has resulted in increasing isolation of populations. Recruitment into or recolonization of historically occupied streams becomes more difficult as streams are occupied by non-native predators and barriers to movement are created.

Feather River Fish

The Feather River supports runs of fall-, late fall-, and spring-run Chinook, Central Valley steelhead, and Pacific lamprey. The Sacramento-San Joaquin roach appears to be absent in areas downstream of Oroville dam, but may still be present in the Feather River upstream of

Lake Oroville.[62] It is assumed that Sacramento splittail enter the lower river when flows permit during the appropriate time of year. Hardhead and striped bass may also be found here in appropriate habitats in the right season. Seasonal occurrence of fish species is presented in Table 7.3-8.

TABLE 7.3-8

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE FEATHER RIVER

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall (Sep-Nov)	Feb-May	3-5 years	Spring (est Mar-May)	Moyle 2002
Pacific Lamprey	Mar-June (Mar-May)	Mar-July (Mar-May)	5-7 years	Winter-spring (est Mar-May)	Moyle 2002, SWRI 2003
Green Sturgeon	Feb-July	Mar-July (April-June)	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Spring-run	Mar-Sep (May-June)	Aug-Oct (Sep)	3-15 months	(Jan-Feb, and April)	DWR 2002, Moyle 2002
Fall/Late Fall-run	Sep-Dec (Sep-Oct)	Sep-Dec (Oct-Nov)	1-7 months	Jan-Mar	DWR 2002, Moyle 2002
Central Valley Steelhead	Sep-Mar (Sep-Oct)	Dec-Apr	1-2 years	Feb-Sep (Mar)	Moyle 2002, SWRI 2003
Sacramento Splittail	Jan-Mar	Feb-July (Mar-April)	1 Month	May-June	DWR 2007
Hardhead	N/A	Apr-May	N/A	N/A	SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	Apr-June	N/A	N/A	DWR 2007

Source: California Department of Water Resources, Draft Environmental Impact Report, Oroville Facilities Relicensing, May 2007.

American River Fish

Similar to the Feather River, the American River supports a fall/late fall-run Chinook, Central Valley steelhead, and Pacific lamprey. It is unknown if sturgeon use this system, but it is likely that Sacramento splittail, hardhead, and striped bass can be found in the American River. Similar to the Feather River, the Sacramento-San Joaquin roach may be absent in areas downstream of Nimbus dam, but may still be present in the American River upstream of Folsom Lake. Seasonal occurrence of fish species is presented on Table 7.3-9.

Sacramento River Fish

The additional species found within the Sacramento River that were not considered special status in 1995 include river and Pacific lamprey, fall/late fall-run Chinook, Central Valley steelhead, Sacramento-San Joaquin roach, and hardhead. The Sacramento River continues to be the only watershed supporting winter-run Chinook and one of the only supporting spring-run Chinook. The Sacramento River also is the only watershed known to have green sturgeon. Populations of winter-run Chinook were at an all time low in 1994 but had rebounded by 2002 (Table 7.3-3) due in large part to aggressive population management and an intensive stocking regime.[63] Seasonal occurrence of fish species is presented on Table 7.3-10.

TABLE 7.3-9

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE AMERICAN RIVER

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall (Sep-Nov)	Feb-May	3-5 years	Spring (est Mar-May)	Moyle 2002
Pacific Lamprey	Mar-June (Mar-May)	Mar-July (Mar-May)	5-7 years	Winter-spring (est Mar-May)	Moyle 2002
Green Sturgeon	Feb-July	Mar-July (April-June)	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Fall/Late Fall-run	Aug-Dec (Sep-Oct)	Sep-Dec (Oct-Nov)	1-7 months	Jan-Mar	DWR 2002, Moyle 2002
Central Valley Steelhead	Aug-Mar (Sep-Oct)	Feb-Apr	1-2 years	Jan-Apr (Mar)	Moyle 2002
Sacramento Splittail	Jan-Mar	Feb-June (Mar-May)	1 month	May-June	
Hardhead	N/A	Apr-May	N/A	N/A	SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	Apr-June	N/A	N/A	SWRI 2003

TABLE 7.3-10

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE SACRAMENTO RIVER UPSTREAM OF TIDAL INFLUENCE

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall (Sep-Nov)	Feb-May	3-5 years	Spring (est. Mar-May)	Moyle 2002
Pacific Lamprey	Mar-June (Mar-May)	Mar-July (Mar-May)	5-7 years	Winter-spring (est Mar-May)	Moyle 2002
Green Sturgeon	Feb-July	Mar-July (April-June)	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Winter-run	Dec-July (Mar)	Apr-Aug (May-June)	5-10 months	July-Oct	Moyle 2002
Spring-run	Mar-Sep (May-June)	Aug-Oct (Sep)	3-15 months	Nov-Mar (Jan-Mar)	Moyle et al 1995, Moyle 2002
Fall-run	June-Dec (Sep-Oct)	Sep-Dec (Oct-Nov)	1-7 months	Dec-Mar	Moyle 2002
Late Fall-run	Oct-Feb (Dec)	Jan-Apr (Feb-Mar)	7-13 months	Apr-June (Dec-Mar)	Moyle et al 1995, Moyle 2002
Central Valley Steelhead	Aug-Mar (Sep-Oct)		1-3 years		Moyle 2002
Sacramento Splittail	Dec-Mar	Mar-May	1-3months	Apr-July	Moyle et al 1995, Moyle 2002; Feyrer et al. 2005
Hardhead	N/A	Apr-May	entire life cycle	N/A	SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	May	N/A	N/A	SWRI 2003

San Joaquin River Fish

The San Joaquin River continued to support special-status species in this period between 1996 and 2003. Those added to the previously discussed list include river and Pacific lamprey, Sacramento-San Joaquin roach, fall/late fall-run Chinook, Central Valley steelhead, hardhead, and Sacramento splittail. The steelhead spawn in the Tuolumne and Stanislaus rivers[64] and probably use the San Joaquin only as a migratory corridor. Seasonal occurrence of fish species is presented on Table 7.3-11.

TABLE 7.3-11

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE SAN JOAQUIN RIVER

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)	Source
River Lamprey	Fall	Feb-May	3-5 years	Spring	Moyle 2002
Pacific Lamprey	Jan-June (Mar-May)	Feb-May	5-7 years	Spring	Moyle 2002
Kern Brook Lamprey	N/A	Spring-Summer	4-5 years	No information	Moyle et al 1995
Chinook					
Fall-run	Oct-Jan (Nov)	Oct-Jan (Nov)	1-7 months	Jan-Mar	Moyle 2002
Central Valley Steelhead	Aug-Mar	No Data	1-3 years	Spring	Moyle 2002
Sacramento Splittail	Dec-Mar	Mar-May	1-3 months	Apr-July	Moyle et al 1995, Moyle 2002; Feyrer et al. 2005
Hardhead	N/A	Apr-May	N/A		SWRI 2003
San Joaquin Roach	N/A	Mar-July	N/A	N/A	Moyle 2002
Striped Bass	Apr-June	May	N/A		SWRI 2003

Sacramento-San Joaquin Delta Fish

All of the listed species (see Table 7.3-5), with the exception of Kern brook lamprey are found within the Delta. Some species (Chinook, steelhead, river and Pacific lamprey, and sturgeon) migrate through the Delta on their way to spawning grounds further upstream. Others spend their entire life cycles in the Delta and seaward regions of the San Francisco Estuary (striped bass, delta smelt, longfin smelt, and Sacramento splittail). Seasonal occurrence of fish species is presented on Table 7.3-12.

Lake Oroville Fish

The fisheries of Lake Oroville are essentially the same in the period of 1996 to 2003 as compared to 1995. The Department and CDFG have provided for fishery improvements at Lake Oroville. The Department's efforts have more than doubled the amount of fish habitat enhancement at Lake Oroville. Since 1995, the Department has funded the entire Chinook salmon stocking at Lake Oroville. This represents over 80 percent of the 2.4 million fish stocked in Lake Oroville during that period. As mentioned previously, the Department began to plant

TABLE 7.3-12

SEASONAL OCCURRENCE OF DIFFERENT LIFE CYCLE STAGES OF FISH WITHIN THE SACRAMENTO-SAN JOAQUIN DELTA

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency (all freshwater residency, not Delta residency)	Outmigration (peak)	Source
River Lamprey	Fall	N/A	3-5 years	Spring	Moyle 2002
Pacific Lamprey	Jan-June (Mar-May)	N/A	5-7 years	Spring	Moyle 2002
Kern Brook Lamprey	Not Present				Moyle 2002
Green Sturgeon	Feb-July	N/A	1-4 years	Aug-Oct	70FR17386, Moyle 2002
Chinook					
Winter-run	Dec-July (Mar)	N/A	5-10 months	Oct-May	Moyle 2002; SWP/CVP fish facilities data
Spring-run	Mar-Sep (May-June)	N/A	3-15 months	Nov-Jun	Moyle 2002; SWP/CVP fish facilities data
Fall-run	June-Dec (Sep-Oct)	N/A	1-7 months	Jan-Jun	Moyle 2002; SWP/CVP fish facilities data
Late Fall-run	Oct-Apr (Dec)	N/A	7-13 months	Apr-Sep	Moyle 2002; SWP/CVP fish facilities data
Central Valley Steelhead	Aug-Mar (Sep-Oct)	N/A	1-3 years	Jan-Jun	Moyle 2002; SWP/CVP fish facilities data
Delta Smelt	Dec-Mar (Jan)	Feb-July (Apr-May)	1-2 months	N/A	Moyle 2002
Longfin Smelt	Winter	Nov-June (Feb-Apr)	0-2 months	Jan-Aug (Apr-June)	Moyle 2002
Sacramento Splittail	Dec-Mar	Feb-July (Mar-May)	All Year	N/A	Moyle et al 1995, Moyle 2002
Striped Bass	Apr-June	Apr-May	All Year	N/A	SWRI 2003

Coho salmon in 2002 as opposed to Chinook salmon. A total of 172,792, 58,802, and 251,126 Coho were planted in 2003, 2004, and 2006 respectively. None were planted in 2005 due to a fish disease problem with the egg supply. CDFG has continued to regularly stock brown trout. Since 1995, the Department has been conducting fish habitat enhancement projects at Lake Oroville. Willow trees (rooted and cuttings) have been planted, hundreds of brush shelters have been constructed in coves using Manzanita and over 6,500 Christmas trees collected from the surrounding area by the Department, CDFG, local boy scouts, schools, angling organizations, merchants, and waste disposal companies. The completion of the new Federal Energy Regulatory Commission license in 2008 is expected to provide more fisheries enhancement opportunities to Lake Oroville.

San Luis Reservoir and Castaic Lake Fish

The fisheries resources of these two reservoirs have not changed from 1996 to 2003. The fishery at San Luis Reservoir is still greatly influenced by imported water from the Delta. Castaic Lake continues to support an excellent warm-water bass fishery and CDFG continues to stock this lake with rainbow trout.

Lake Perris Fish

The reservoir sport fish assemblage is assumed to be essentially the same in the 1996 to 2003 period as it was in 1995 (see Impact 7.3-7 for a discussion of impacts). However, management of the reservoir has recently changed. Historically, this reservoir was subject to relatively extreme water elevation fluctuations that limited the spawning success of the bass and affected recreational use. In 2001, an interagency Memorandum of Understanding (MOU) was reached between CDFG, the Department, MWDSC, California Department of Boating and Waterways, and California State Parks that was intended to reduce reservoir water elevation fluctuation.[65] The MOU established a Lake Perris Operations Committee (LPOC) that was charged with development of operational guidelines. These guidelines established a maximum fluctuation of 0.5-foot per day with a total of 3 feet of elevation change between March 15 and May 1; the spring fish spawning period.[66] Additionally a minimum elevation goal of 1,584 feet between the start of Memorial Day weekend and Labor Day has been established, primarily to provide the maximum recreational space possible,[67] and also allow for relatively stable fish habitat.

Other Recreationally Important Fish

Striped bass is not considered a species of concern, but is included here as an example of a recreationally important species that has been introduced into the habitats of the native fish species listed in the Fisheries Resources section. The striped bass populations, in spite of appearing to rise through 2003, may in fact have been declining. By 2001 the population was estimated at over 1.5 million fish. This is well over the upper threshold established through the Striped Bass Conservation Plan and resulted in a cessation of stocking.[68] However, two indices calculated by CDFG for young-of-year striped bass, FMWT and summer townet survey (TNS), indicated that the striped bass population may have been in decline. The TNS population index was 1.5 in 2003; the second lowest index on record. The TNS index was below 10 every year since 1994.[69] The FMWT index in 2003 was 108, a slight increase from the record low of 71 in 2002, but still the second lowest on record.[70] Together, these indices indicate that the population of young striped bass continued to decline through 2003.

7.3.2.4 Decline of Delta Pelagic Organisms since 2003

The San Francisco Estuary is a highly modified ecosystem with numerous documented long-term ecological changes. Declining abundance of some estuarine fish taxa has been one conspicuous change. Longfin smelt, delta smelt, and young-of-year striped bass are several taxa that have declined since intensive monitoring programs were initiated in the 1950s and 1960s. Recently, these and other species have declined further and have generally had abundance indices that were lower than expected based on previous relationships to springtime river flow into the estuary. This recent decline, which happened somewhere between the late 1990s and early 2000s has been described as Pelagic Organism Decline (POD). The POD includes four fish species along with several zooplankton taxa. Life history background for three of the POD fishes (longfin smelt, delta smelt, and splittail) is provided below. Department monitoring, through the Interagency Ecological Program (IEP), has found the POD is likely restricted to pelagic fishes dependent on the upper estuary (Suisun Bay and the Delta). Pelagic marine fishes using San Francisco and San Pablo bays were not affected, nor were nearshore fishes (such as splittail described below) that inhabit the upper estuary.

It is not clear whether the POD represents a simple continuation of long-term declines or a new stressor that has further degraded pelagic fish resilience. Long-term influences such as river flow variation and overbite clam impacts on the pelagic food web are mentioned in the species life history sections below. The POD investigations have proceeded under a working hypothesis that the recent declines are a response to a new stressor (or at least a new version of an older stressor). The investigation centers around impacts of water project operations, food web changes, and contaminants (Table 7.3-13).

TABLE 7.3-13

SUMMARY OF THE PRIMARY ENVIRONMENTAL STRESSORS BEING EVALUATED AS PART OF THE PELAGIC ORGANISM DECLINE INVESTIGATIONS

Stressor Group	Stressor Subgroups	Affected fish life stage or time of year
Water Project Operations	➢ Winter entrainment ➢ Spring entrainment ➢ Fall habitat ➢ Entrainment of lower trophic-level	➢ Spawning adults ➢ Larvae ➢ Juveniles/maturing adults ➢ Juveniles
Food Web Changes	➢ Smelt-copepod co-occurrence ➢ Pelagic productivity sinks ➢ Benthic productivity sinks	➢ Juveniles ➢ Juveniles ➢ Larvae-juveniles
Contaminants	➢ Ambient water toxicity ➢ Pyrethroids ➢ Microcystis blooms	➢ All year ➢ All year ➢ Late summer/fall

Note: The Department recognizes that during the 2007 calendar year there has been a continued decline in pelagic fisheries within the San Francisco Estuary, most notably the delta smelt. The operation of the SWP, with emphasis on water deliveries via Banks Pumping Plant, is undergoing increased scrutiny from the public and various groups concerned about the health of fisheries and the Delta ecosystem. On May 31, 2007, the Department shut down the pumps at Banks after record low number of delta smelt. On June 8, 2007, limited pumping resumed to meet critical water needs. Increasingly, fish species in the Delta face stressors that include competition with invasive species, toxicity run-off from surrounding farms, and a shortage of food sources. Additional information is currently being obtained regarding the multiple threats currently faced in the Delta and San Francisco Estuary. The Department continues to follow all legal environmental restrictions regarding the timing and amount of water that is pumped at Banks. As new scientific data and legal environmental issues surface regarding the SWP operation in the Delta, the Department will continue to evolve its SWP operation strategies to ensure environmental compliance and SWP contractor deliveries. In winter 2008 a new POD synthesis report will be available that will include all the latest scientific data and information as it pertains to the Delta and the POD.

at Banks after record low number of delta smelt. On June 8, 2007, limited pumping resumed to meet critical water needs. Increasingly, fish species in the Delta face stressors that include competition with invasive species, toxicity run-off from surrounding farms, and a shortage of food sources. Additional information is currently being obtained regarding the multiple threats currently faced in the Delta and San Francisco Estuary. The Department continues to follow all legal environmental restrictions regarding the timing and amount of water that is pumped at

Banks. As new scientific data and legal environmental issues surface regarding the SWP operation in the Delta, the Department will continue to evolve its SWP operation strategies to ensure environmental compliance and SWP contractor fulfillment. In Fall 2007 a new POD synthesis report will be available that will include all the latest scientific data and information as it pertains to the Delta and the POD.

Longfin Smelt (*Spirinchus thaleichthys*)

The San Francisco Estuary population of longfin smelt is the southernmost along the U.S. Pacific Coast. Most longfin smelt live two to three years. They spawn in tidal freshwaters of the Delta, Suisun Bay/Marsh, and probably other suitable locations such as the Napa River. Most spawning occurs between February and April, though spawning can occur well before and after the peak period. Larvae drift downstream and generally have population epicenters at X2. The juvenile and adult longfin smelt rear in brackish to marine waters throughout San Francisco Estuary and the adjacent coastal ocean. San Francisco Estuary longfin smelt population abundance fluctuates in response to Delta river outflows, being higher in years of high spring flow.[71] The flow versus abundance relationship for longfin smelt changed coincident with the invasion of overbite clam, *Corbula amurensis*; fewer longfin smelt are now produced per unit flow as indexed by X2. The CDFG Fall Midwater Trawl has monitored longfin smelt population trends since 1967. The maximum abundance index (81,790) was recorded in 1967. The indices averaged 17,060 per year for the pre-overbite clam period, 1967-1986. Since then, the indices have averaged 1,775 per year, with a maximum of 8,646 in 1995. Even after the overbite clam invasion, longfin smelt larvae were the most numerous species collected during the first seven years of the CDFG 20mm Survey of post-larval fishes. This suggests young longfin smelt still comprise a dominant portion of spring pelagic fish biomass in the upper estuary and Delta.

Delta Smelt (*Hypomesus transpacificus*)

Delta smelt is a landlocked relative of the surf smelt, *Hypomesus pretiosus*, and is endemic to the San Francisco Estuary. Most delta smelt live one year. They spawn in tidal freshwaters of the Delta, Suisun Bay/Marsh, and the Napa River. Most spawning occurs between March and May, though spawning can occur before and after the peak period. Larvae drift downstream and generally have population epicenters about 20 kilometers upstream of X2. Juvenile and adult delta smelt rear in fresh to brackish waters of Suisun Bay and the lower Sacramento River. Delta smelt population trends have fluctuated unpredictably through time. This suggests the delta smelt population is subjected to several significant drivers that cannot be readily aggregated into a variable like X2. The CDFG Fall Midwater Trawl has monitored delta smelt population trends since 1967 (Table 7.3-14). The maximum abundance index (1,673) was recorded in 1970; a nearly equivalent index (1,653) was recorded in 1980. Delta smelt larvae were the eighth most numerous species collected during the first seven years of the CDFG 20mm Survey of post-larval fishes.

Splittail (*Pogonichthys macrolepidotus*)

Splittail are a large cyprinid fish species endemic to the San Francisco Estuary and its watershed. Splittail can sexually mature at two years; most splittail seem to live at least five years and ages up to eight have been recorded. Splittail spawn on flooded vegetation, mainly during February through May. Splittail spawning habitat is greatly increased during periods of floodplain inundation in the Sacramento and San Joaquin basins. Consequently, like longfin smelt, splittail populations have fluctuated in response to river flows as indexed by X2. Unlike

TABLE 7.3-14

ADULT DELTA SMELT RECOVERY INDEX (BASED ON FALL MID-WATER TRAWL SURVEY)

Year	Recovery Index	Year	Recovery Index
1967	139	1987	72
1968	251	1988	67
1969	128	1989	76
1970	598	1990	81
1971	352	1991	171
1972	551	1992	26
1973	305	1993	400
1974	No Data	1994	19
1975	239	1995	252
1976	22	1996	28
1977	146	1997	62
1978	108	1998	169
1979	No Data	1999	322
1980	312	2000	265
1981	78	2001	314
1982	37	2002	33
1983	17	2003	101
1984	51	2004	25
1985	29	2005	4
1986	70		

Source: Emergency Petition to list the delta smelt as an endangered species under the ESA. Center for Biological Diversity, The Bay Institute, Natural Resource Defense Council. March 8, 2005.

longfin smelt, the invasion of overbite clam did not affect the X2-abundance relationship for splittail, presumably because the young fish are not dependent on the upper estuary pelagic food web. Young splittail feed on zooplankton, insect larvae, and miscellaneous benthic invertebrates, including overbite clams. Larval splittail typically rear in shallow freshwater habitats; juveniles may migrate into brackish water habitats. Juvenile and adult splittail are physiologically hardy and are very tolerant of estuarine conditions (elevated salinity, low dissolved oxygen, and high water temperatures). Splittail are not readily collected by the CDFG trawling surveys because they are often distributed in very shallow water. However, their annual abundance trends have been indexed by the Fall Midwater Trawl Survey since 1967. The index has averaged 32 per year, with a maximum index of 281 in 1998.

Splittail (*Pogonichthys macrolepidotus*)

Splittail are a large cyprinid fish species endemic to the San Francisco Estuary and its watershed. Splittail can sexually mature at two years; most splittail seem to live at least five years and ages up to eight have been recorded. Splittail spawn on flooded vegetation, mainly during February through May. Splittail spawning habitat is greatly increased during periods of floodplain inundation in the Sacramento and San Joaquin basins. Consequently, like longfin smelt, splittail populations have fluctuated in response to river flows as indexed by X2. Unlike longfin smelt, the invasion of overbite clam did not affect the X2-abundance relationship for splittail, presumably because the young fish are not dependent on the upper estuary pelagic food web. Young splittail feed on zooplankton, insect larvae, and miscellaneous benthic invertebrates, including overbite clams. Larval splittail typically rear in shallow freshwater habitats; juveniles may migrate into brackish water habitats. Juvenile and adult splittail are physiologically hardy and are very tolerant of estuarine conditions (elevated salinity, low dissolved oxygen, and high water temperatures). Splittail are not readily collected by the CDFG trawling surveys because they are often distributed in very shallow water. However, their annual abundance trends have been indexed by the FMWT Survey since 1967. The index has averaged 32 per year, with a maximum index of 281 in 1998.

7.3.2.5 Regulatory Setting in 1995

Several federal, State, and regional agencies have jurisdictional responsibilities regarding permit approvals and other regulatory actions for public improvements and private development projects that may affect fisheries resources within the SWP service area. Following is a discussion of relevant federal and State regulations.

Federal

<u>Federal Endangered Species Act of 1973 (FESA)</u>

Section 3 of the FESA defines an endangered species as any species or subspecies of fish, wildlife, or plants "in danger of extinction throughout all or a significant portion of its range." A threatened species is defined as any species or subspecies "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Designated endangered and threatened species, as listed through publication of a final rule in the *Federal Register*, are fully protected from a "take" without an incidental take permit administered by the USFWS or NOAA Fisheries under Section 10 of the FESA. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (50 CFR 17.3). The term "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). The term "harass" in the definition of "take" means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Proposed endangered or threatened species are those for which a proposed regulation, but not a final rule, has been published in the *Federal Register*.

Section 7 of the FESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. This obligation requires federal agencies to consult with the USFWS or NOAA Fisheries on any actions (including issuing Clean Water Act Section 404 permits, issuing licenses, or providing federal funding) that may affect listed species to ensure that reasonable and prudent measures will be undertaken to mitigate impacts on listed species. Consultation with USFWS or NOAA Fisheries can be either formal or informal depending on the likelihood of the action to adversely affect listed species or critical habitat. Once a formal consultation is initiated, USFWS or NOAA Fisheries will issue a Biological Opinion (either a "jeopardy" or a "no jeopardy" opinion) indicating whether the proposed agency action will or will not jeopardize the continued existence of a listed species or result in the destruction or modification of its critical habitat. A federal permit cannot be issued for a project with a "jeopardy" opinion unless the project is redesigned to lessen impacts.

In the absence of any federal involvement, as in a privately-funded project on private land with no Federal permit or funding, only Section 10(a) of the FESA can empower the USFWS or

NOAA Fisheries to authorize incidental take of a listed species provided a habitat conservation plan (HCP) is developed. To qualify for a Section 10(a) permit, strict conditions must be met including a lengthy procedure involving discussions with USFWS, NOAA Fisheries, and local agencies, preparation of a HCP, and a detailed Section 10(a) permit application.

State

California Endangered Species Act (CESA)

The CESA declares that certain plant or animal species will be given protection by the State because they are of ecological, educational, historical, recreational, aesthetic, economic, and scientific value to the people of California. The CESA established that it is State policy to conserve, protect, restore, and enhance endangered species and their habitats. Under State law, plant and animal species may be formally designated rare, threatened, or endangered by the California Fish and Game Commission. Listed species are generally given greater attention during the project evaluation process by local governments, public agencies, and landowners than are species that have not been listed.

The CESA states, "Private entities may take plant or wildlife species listed as endangered or threatened under the Federal ESA and CESA, pursuant to a federal incidental take permit issued in accordance with Section 10 of the Federal ESA, if the CDFG certifies that the incidental take statement or incidental take permit is consistent with CESA." (Fish and Game Code Section 2080.1)

California Environmental Quality Act - Treatment of Listed Plant and Animal Species

Both the FESA and CESA protect only those species formally listed as threatened or endangered (or rare in the case of the State plant list). Section 15380 of CEQA Guidelines, however, independently defines "endangered" species of plants, fish, or wildlife as those whose survival and reproduction in the wild are in immediate jeopardy and "rare" species as those who are in such low numbers that they could become endangered if their environment worsens. Therefore, a project will normally have a significant affect on the environment if it will substantially affect a rare or endangered species or the habitat of the species. The significance of impacts to a species under CEQA, must be based on analyzing actual rarity and threat of extinction despite legal its status.

Sections 2090-2096 of the Fish and Game Code

In 1995, Section 2090 of the Fish and Game Code required that the lead agency consult with CDFG for projects likely to jeopardize the continued existence of a State-listed threatened or endangered species. This section and those that follow set forth the formal and informal consultation process to be followed in this consultation. They require reasonable and prudent alternatives be developed for projects that could jeopardize the continued existence of a State-listed species. It is also these sections of the code that establish the relationship between the State and federal consultation processes. However, as described below, these sections were repealed in 1999 and replaced with a process to obtain a permit based on an application to CDFG.

7.3.2.6 Changes in Regulatory Setting between 1996 and 2003

Federal

The regulatory climate as it relates to treatment of State or federally-listed rare, threatened, or endangered species between 1996 and 2003 is essentially the same as in 1995. Either USFWS or NOAA Fisheries is required to be consulted on all federal actions that could affect listed species. These agencies still prepare Biological Opinions. Development of HCPs has become more common as non-federal entities and organizations attempt to obtain incidental take permits under Section 10 of the FESA. The USFWS and NOAA Fisheries eliminated the Candidate 1 and Candidate 2 (C1 and C2) designations instead opting to use the terms Federal Candidate (the former C1 species) and Federal Species of Concern for the C2 species. Candidate species have been determined to be suitable for listing by the USFWS, or more information is required (NOAA Fisheries) before listing can occur. Candidate species are reviewed for potential listing actions on an annual basis. Regardless of a species status as C1 or C2 or, in 2003, as a Federal Candidate or Federal Species of Concern, they all meet the criteria for rare, threatened, or endangered according to CEQA Section 15380.

State

At the State level, Fish and Game Code Section 2097 limited the duration of the consultation process required under Sections 2090-2096. Unless a statute was enacted prior to January 1, 1994, the article would remain in effect only until the beginning of 1994. The section was extended for five years (through 1998) and repealed by the terms of Section 2097 on January 1, 1999. The consultation process was replaced with Section 2081 that requires an application be filed to obtain a permit from CDFG authorizing the take of State-listed species. Regardless of this change, CDFG may still consult with applicants whose projects could impact State-listed species for purposes of issuing permits. For federally protected species, an incidental take permit issued pursuant to the FESA may be accepted by CDFG provided the proper notification process is followed (Fish and Game Code Section 2080.1). Fish and Game Code Section 5515 lists fully-protected fish species.

7.3.3 IMPACTS AND MITIGATION MEASURES

Upstream of the Delta, the Feather, Sacramento, and American rivers are the water transport routes used to move water from the main SWP and CVP storage reservoirs to the Delta pumping plants. The proposed project has the potential to change how water is released for transport within these rivers. These changes could result in different flow levels at different times of year. Because these rivers support special-status species of fish, including steelhead and Chinook, changes in flow that substantially alter available habitat could result in impacts to these species.

The altered water allocation procedures and Table A retirements and transfers that are a part of the proposed project can affect flow in the Feather and Sacramento rivers, Delta inflow, and Delta exports, and the water supply management practices can affect Delta exports. Because Delta outflow is dependent on both Delta inflow and Delta exports, it can be affected by all of these provisions.

The altered allocation procedures and Table A retirements and transfers result primarily in a shift among contractors of the available supply in a given year, which affects the amount of that total SWP supply that is allocated to contractors located north of the Delta and to those located downstream of the Banks Pumping Plant. The retirement of Table A reduces demand, and at times may reduce total SWP deliveries. If deliveries upstream of the Delta increase slightly, deliveries south of the Delta may decrease slightly, and the water reaching the Banks pumps will decrease by approximately the amount of the increase in upstream allocations.

Under normal operations, the SWP reservoirs are operated to meet target storage levels at certain times of the year while meeting contractor demands and other required releases. Modified releases from Lake Oroville would be unlikely due to small changes in deliveries that do not affect Delta water quality, minimum flow requirements, or other operational constraints of the SWP. The small changes are mostly below the measurement threshold of most river gages and Lake Oroville release controls. The Department would therefore have a difficult time modifying releases to exactly match the very small increment of delivery changes.

For this reason, the river flow analysis in this section assumes that releases from Lake Oroville would remain unchanged compared to releases under the baseline scenario, the north of the Delta SWP contractors would take delivery of their allocated SWP supplies, and Feather and Sacramento river flows and Delta inflows would be slightly changed as a result of any changes in these deliveries. The analysis in this section reflects these assumptions. While at times, conditions might dictate an operational change that differs from these assumptions, that is not anticipated to occur very frequently. These potential operational changes are discussed in more general terms in the impact areas that follow.

Tables 7.3-15 and 7.3-16 show the total deliveries of SWP water, including both Table A and Article 21 water, to the five contractors north of the Delta and the 24 contractors south of the Delta. Each table shows contractor deliveries with the proposed project and under the baseline scenario and under 2003 and 2020 conditions, respectively. Under both the 2003 and 2020 conditions, the proposed project results in increased total deliveries to the five north of the Delta contractors.

Table 7.3-17 shows the changes in total annual deliveries to the Feather River and north of Delta contractors with the proposed project compared to the baseline, under 2003 and 2020 conditions, showing the change in average deliveries by year type and over all year types.

7.3-1 Implementation of the proposed project could potentially affect special-status fish species in the Feather River due to water flow changes.

This section describes proposed project impacts on the Feather River that may have occurred from 1996 to 2003, and potential future impacts of the proposed project. The Feather River is one of the natural waterways used to move water from SWP storage reservoirs north of the Delta to the Delta pumping plants. The proposed project has the potential to change how water is released for transport within the Feather River. These changes could result in different flow levels at different times of year. Because the Feather River supports special-status species of fish, including steelhead and Chinook salmon, changes in flow that substantially alter available habitat could result in impacts to these species.

As was discussed above, the river flow analysis in this section assumes that releases from Lake Oroville would remain unchanged compared to releases under the baseline scenario, the north of Delta SWP contractors would take delivery of their allocated SWP supplies, and Feather River flows would be slightly changed as a result of any changes in these deliveries. Under these conditions, there would be slight changes in Feather River flows downstream of contractor diversions to its confluence with the Sacramento River due to the changed diversions by

TABLE 7.3-15

TOTAL AVERAGE ANNUAL DELIVERIES UNDER 2003 CONDITIONS[a] (AF)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
2003 Baseline						
County of Butte	300	300	290	330	290	260
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	660	640	640	500	500	880
Subtotal (Feather River)	960	940	940	820	790	1,140
Napa County FC&WCD	7,360	8,760	7,400	7,470	7,130	5,030
Solano County	35,130	39,860	38,300	38,410	36,780	18,200
Cumulative Subtotal (N of Delta)	43,450	49,560	46,640	46,700	44,710	24,370
All other contractors (S of Delta)	3,045,000	3,540,000	3,582,000	3,508,000	2,831,000	1,476,000
Total SWP Deliveries	3,088,000	3,589,000	3,628,000	3,555,000	2,876,000	1,501,000
2003 Proposed Project						
County of Butte	300	280	300	350	290	260
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	660	590	700	640	610	900
Subtotal (Feather River)	950	880	1,000	990	900	1,150
Napa County FC&WCD	7,990	9,840	8,510	8,120	7,460	4,880
Solano County	36,130	41,780	39,840	37,700	36,120	19,630
Cumulative Subtotal (N of Delta)	45,080	52,500	49,350	46,810	44,480	25,670
All other contractors (S of Delta)	3,011,000	3,471,000	3,520,000	3,430,000	2,809,000	1,519,000
Total SWP Deliveries	3,056,000	3,523,000	3,569,000	3,477,000	2,853,000	1,545,000
2003 Change from Baseline						
Feather River	-10	-70	60	170	110	10
North of Delta (including Feather R)	1,630	2,940	2,710	110	-230	1,300
South of Delta	-34,000	-69,000	-62,000	-78,000	-22,000	43,000
Total SWP Deliveries	-32,000	-66,000	-59,000	-78,000	-23,000	44,000

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical

a. Includes deliveries of both Table A and Article 21 water.
b. Plumas County FC&WCD takes delivery of its SWP supply from Lake Davis, upstream of Lake Oroville, so its deliveries do not affect flows downstream of Lake Oroville.
Source: Appendix I.

TABLE 7.3-16

TOTAL AVERAGE ANNUAL DELIVERIES UNDER 2020 CONDITIONS[a] (AF)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
2020 Baseline						
County of Butte	13,300	12,790	15,240	16,670	13,380	11,530
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4,220	3,730	5,260	4,180	3,870	5,970
Subtotal (Feather River)	17,520	16,520	20,500	20,840	17,250	17,500
Napa County FC&WCD	20,080	24,520	24,350	22,730	17,760	8,760
Solano County	33,790	41,370	41,080	38,290	29,790	14,550
Cumulative Subtotal (N of Delta)	71,390	82,400	85,940	81,860	64,800	40,810
All other contractors (S of Delta)	3,242,000	4,143,000	3,985,000	3,622,000	2,717,000	1,302,000
Total SWP Deliveries	3,313,000	4,225,000	4,071,000	3,704,000	2,782,000	1,342,000
2020 Proposed Project						
County of Butte	13,390	12,920	15,290	16,840	13,440	11,600
Plumas County FC&WCD [b]	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4,260	3,770	5,280	4,200	3,880	6,000
Subtotal (Feather River)	17,650	16,690	20,580	21,040	17,320	17,600
Napa County FC&WCD	23,120	29,600	28,490	25,920	19,250	9,200
Solano County	37,700	48,060	46,560	42,360	31,550	14,920
Cumulative Subtotal (N of Delta)	78,460	94,350	95,630	89,320	68,120	41,730
All other contractors (S of Delta)	3,219,000	4,090,000	3,943,000	3,626,000	2,700,000	1,308,000
Total SWP Deliveries	3,297,000	4,184,000	4,039,000	3,715,000	2,768,000	1,349,000
2020 Change from Baseline						
Feather River	120	170	70	190	70	110
North of Delta (including Feather R)	7,070	11,950	9,690	7,450	3,320	920
South of Delta	-23,000	-53,000	-42,000	4,000	-17,000	6,000
Total SWP Deliveries	-16,000	-41,000	-32,000	11,000	-14,000	7,000

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical

a. Includes deliveries of both Table A and Article 21 water.
b. Plumas County FC&WCD takes delivery of its SWP supply from Lake Davis, upstream of Lake Oroville, so its deliveries do not affect flows downstream of Lake Oroville.

Source: Appendix F.

TABLE 7.3-17

CHANGE IN AVERAGE ANNUAL TOTAL DELIVERIES TO FEATHER RIVER AND NORTH OF DELTA CONTRACTORS FOR PROPOSED PROJECT COMPARED TO BASELINES (AF)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
Feather River Contractors						
2003 Proposed Project vs. Baseline	-10	-70	60	170	110	10
2020 Proposed Project vs. Baseline	120	170	70	190	70	110
North of Delta Contractors						
2003 Proposed Project vs. Baseline	1,630	2,940	2,710	110	-230	1,300
2020 Proposed Project vs. Baseline	7,070	11,950	9,690	7,450	3,320	920

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical
Source: Appendix F.

Feather River region contractors, but there would be no change in Lake Oroville storage. These conditions are used in the analysis of the impacts on flows in the Feather River for several reasons: the conditions provide a conservative estimate of the impacts on the flow; the changes are so small that they are not measurable in the system; and the Department would have a difficult time adjusting releases from Lake Oroville to exactly match the flow changes.

Under limited circumstances, there could be minor operational changes in the Feather River in response to the slight delivery changes to SWP contractors upstream from the Delta (Tables 7.3-17 and 7.3-18). When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in Lake Oroville releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger changes are the export/Delta inflow (E/I) ratio, Delta water quality constraints, and South Delta water levels. If this were the case and Oroville releases were affected, there would be a slight additional change in Feather River flows between the Thermalito Afterbay and its confluence with the Sacramento River. There would also be a slight change in Lake Oroville storage should such release changes be made. However, as indicated above, these conditions are not anticipated to occur frequently and the effects would not be significant.

TABLE 7.3-18

AVERAGE ANNUAL FLOW CHANGES IN FEATHER AND SACRAMENTO RIVERS DUE TO CHANGES IN SWP DELIVERIES TO FEATHER RIVER AND NORTH OF DELTA CONTRACTORS FOR PROPOSED PROJECT COMPARED TO BASELINES (AF, %)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
Flow Change Due to Change in Delivery, AF						
2003 Feather River	10	70	-60	-170	-110	-10
2020 Feather River	-120	-170	-70	-190	-70	-110
2003 North of Delta	-1,630	-2,940	-2,710	-110	203	-1,300
2020 North of Delta	-7,070	-11,950	-9,690	-7,450	-3,320	-920
Annual Baseline River Flows, AF						
2003 Baseline Feather River Flows	3,022,000	4,743,000	3,317,000	2,565,000	2,032,000	1,618,000
2020 Baseline Feather River Flows	3,015,000	4,733,000	3,381,000	2,560,000	2,030,000	1,545,000
2003 Baseline Sac River Flows	16,074,000	24,438,000	19,137,000	13,840,000	11,115,000	8,106,000
2020 Baseline Sac River Flows	15,965,000	24,201,000	19,086,000	13,749,000	11,039,000	8,103,000
Flow Change Due to Change in Delivery, as % of River Flow						
2003 Feather Basin Delivery Change/ Feather R Flow	0.0002%	0,0014%	-0.0018%	-0.0066%	-0.0054%	-0.0006%
2020 Feather Basin Delivery Change / Feather R Flow	-0.0041%	-0.0036%	-0.0022%	-0.0076%	-0.0034%	-0.0069%
2003 North of Delta Delivery Change / Sacramento R Flow	-0.0101%	-0.0120%	-0.0142%	-0.0008%	0.0020%	-0.0160%
2020 North of Delta Delivery Change / Sacramento R Flow	-0.0443%	-0.0494%	-0.0508%	-0.0542%	-0.0301%	-0.0114%

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical
Source: Appendix H.

1996 — 2003

Tables 7.3-15 and 7.3-17 shows the estimated changes in total average annual deliveries to the Feather River contractors with the proposed project compared to the baseline scenario under 2003 conditions by year type. Under 2003 conditions, deliveries to the Feather River contractors are estimated to increase slightly on average, increasing in some year types and decreasing in others. The largest delivery decrease is 70 AF per year, occurring in wet years. The largest delivery increase is 170 AF per year, occurring in below normal years.

Increases in deliveries to the Feather River contractors would result in decreased river flows downstream of those diversions. Table 7.3-18 shows flows for the Feather River for the baseline scenario under 2003 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. The largest annual Feather River flow increase is 0.0014 percent, occurring in wet years. The largest annual Feather River flow decrease, as a percentage of the baseline river flows, is 0.0066 percent, occurring in below normal years.

At most, the proposed project under 2003 conditions may result in only slight changes in Feather River flow as compared to the baseline. This slight change will not constitute a substantial change in habitat and will not adversely affect special-status species of fish. Therefore, the proposed project under 2003 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Feather River.

At most, the proposed project under 2003 conditions may result in only slight changes in Feather River flow as compared to the baseline. This slight change will not constitute a substantial change in habitat and will not adversely affect special-status species of fish because, except for fall-run Chinook salmon, they spawn and rear in the low flow channel which would not be affected. Therefore, the proposed project under 2003 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Feather River.

<u>Mitigation Measures</u>

None required.

Future Impacts

Tables 7.3-16 and 7.3-18 show the estimated changes in total average annual deliveries to the Feather River contractors with the proposed project compared to the 2020 baseline scenario, by year type and over all year types. Under 2020 conditions, deliveries to the Feather River contractors are estimated to increase, on average and in all year types. The largest delivery increase is 190 AF per year, occurring in below normal years. Increases in deliveries to the Feather River contractors would result in decreased river flows downstream of those diversions. Table 7.3-19 shows the largest annual Feather River flow decrease, as a percentage of baseline river flows, is 0.0076 percent, occurring in below normal years.

An additional analysis was performed for the 2020 conditions to determine if there were individual months in which flow changes would be significantly different from annual changes. It was determined that the monthly changes were within the approximate range of annual values, and no comparable monthly tabulation was undertaken for the 2003 condition.

Table 7.3-19 shows monthly changes in Feather River flows resulting from changes in deliveries to the Feather River contractors with the proposed project compared to the baseline scenario under 2020 conditions. The maximum monthly delivery increase on the Feather River would be about 0.04 TAF (40 AF) in September of below normal years. This delivery increase would result in a reduction in Feather River flows downstream of those diversions of about 0.7 cubic feet per second (cfs), or 0.028 percent of Feather River flows in September of below normal years.

As stated above, the proposed project under 2020 conditions may result in only slight decreases in Feather River flow as compared to the baseline. This slight decrease will not constitute a substantial change in habitat and will not adversely affect special-status species of fish. Therefore, the proposed project under 2020 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Feather River.

<u>Mitigation Measures</u>

None required.

7.3-2 Implementation of the proposed project could potentially affect special-status fish species in the American River due to water flow changes.

This section describes proposed project impacts on the American River that might have occurred from 1996 to 2003, and potential future impacts of the proposed project. None of the water supply management practices involve operation of facilities on the American River. Therefore, implementation of water supply management practices will have no impact on fisheries resources of the American River.

The American River flows downstream of Folsom Reservoir are managed by U.S. Bureau of Reclamation (Reclamation) to meet certain in-stream flow requirements which provide fishery benefits, supply CVP contractors, and other beneficial uses. The proposed project would not affect the American River in any direct way. Although some changes in American River operations may occur, the changes in deliveries to the Feather River and north of Delta contractors are not likely to affect CVP operations at Folsom Reservoir under most conditions.

The one possible mechanism that could trigger a change at Folsom Reservoir and change flows in the American River would be at times when Delta water quality becomes an issue and added Delta inflow is required. Because SWP and CVP operations are coordinated and Folsom Reservoir releases reach the Delta in about one day, as compared to three days from Lake Oroville and five days from Shasta Reservoir, an increased release may be made from Folsom Reservoir to achieve the desired water quality objective if a longer lead time is not available. The real-world frequency with which such an American River flow increase might be made is not possible to predict with any confidence using model output, and such release events often span a few days until other reservoir releases can be adjusted and the flows reach the Delta. The magnitude of such an increased release is likewise not predictable.

1996 — 2003

The magnitude of potential release changes from Folsom Reservoir, and the duration of those changes, was not predictable. If releases from Folsom were made to meet water quality or flow objectives in the Delta, the releases occured independent of water delivery to SWP contractors, and these resulted in brief increases in American River flow as compared to the baseline

TABLE 7.3-19

AVERAGE MONTHLY FLOW CHANGES FOR PROPOSED PROJECT COMPARED TO BASELINE UNDER 2020 CONDITIONS (AF, %)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
2020 Monthly Flow Change Due to Change in Deliveries, AF													
Feather River Region: Butte, Plumas, Yuba City													
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	-20,000	-0	-0	-0	-0	-0	-10,000	-10,000	-10,000	-20,000	-20,000	-20,000	-120,000
22-94 Wet	-20,000	-0	-0	-0	-0	-0	-20,000	-20,000	-20,000	-20,000	-20,000	-30,000	-170,000
22-94 AN	-10,000	-0	-0	-0	-0	-0	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-70,000
22-94 BN	-30,000	-0	-0	-0	-0	-10,000	-20,000	-20,000	-20,000	-20,000	-30,000	-40,000	-190,000
22-94 Dry	-10,000	-0	-0	-0	-0	-0	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-70,000
22-94 Crit	-20,000	-10,000	-0	-0	-0	-10,000	-10,000	-10,000	-10,000	-20,000	-20,000	-10,000	-110,000
North Bay Region: Feather River Region, Solano, Napa													
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	-700,000	-590,000	-600,000	-330,000	-370,000	-460,000	-600,000	-660,000	-680,000	-700,000	-700,000	-680,000	-7,070,000
22-94 Wet	-1,090,000	-920,000	-960,000	-680,000	-740,000	-840,000	-1,020,000	-1,100,000	-1,130,000	-1,170,000	-1,170,000	-1,130,000	-11,950,000
22-94 AN	-800,000	-670,000	-660,000	-400,000	-540,000	-710,000	-900,000	-970,000	-990,000	-1,030,000	-1,030,000	-990,000	-9,690,000
22-94 BN	-730,000	-620,000	-630,000	-290,000	-320,000	-450,000	-630,000	-730,000	-750,000	-770,000	-770,000	-750,000	-7,450,000
22-94 Dry	-340,000	-280,000	-280,000	-140,000	-150,000	-190,000	-290,000	-320,000	-330,000	-340,000	-340,000	-330,000	-3,320,000
22-94 Crit	-150,000	-120,000	-130,000	-40,000	-40,000	-50,000	-60,000	-70,000	-70,000	-70,000	-70,000	-70,000	-920,000
2020 Monthly Baseline River Flows, AF													
2020 Feather River Baseline Flows													
22-94 Avg	153,000	130,000	222,000	284,000	317,000	368,000	189,000	224,000	280,000	431,000	293,000	125,000	3,015,000
22-94 Wet	171,000	175,000	389,000	621,000	653,000	738,000	413,000	456,000	338,000	445,000	232,000	101,000	4,733,000
22-94 AN	152,000	105,000	222,000	289,000	391,000	541,000	151,000	274,000	261,000	519,000	362,000	114,000	3,381,000
22-94 BN	155,000	119,000	148,000	164,000	211,000	189,000	80,000	105,000	329,000	515,000	406,000	140,000	2,560,000
22-94 Dry	142,000	103,000	138,000	93,000	90,000	133,000	94,000	101,000	257,000	420,000	314,000	143,000	2,030,000
22-94 Crit	132,000	119,000	128,000	82,000	91,000	101,000	81,000	82,000	165,000	248,000	183,000	132,000	1,545,000
2020 Sacramento River Baseline Flows													
22-94 Avg	754,000	924,000	1,530,000	2,009,000	2,186,000	2,102,000	1,462,000	1,180,000	1,038,000	1,130,000	880,000	770,000	15,965,000
22-94 Wet	898,000	1,296,000	2,824,000	3,427,000	3,402,000	3,226,000	2,531,000	1,992,000	1,406,000	1,246,000	950,000	1,003,000	24,201,000
22-94 AN	726,000	958,000	1,356,000	2,730,000	2,940,000	3,104,000	1,746,000	1,362,000	1,086,000	1,301,000	980,000	798,000	19,086,000
22-94 BN	720,000	798,000	1,098,000	1,520,000	1,969,000	1,611,000	1,112,000	948,000	1,049,000	1,213,000	969,000	741,000	13,749,000
22-94 Dry	686,000	774,000	927,000	978,000	1,295,000	1,383,000	830,000	734,000	827,000	1,077,000	838,000	688,000	11,039,000
22-94 Crit	657,000	592,000	716,000	875,000	872,000	829,000	606,000	470,000	623,000	758,000	626,000	480,000	8,103,000

TABLE 7.3-19, Continued

AVERAGE MONTHLY FLOW CHANGES FOR PROPOSED PROJECT COMPARED TO BASELINE UNDER 2020 CONDITIONS (AF, %)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
	Monthly Flow Reductions as a Percentage of Monthly Baseline River Flows												
2020 Change as % of Feather River Flows													
22-94 Avg	0.0114%	0.0019%	0.0000%	0.0000%	0.0001%	0.0010%	0.0070%	0.0064%	0.0049%	0.0042%	0.0068%	0.0175%	0.0041%
22-94 Wet	0.0121%	0.0004%	0.0000%	0.0000%	0.0000%	0.0005%	0.0054%	0.0053%	0.0068%	0.0051%	0.0108%	0.0292%	0.0036%
22-94 AN	0.0053%	0.0017%	0.0000%	0.0000%	0.0000%	0.0001%	0.0054%	0.0033%	0.0032%	0.0025%	0.0035%	0.0113%	0.0022%
22-94 BN	0.0191%	0.0029%	0.0000%	0.0000%	0.0000%	0.0041%	0.0242%	0.0201%	0.0054%	0.0048%	0.0077%	0.0280%	0.0076%
22-94 Dry	0.0072%	0.0020%	0.0000%	0.0000%	0.0003%	0.0016%	0.0066%	0.0071%	0.0027%	0.0025%	0.0037%	0.0081%	0.0034%
22-94 Crit	0.0169%	0.0043%	0.0000%	0.0000%	0.0010%	0.0075%	0.0090%	0.0074%	0.0054%	0.0067%	0.0090%	0.0109%	0.0069%
2020 Change as % of Sac River Flows													
22-94 Avg	0.0931%	0.0638%	0.0393%	0.0163%	0.0170%	0.0219%	0.0411%	0.0560%	0.0652%	0.0621%	0.0795%	0.0880%	0.0443%
22-94 Wet	0.1215%	0.0711%	0.0339%	0.0200%	0.0218%	0.0261%	0.0402%	0.0552%	0.0801%	0.0937%	0.1228%	0.1130%	0.0494%
22-94 AN	0.1105%	0.0698%	0.0490%	0.0145%	0.0184%	0.0230%	0.0516%	0.0710%	0.0912%	0.0790%	0.1047%	0.1246%	0.0508%
22-94 BN	0.1016%	0.0772%	0.0578%	0.0193%	0.0165%	0.0282%	0.0568%	0.0769%	0.0712%	0.0638%	0.0796%	0.1007%	0.0542%
22-94 Dry	0.0494%	0.0365%	0.0306%	0.0140%	0.0117%	0.0138%	0.0348%	0.0436%	0.0397%	0.0315%	0.0402%	0.0473%	0.0301%
22-94 Crit	0.0226%	0.0208%	0.0175%	0.0042%	0.0046%	0.0058%	0.0100%	0.0139%	0.0108%	0.0092%	0.0110%	0.0139%	0.0114%

Source: Appendix H.

scenario. Therefore, any impact on the American River from the proposed project under 2003 conditions attributed to upstream delivery increases were brief and minor, such as a pulse flow over a few days.

At most, the proposed project under 2003 conditions resulted in a very slight and brief increased release from Folsom Reservoir into the American River followed by a return to the baseline flows. Therefore, the proposed project under 2003 conditions had ***no impact*** on special-status fisheries resources in the American River.

Mitigation Measures

None required.

Future Impacts

As stated above, the American River does not operate as part of the SWP. Therefore, changes in deliveries to north of Delta contractors cannot directly alter streamflows in the American River. If releases from Folsom are made to meet water quality or flow objectives in the Delta, releases would occur independent of water delivery to SWP contractors, and these would result in brief increases in American River flow as compared to the baseline scenario. Therefore, the proposed project under 2020 conditions will have ***no impact*** on special-status fisheries resources in the American River.

Mitigation Measures

None required.

7.3-3 Implementation of the proposed project could potentially affect special-status fish species in the Sacramento River due to water flow changes.

1996 — 2003

As discussed previously, it is assumed that releases from Lake Oroville would remain unchanged compared to releases under the baseline scenario, the north of Delta SWP contractors would take delivery of their allocated SWP supplies, and Feather and Sacramento river flows would be slightly changed as a result of any changes in these deliveries. Under these assumptions, there would be slight changes in Feather and Sacramento river flows downstream of Feather River region contractor diversions and upstream of diversions to the north of Delta contractors, and additional changes in Sacramento River flows downstream of diversions to the north of Delta contractors. Since the largest potential change in Sacramento River flows is downstream of the diversion to the north of Delta contractors, it is the changes in those flows that are described in the following text.

Tables 7.3-17 and 7.3-18 show the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the baseline scenario under 2003 conditions, by year type and over all year types. Under 2003 conditions, deliveries to these contractors are estimated to increase by an average of 1,630 AF per year. These deliveries are estimated to increase in most year types, by amounts up to 2,940 AF per year in wet years, and to decrease in one year type, by 230 AF per year in dry years.

Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions. Table 7.3-18 shows Sacramento River flows for the baseline scenario under 2003 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. The largest annual Sacramento River flow decrease resulting from the proposed project, as a percentage of baseline river flows, is 0.016 percent, occurring in critically dry years.

Under some limited circumstances, there could be minor operational changes to Sacramento River flows in response to the slight delivery changes to SWP contractors upstream from the Delta. When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in upstream reservoir releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger such changes are: the E/I ratio, Delta water quality constraints, and South Delta water levels.

At most, the proposed project under 2003 conditions may result in minor decreases in Sacramento River flow as compared to the baseline scenario. This decrease in flow will not constitute a substantial change in habitat and will not adversely affect special-status species of fish. Therefore, the proposed project under 2003 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Sacramento River.

Mitigation Measures

None required.

Future Impacts

Tables 7.3-16 and 7.3-17 show the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the 2020 baseline scenario, by year type and over all year types. Under 2020 conditions, annual deliveries to the contractors north of the Delta are estimated to increase by an average of 7,070 AF per year, ranging from 920 AF in critically dry years to 11,950 AF in wet years. Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions. Table 7.3-18 shows the largest annual Sacramento River flow decrease, as a percentage of baseline river flows, is 0.0542 percent, occurring in below normal years.

Table 7.3-20 shows monthly changes in Sacramento River flows resulting from changes in deliveries to the north of Delta contractors with the proposed project compared to the baseline scenario under 2020 conditions. The maximum monthly delivery increases would be up to about 1,170 TAF (11,700,000 AF) in June through September of wet years as shown in Table 7.3-19. This delivery increase would result in a reduction in Sacramento River flows downstream of North Bay diversions of about 19 cfs in these months as shown in Table 7.3-20. As a percentage of baseline Sacramento River flows, the largest monthly decrease is 0.1246 percent, occurring in September of above normal years as shown in Table 7.3-19. The largest monthly decrease during critically dry years is 0.0226 percent, occurring in October.

As stated above, the proposed project under 2020 conditions could result in minor decreases in Sacramento River flow as compared to the baseline. This decrease in flow would not constitute a substantial change in habitat and would not adversely affect special-status species of fish.

TABLE 7.3-20

AVERAGE MONTHLY FLOW CHANGES FOR PROPOSED PROJECT COMPARED TO BASELINE UNDER 2020 CONDITIONS (CFS)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
2020 Decrease in Feather River Flows and Sacramento River Flows Upstream of North Bay Aqueduct Intake, cfs												
22-94 Avg	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.4
22-94 Wet	0.3	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.4	0.4	0.4	0.5
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
22-94 BN	0.5	0.1	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.4	0.5	0.7
22-94 Dry	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
22-94 Crit	0.4	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.2
2020 Decrease in Sac River Flows at the Delta, Downstream of North Bay Aqueduct Intake, cfs												
22-94 Avg	11.4	9.9	9.8	5.3	6.7	7.5	10.1	10.8	11.4	11.4	11.4	11.4
22-94 Wet	17.8	15.5	15.6	11.1	13.4	13.7	17.1	17.9	19.0	19.0	19.0	19.1
22-94 AN	13.1	11.3	10.8	6.5	9.8	11.6	15.2	15.8	16.7	16.7	16.7	16.7
22-94 BN	11.9	10.4	10.3	4.8	5.9	7.4	10.6	11.9	12.6	12.6	12.6	12.6
22-94 Dry	5.5	4.8	4.6	2.2	2.7	3.1	4.9	5.2	5.5	5.5	5.5	5.5
22-94 Crit	2.4	2.1	2.0	0.6	0.7	0.8	1.0	1.1	1.1	1.1	1.1	1.1

Source: Appendix H.

Therefore, the proposed project under 2020 conditions is expected to have a ***less-than-significant impact*** on special-status fisheries resources in the Sacramento River.

Mitigation Measures

None required.

7.3-4 Implementation of the proposed project could potentially affect special-status fish species in the San Joaquin River due to water flow changes.

1996 — 2003 and Future Impacts

None of the elements of the proposed project under 2003 or 2020 conditions involve operation of facilities on the San Joaquin River. Therefore, implementation of the proposed project will have ***no impact*** on fisheries resources of the San Joaquin River.

Mitigation Measures

None required.

7.3-5 Implementation of the proposed project Water Supply Management Practices could potentially affect special-status fish species in the Sacramento-San Joaquin Delta due to Delta export changes.

1996 — 2003

The Delta is home to dozens of fish species, both native and introduced. All of the special-status species of fish previously discussed (Section 7.3.2.1) either pass through the Delta during migration as adults and juveniles or are permanent residents.

Water is exported from the Delta at the Banks Pumping plant from Clifton Court Forebay. Increases in exports of water from the Delta could alter streamflows and Delta hydrodynamics and increase entrainment of fish at the pumping facilities. The export of water from the Delta has the potential to impact special-status species of fish as they move up and downstream through the Delta, or into and out of spawning habitats within the Delta.

Analysis of Effects of Table A Transfers and Retirements and Altered Water Allocation Procedures using CALSIM II Simulations

The retirements and transfers of Table A amounts and altered water allocation procedures that are a part of the proposed project would change both the total quantity of SWP water delivered and the quantities of SWP water delivered to individual contractors. These changes in deliveries could affect Delta exports.

Deliveries to contractors south of the Delta vary annually depending on hydrology and reservoir storage. Table 7.3-21 shows changes in annual deliveries to contractors south of the Delta with the proposed project as compared to the baseline scenario. Under 2003 conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 34,000 AF, with delivery changes by year type ranging from decreases of about 78,000 AF in below normal years to increases of about 43,000 AF in critically dry years. Delivery changes can be made from south of Delta storage and may not alter Delta exports.

TABLE 7.3-21

CHANGE IN AVERAGE ANNUAL TOTAL EXPORTS TO SOUTH OF DELTA CONTRACTORS FOR PROPOSED PROJECT COMPARED TO BASELINES (AF, %)

Water Year Type	Ann Avg	Wet	AN	BN	Dry	Crit
2003 and 2020 Exports to South of Delta Contractors, AF						
2003 Baseline	3,045,000	3,540,000	3,582,000	3,508,000	2,831,000	1,476,000
2003 Proposed Project	3,011,000	3,471,000	3,520,000	3,430,000	2,809,000	1,519,000
2020 Baseline	3,242,000	4,143,000	3,985,000	3,622,000	2,717,000	1,302,000
2020 Proposed Project	3,219,000	4,090,000	3,943,000	3,626,000	2,700,000	1,308,000
Change in Exports to South of Delta Contractors, AF						
2003 Proposed Project vs. Baseline	-34,160	-68,830	-62,090	-78,070	-22,210	42,800
2020 Proposed Project vs. Baseline	-22,960	-52,910	-42,200	4,250	-17,140	5,970
Change in Exports to South of Delta Contractors, as % of Baseline South of Delta deliveries						
2003 Proposed Project vs. Baseline	-1.122%	-1.944%	-1.733%	-2.225%	-0.784%	2.899%
2020 Proposed Project vs. Baseline	-0.708%	-1.277%	-1.059%	0.117%	-0.631%	0.065%
Annual Baseline Delta Inflow (Sacramento + San Joaquin), AF						
2003 Delta Inflow	18,880,000	29,340,000	22,190,000	16,233,000	12,654,000	9,209,000
2020 Delta Inflow	18,770,000	29,126,000	22,125,000	16,137,000	12,564,000	9,198,000
Total Export Change South of Delta Contractors, as % of Sac and San Joaquin Delta Inflow						
2003 Proposed Project vs. Baseline	-0.1809%	-0.2346%	-0.2798%	-0.4809%	-0.1755%	0.4647%
2020 Proposed Project vs. Baseline	-0.1223%	-0.1817%	-0.1908%	0.0263%	-0.1364%	0.0649%

Notes:
Ann Avg = Annual Average AN = Above Normal BN = Below Normal Crit = Critical
Delivery changes south of the Delta may be met by changes in San Luis Reservoir storage releases. However, it is assumed that delivery changes would be made by changes in Delta exports.
Sources: Appendix F and H.

However, to provide the most conservative impact analysis, it is assumed that any increase in delivery would be made by increased exports. As a percent of baseline scenario Delta exports under 2003 conditions, the Table A retirements and transfers and altered water allocation procedures would be estimated to decrease Delta exports by an annual average of about 1.12 percent, with delivery changes by year type ranging from a decrease of 2.23 percent in below normal years to an increase of 2.90 percent in critically dry years. Any increase in exports in critically dry years would likely not occur in any one month, but over the course of multiple months, typically occurring during the summer.

<u>Analysis of Effects of Proposed Project using Historical Data</u>

In addition to the altered water allocation procedures and the transfers and retirement of Table A amounts analyzed above, the Monterey Amendment contains several other provisions, i.e., the water supply management practices, which could change deliveries of water to contractors. Changes in deliveries could in turn result in changes in exports from the Delta at Banks Pumping Plant. Monterey Amendment-induced changes in SWP operations and deliveries to SWP contractors are described in Chapter 6.

Provisions of the Monterey Amendment, other than the altered water allocation procedures and the transfers and retirement of Table A amounts, with the potential to affect flows in the Delta include Articles 52, 54, and 56. Article 52 transfers ownership of the Kern Fan Element property from the state to KCWA, which enabled local development of the Kern Water Bank. Article 54 of the Monterey Amendment provides that certain contractors may borrow water from Castaic

Lake and Lake Perris, up to specified amounts and provided they replace the water within five years. Article 56 of the Monterey Amendment gives prior Department approval for contractors to store SWP water outside their service areas for later use within their service areas. This could include storage in groundwater banks or storage in surface water reservoirs owned by the SWP or others. Another provision of Article 56 establishes an annual turnback pool. Each of these provisions and its potential effect on SWP operations is described in more detail in Chapter 6. The Article 52, 54, and 56 provisions apply to SWP operations south of the Delta and as such could affect Delta exports and Delta outflow.

Because CALSIM II does not model the water supply management practices provided for in the Monterey Amendment, an additional analysis was conducted based on historical data from 1996 through 2004. The estimated effects of nearly all of the Monterey Amendment provisions, including the Table A retirements and the water supply management practices, on Delta exports between 1996 and 2004 were determined by a historical operations analysis, summarized below and described in more detail in Chapter 6 and Appendix K.

The Department determined that these Monterey Amendment provisions resulted in increased pumping in a few months from 1996 to 2004. Increased pumping was infrequent because from 1996 to 2004 there were only a few months when these provisions resulted in an added SWP demand at a time when the contractors otherwise had all the SWP water they could use or store, and all SWP reservoirs south of the Delta were full or at their storage targets. The Department estimates that from 1996 to 2004, these provisions resulted in the SWP pumping a total of about 44,000 AF more at the Banks Pumping Plant than it would have under the baseline scenario. Thus, from 1996 to 2004 (see note below), these Monterey Amendment provisions increased Delta exports and reduced Delta outflow by a total of about 44,000 AF. The increase in Delta exports occurred during four events: January 13, 1998 (a wet year); February 24 through March 31 of 1999 (a wet year), February 22 through March 31 of 2000 (an above normal year), and March 23 through March 30 of 2004 (a below normal year). (See discussion on these four separate events below).

November through March are important months in the life cycle of many fish species within the Delta. Winter-run and fall/late fall-run Chinook salmon and Central Valley steelhead are migrating upstream to spawning grounds. Juvenile spring-run and late fall-run Chinook are moving downstream into the estuary during these months. Delta smelt and longfin smelt are also beginning to move into spawning areas. Movement into and out of the Delta by salmonids is typically not compromised by reductions in Delta flow, and many migrate during low flows. However, high flows provide important attraction flows for species migrating into the Delta from the ocean. These peak events are necessary to move river water further out into the San Francisco Bay and eventually the Pacific Ocean. Anadromous fish recognize these waters and essentially follow them to their spawning streams. It is unlikely that an intermittent, temporary reduction in Delta outflow under most conditions would reduce attraction flows or substantially confuse upstream migratory cues.

March is an important month, especially for the movement of juvenile fish into the estuary and eventually the ocean. All runs of juvenile Chinook are typically moving downstream along with steelhead smolts. Both river and Pacific lamprey move into the ocean in the spring. Localized movements of splittail, longfin, and delta smelt also occur in March. Longfin smelt larvae rear in the Delta during March, and in warmer years, delta smelt larvae start hatching in March.

An increase in river flows can increase the speed with which some fish move downstream and help reduce exposure to predators and water diversions. However, when pumping is increased during outmigration, juvenile fish may be more susceptible to entrainment in the SWP pumps. To investigate any possible entrainment increases due to the water supply management practices, salvage rates, the daily total number of fish salvaged at the Skinner Delta Fish Protective Facility and Tracy Fish Collection Facility were calculated from existing CDFG databases (Tables 7.3-22 to 7.3-25).[72] The downstream movement of fish is a complex process where the fish follow multiple cues including water temperature, streamflow, pulse flows, day length, weather, moon phase, etc. This variety of factors makes it almost impossible to isolate the driving mechanism for fish movement and to determine if the Monterey Amendment resulted in increased entrainment. The water flows of Old and Middle rivers, located in the Delta, are known to influence the movement of Delta fish species. When the flows in Old and Middle rivers are positive (flows moving towards the mouth of the Delta), this is considered favorable for preventing fish salvage at Banks Pumping Plant. Likewise, when the flows of the Old and Middle rivers are -5,000 to -10,000 cfs, Delta fish species may migrate towards the Banks Pumping Plant, thus inducing fish loss at the salvage facilities.

Delta smelt and splittail salvage numbers for each period, or event, of proposed project under 2003 conditions induced pumping is included in Tables 7.3-22 to 7.3-25, along with salvage numbers for one week prior and after each event. There are a couple of purposes for including salvage numbers one week prior and after events due to induced pumping under 2003 conditions of the proposed project. One purpose is for numerical comparison and the second purpose is due to the behavior of delta smelt and splittail. When an increase in pumping occurs that may influence fish movement, it may take up to an estimated three to seven days for the cohorts of delta smelt and splittail to reach the salvage facilities (Skinner Delta Fish Protective Facility and Tracy Fish Collection Facility) near the pumps.

Below is an event by event discussion of four time periods from 1996 to 2004 where the Monterey Amendment resulted in additional pumping at Banks Pumping Plant. An accompanying table is included for each event that shows daily information pertinent to a better understanding of conditions during the event (e.g., the amounts of Banks pumping, additional pumping related to the proposed project, Delta outflow, delta smelt and splittail salvage, and Old and Middle river flows). The events that demonstrate a possible impact to delta fish populations will have a correlation between increased pumping due to the proposed project and increased fish salvage numbers.

Note: The March 23 to March 30, 2004, event occurs outside of the 1996–2003 timeframe designated for this analysis. However, to conduct the analysis of when the Monterey Amendment resulted in increased pumping, we looked at all known historical data since 1995, this includes 2004 as it is part of the 2003-2004 water year. For the sake of a more thorough analysis, this event was included.

Event 1: January 13, 1998 (Table 7.3-22)

This proposed project-induced[73] pumping lasted only three hours; therefore, there is little to be derived from this event. High pumping occurred at Banks Pumping Plant in the weeks prior to January 13, possibly creating the salvage numbers seen in the week prior to January 13. In the two weeks following January 13, there was no recorded salvage for delta smelt or splittail.

Note: The term induced used in this context and throughout the impact section refers to when pumping at Banks Pumping Plant continued at a higher rate as a result of proposed project actions.

TABLE 7.3-22

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 1

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
6-Jan-98	6,046	11,971	50,975	12	18	-8,180			
7-Jan-98	6,722	13,310	42,889	32	18	-8,780			
8-Jan-98	7,068	13,995	37,048	12	12	-9,010			
9-Jan-98	7,250	14,355	35,391	8	12	-9,210			
10-Jan-98	7,246	14,347	39,285	12	126	-8,700			
11-Jan-98	7,292	14,438	42,922	16	98	-8,320			
12-Jan-98	7,340	14,533	80,832	0	90	-8,500			
13-Jan-98	7,465	14,781	118,687	8	12	-6,710	X (3 hours)	10,821	9.117%
14-Jan-98	76	150	148,787	0	0	-2,672			
15-Jan-98	76	150	170,551	0	0	-594			
16-Jan-98	74	147	209,504	0	0	229			
17-Jan-98	69	137	239,693	0	0	1,281			
18-Jan-98	76	150	260,661	0	0	1,353			
19-Jan-98	70	139	269,036	0	0	2,476			
20-Jan-98	74	147	259,226	0	0	2,730			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-23

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 2

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
17-Feb-99	71	141	202,946	0	0	3,230			
18-Feb-99	75	149	250,478	0	0	2,860			
19-Feb-99	0	0	266,433	0	0	3,080			
20-Feb-99	79	156	268,692	0	0	2,890			
21-Feb-99	0	0	271,306	0	0	3,350			
22-Feb-99	519	1,028	268,522	0	0	3,160			
23-Feb-99	1,397	2,766	255,648	0	0	2,105			
24-Feb-99	2,552	5,053	232,535	3	4	792	X	200	0.086%
25-Feb-99	2,994	5,928	208,393	42	12	706	X	200	0.096%
26-Feb-99	3,400	6,732	196,844	19	36	293	X	200	0.102%
27-Feb-99	4,006	7,932	188,383	0	60	-589	X	200	0.106%
28-Feb-99	2,395	4,742	186,227	32	4	-344	X	200	0.107%
1-Mar-99	2,372	4,697	187,961	32	8	99	X	65	0.034%
2-Mar-99	2,217	4,390	196,149	0	0	-632	X	65	0.033%
3-Mar-99	1,793	3,550	204,734	8	0	-325	X	65	0.032%
4-Mar-99	3,204	6,344	205,225	22	34	-157	X	65	0.031%
5-Mar-99	3,477	6,884	201,311	12	54	-1,584	X	65	0.032%
6-Mar-99	3,999	7,918	196,844	0	69	-2,607	X	65	0.033%
7-Mar-99	4,274	8,463	188,138	0	20	-2,170	X	65	0.034%
8-Mar-99	3,110	6,158	182,924	11	9	-2,389	X	65	0.035%
9-Mar-99	3,146	6,229	179,641	12	34	-1,744	X	65	0.036%
10-Mar-99	2,042	4,043	175,299	3	46	-1,713	X	65	0.037%
11-Mar-99	3,292	6,518	165,690	0	68	-2,031	X	65	0.039%
12-Mar-99	3,245	6,425	159,253	0	36	-2,243	X	65	0.041%
13-Mar-99	4,676	9,258	146,946	0	12	-3,610	X	65	0.044%
14-Mar-99	5,176	10,248	138,640	0	23	-3,970	X	65	0.047%
15-Mar-99	3,395	6,722	135,977	0	24	-3,340	X	65	0.047%
16-Mar-99	3,562	7,053	129,874	9	6	-2,361	X	65	0.050%
17-Mar-99	2,978	5,896	123,685	0	24	-2,505	X	65	0.052%
18-Mar-99	2,693	5,332	116,058	0	32	-2,740	X	65	0.056%
19-Mar-99	2,677	5,300	107,930	0	0	-2,326	X	65	0.060%
20-Mar-99	1,668	3,303	104,859	3	6	-1,854	X	65	0.062%
21-Mar-99	2,474	4,899	94,969	2	11	-2,362	X	65	0.068%
22-Mar-99	1,431	2,833	90,732	4	12	-2,287	X	65	0.071%
23-Mar-99	1,665	3,297	83,974	0	0	-2,196	X	65	0.077%
24-Mar-99	2,247	4,449	78,735	0	18	-2,740	X	65	0.082%
25-Mar-99	2,009	3,978	78,976	0	30	-2,283	X	65	0.082%
26-Mar-99	1,888	3,738	88,413	6	30	-1,545	X	65	0.073%
27-Mar-99	1,886	3,734	100,400	0	2	-1,103	X	65	0.064%
28-Mar-99	2,754	5,453	101,711	0	16	-2,452	X	65	0.063%
29-Mar-99	4,237	8,389	96,580	0	32	-3,400	X	65	0.067%
30-Mar-99	3,946	7,813	92,929	0	32	-2,840	X	65	0.069%

31-Mar-99	3,859	7,641	87,146	0	15	-2,495	X	65	0.074%
1-Apr-99	4,083	8,084	78,614	0	28	-2,530			
2-Apr-99	3,596	7,120	72,090	0	40	-2,520			
3-Apr-99	5,088	10,074	64,712	0	28	-2,940			
4- Apr-99	4,647	9,201	60,752	32	128	-3,731			
5- Apr-99	5,189	10,274	61,675	0	27	-4,060			
6- Apr-99	3,237	6,409	66,427	0	24	-2,691			
7- Apr-99	3,022	5,984	65,714	12	78	-1,981			

Notes:

a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1996 to 2004.

b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-24

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 3

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
15-Feb-00	7,913	15,668	324,512	374	624	-6,290			
16-Feb-00	8,806	17,436	321,960	300	93	-7,260			
17-Feb-00	9,059	17,937	316,143	300	204	-7,140			
18-Feb-00	9,229	18,273	284,090	172	97	-6,510			
19-Feb-00	8,705	17,236	255,747	254	190	-6,190			
20-Feb-00	8,165	16,167	238,533	504	147	-6,240			
21-Feb-00	9,487	18,784	217,887	420	150	-5,600			
22-Feb-00	9,182	18,180	219,455	290	189	-5,030	X	6,300	2.871%
23-Feb-00	8,059	15,957	249,789	392	104	-4,630	X	4,077	1.632%
24-Feb-00	5,998	11,876	280,322	196	175	-2,954	X	129	0.046%
25-Feb-00	5,811	11,506	272,494	143	56	-2,045	X	129	0.047%
26-Feb-00	5,669	11,225	267,690	165	84	-3,396	X	129	0.048%
27-Feb-00	5,987	11,854	274,470	202	88	-2,961	X	129	0.047%
28-Feb-00	5,995	11,870	317,695	230	186	-1,951	X	129	0.041%
29-Feb-00	5,998	11,876	320,289	151	40	-2,375	X	129	0.040%
1-Mar-00	5,995	11,870	316,206	171	39	-1,463	X	129	0.041%
2-Mar-00	6,550	12,969	297,784	192	33	-2,130	X	129	0.043%
3-Mar-00	7,962	15,765	271,872	126	81	-3,440	X	129	0.047%
4-Mar-00	8,718	17,262	255,238	120	117	-4,670	X	129	0.051%
5-Mar-00	8,902	17,626	250,397	96	66	-4,490	X	129	0.052%
6-Mar-00	7,854	15,551	262,011	111	84	-3,160	X	129	0.049%
7-Mar-00	8,120	16,078	262,398	57	51	-2,594	X	129	0.049%
8-Mar-00	8,540	16,909	269,821	120	104	-2,360	X	129	0.048%
9-Mar-00	4,028	7,975	283,544	81	54	-280	X	129	0.046%
10-Mar-00	3,936	7,793	274,339	61	50	1,335	X	129	0.047%
11-Mar-00	2,860	5,663	264,809	57	30	1,437	X	129	0.049%
12-Mar-00	5,009	9,918	242,934	54	66	-168	X	129	0.053%
13-Mar-00	5,299	10,492	224,245	27	84	-701	X	129	0.058%
14-Mar-00	3,201	6,338	211,232	24	69	1,294	X	129	0.061%
15-Mar-00	2,678	5,302	193,979	54	81	1,259	X	129	0.067%
16-Mar-00	3,090	6,118	171,339	21	45	911	X	129	0.075%
17-Mar-00	3,205	6,346	154,212	9	27	682	X	129	0.084%
18-Mar-00	5,422	10,736	138,879	12	100	-1,615	X	129	0.093%
19-Mar-00	6,679	13,224	124,025	9	36	-3,400	X	129	0.104%
20-Mar-00	6,640	13,147	115,824	48	1044	-3,110	X	129	0.111%
21-Mar-00	4,807	9,518	107,692	41	1579	-2,490	X	129	0.120%
22-Mar-00	5,878	11,638	94,230	18	219	-4,010	X	129	0.137%
23-Mar-00	4,707	9,320	88,740	27	141	-4,160	X	129	0.145%
24-Mar-00	4,270	8,455	84,932	3	150	-2,702	X	129	0.152%
25-Mar-00	4,381	8,674	80,596	3	99	-1,670	X	129	0.160%
26-Mar-00	4,529	8,967	72,280	6	87	-2,352	X	129	0.179%
27-Mar-00	5,793	11,470	64,817	10	93	-3,790	X	129	0.199%
28-Mar-00	5,198	10,292	60,463	39	405	-3,700	X	129	0.213%

29-Mar-00	5,546	10,981	55,078	42	181	-4,370	X	129	0.234%
30-Mar-00	6,674	13,215	49,619	24	222	-5,130	X	129	0.260%
31-Mar-00	5,716	11,318	47,338	27	153	-5,310	X	129	0.273%
1-Apr-00	5,712	11,310	42,968	60	141	-6,080			
2-Apr-00	6,065	12,009	39,416	6	84	-6,530			
3-Apr-00	5,600	11,088	38,258	0	75	-6,970			
4-Apr-00	6,125	12,128	34,660	18	99	-6,440			
5-Apr-00	3,432	6,795	38,650	12	9	-5,300			
6-Apr-00	4,203	8,322	36,000	6	63	-5,500			
7-Apr-00	4,098	8,114	34,070	12	69	-6,270			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-25

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 4

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
16-Mar-04	6,691	13,248	72,510	24	60	-7,925			
17-Mar-04	6,676	13,218	66,096	0	36	-7,712			
18-Mar-04	6,687	13,240	60,861	0	30	-7,715			
19-Mar-04	6,595	13,058	57,917	0	15	-7,628			
20-Mar-04	6,640	13,147	55,460	0	48	-7,657			
21-Mar-04	6,685	13,236	53,454	0	24	-7,706			
22-Mar-04	6,669	13,205	50,989	0	56	-5,574			
23-Mar-04	6,121	12,120	49,730	0	90	-5,237	X	3,412	6.860%
24-Mar-04	5,108	10,114	53,506	0	66	-5,439	X	1,404	2.624%
25-Mar-04	5,973	11,827	55,266	0	96	-6,734	X	3,115	5.636%
26-Mar-04	6,458	12,787	52,260	0	42	-7,125	X	4,075	7.797%
27-Mar-04	5,462	10,815	51,902	0	30	-6,459	X	2,103	4.051%
28-Mar-04	6,371	12,615	44,506	0	18	-7,010	X	3,903	8.769%
29-Mar-04	6,629	13,125	38,679	0	67	-8,032	X	4,413	11.410%
30-Mar-04	6,438	12,747	31,939	0	30	-7,241	X	4,035	12.634%
31-Mar-04	4,656	9,219	32,104	0	12	-6,231			
1-Apr-04	4,399	8,710	27,987	0	36	-7,612			
2-Apr-04	4,349	8,611	27,922	0	24	-6,642			
3-Apr-04	4,394	8,700	28,676	0	6	-5,958			
4-Apr-04	4,188	8,292	30,338	0	0	-6,501			
5-Apr-04	4,363	8,639	33,403	0	0	-7,331			
6-Apr-04	4,369	8,651	35,939	0	12	-8,167			
7-Apr-04	1,948	3,857	49,720	0	6	-6,734			

Notes:
a. Based on results from the historical operations analysis, which is intended to estimate the actual impacts of the Monterey Amendment on Delta exports from the Banks Pumping Plant from 1995 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

Event 2: February 24, 1999 through March 31, 1999 (Table 7.3-23)

During the week prior to February 24, 1999, pumping at Banks Pumping Plant was down to zero twice, and in the 70 cfs range three times. Pumping at Banks Pumping Plant ramped up to 2552 cfs on the day that the proposed project induced pumping began. At this time salvage numbers began to increase. However, the proposed project-induced pumping only added 200 AF per day (or 101 cfs) for the first 5 days, and then added only 65 AF per day (or 33 cfs) to base pumping at Banks Pumping Plant for the rest of the impact period. The general increase in pumping may have led to increased salvage; however, the extra pumping due to the proposed project probably did not contribute.

Pumping at Banks was curtailed later in the spring to address an increase in delta smelt salvage at the Skinner facility. Banks pumping was curtailed by 292,000 AF between May 20, 1999 and June 30, 1999 to address the salvage of delta smelt.

Event 3: February 22, 2000 through March 31, 2000 (Table 7.3-24)

During the week prior to February 22, 2000, Old and Middle river flows were between -5,000 and -10,000 cfs. When reverse flows in Old River and Middle river combined exceed 5,000 cfs, fish salvage at the pumps tends to increase. The salvage numbers during the impact period relative to salvage numbers prior to the impact period seem to support this. Also, pumping at Banks Pumping Plant is upwards of 9000 cfs just prior to February 22. Of the pumping that actually occurred during this event, the first two days of the proposed project-induced pumping include 6,300 AF (3,182 cfs) and 4,077 AF (2,059 cfs), respectively, and then the proposed project-induced pumping reduces to 129 AF per day (65 cfs) over the base level for the duration of the impact period. During the impact period, overall pumping at Banks Pumping Plant ranges daily from levels of 2,000 cfs up to a high 8,000 cfs. Also, Old and Middle River flows move back to the positive, before going negative again towards the end of the impact period. Delta smelt salvage numbers generally decline throughout the impact period, while splittail levels remain consistent, with the exception of a spike on March 20 and 21. This could possibly be from Old and Middle river flows going from positive to negative three days prior. Overall Banks Pumping Plant pumping also increased at this time. Based on the evidence from this event, it seems unlikely that the proposed project exacerbated the salvage numbers.

Pumping at Banks was curtailed later in the spring to address an increase in delta smelt salvage at the Skinner facility. Banks pumping was curtailed by 28,000 AF between May 25, 2000 and May 31, 2000 to address the salvage of delta smelt.

Event 4: March 23, 2004 through March 30, 2004 (Table 7.3-25)

During the week prior to March 23, Old and Middle river flows were between -5,000 and -10,000 cfs. There was no recorded salvage of delta smelt at the Skinner facility during this period, although there was continued salvage of splittail. When reverse flows in Old and Middle rivers combined exceed 5,000 cfs, fish salvage at the pumps tends to increase (this is an especially dangerous time for juveniles, although few would be expected in the area in March). The salvage numbers relative to the salvage numbers prior to the proposed project-induced pumping seem to support this. Pumping at Banks Pumping Plant was around 6,500 cfs during the impact period, and dropped to 4,000 cfs after the impact period.

The proposed project-induced pumping had no impact on delta smelt in 2004, as there was no salvage during or following Event 4. The proposed project pumping may have contributed to splittail salvage during this event for the following reasons:

1. Old and Middle river flows are consistent prior to the impact period, during the impact period, and after the impact period.
2. After the impact period the splittail salvage numbers show a gradual decreasing trend from the end of March to the start of April.
3. Delta outflow decreases after the impact period, while salvage numbers go down.
4. The percent contribution of the proposed project to the overall pumping is high compared to other events.

For the reasons stated above, the incremental pumping may have increased splittail salvage at some times. It is possible to conclude that the proposed project may have contributed to increases in salvage under certain conditions from 1996 through 2004.

During 2004, the EWA was in operation, and the EWA Agencies were monitoring fish distribution and abundance, including salvage at the Banks and Jones plants. The EWA Agencies did not take any EWA action at any time during March 2004. EWA is discussed further below.

Proposed Project Impact Summary (1995 - 2003)

Increased pumping in November through March could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult delta smelt and salmonid smolts. The actual magnitude of this impact depends on the Delta outflow and the relative reduction generated by increased pumping. Misdirection or delay of upstream movement could be a problem when Delta outflow is low. The fishes most susceptible to November-March hydrodynamic changes and export increases are outmigrating salmonids, and delta smelt moving upstream to spawn.

The Department prior to and during the inception of the proposed project in 1996, has been operating the SWP and all its subsidiary facilities (including Banks) in accordance with all environmental legal constraints. The environmental constraints that were pertinent for any given time from 1996 to 2003 would have mitigated for any additional pumping due to the proposed project in the Delta, this would include the proposed project and its water supply management practices. The Department believes that the environmental agreements developed with CDFG prior to and during the 1996-2003 timeframe were sufficient to protect Delta species from the impacts of pumping and satisfy any statutory requirements (see Mitigation Measures section below). In addition, the Banks pumping curtailments to address federal ESA concerns in 1996 (71,000 AF May 16-24), 1997 (10,000 AF June 7-11), 1999 (292,000 AF May 20-June 30), and 2000 (28,000 AF May 25-31) provided some added fish benefits. Beginning in 2000, the EWA Program provided a real-time adaptive management response to fish distribution, abundance, and salvage in the Delta.

<u>Environmental Programs</u>

The following summarizes mitigation and environmental programs already in place that were relevant to the SWP (thus the proposed project) and Delta fisheries covered by the federal biological opinions for the 1995-2003 timeframe:

1. CALFED Agreement and Bay-Delta Accord signed in 1994 committed State and federal agencies to improved coordination of water supply operations and protection of endangered species, and provided for the development of long-term Delta ecosystem restoration.
2. The Water Right Decision 1641 issued by the Regional Water Quality Control Board in 2000 included SWP and CVP standards for meeting water quality goals, including the X2 standard, and a combined SWP-CVP export reduction that varies depending on the water year type.
3. ESA-related Banks pumping curtailments in 1996 (71,000 AF May 16-24), 1997 (10,000 AF June 7-11), 1999 (292,000 AF May 20-June 30), and 2000 (28,000 AF May 25-31) provided some mitigation during this period.
4. The EWA was initiated in late 2000 to address impacts of Delta export pumping on fish. The EWA is a cooperatively-managed program intended to provide protection to the fish of the Bay-Delta Estuary through environmentally beneficial changes and increased flexibility in the operations of the SWP and CVP. The program was developed in 2000 as part of the CALFED Record of Decision (ROD), and was structured to address SWP and CVP impacts. The EWA program relies on continuous monitoring of fish distribution and density in the Delta, combined with assessment of the risk to the fish from Delta export pumping, to identify periods when pumping changes can best benefit fish. When there are fish species of concern present near the pumps, the Management Agencies recommended that pumping at Banks Pumping Plant and/or Jones Pumping Plant be curtailed to lower pumping rates to protect fish by reducing salvage at the pumps or to control in-Delta channel flows to avoid attracting fish (especially delta smelt) toward the pumps.
5. The Anadromous Fisheries Biological Opinion of 1995 (this was later superseded by one in 2004) provided FESA incidental take coverage for federally listed species of salmonids in the Delta. This also included operation restrictions of SWP facilities in the Delta.
6. The Delta Pumping Plant Fish Protection Agreement ("Four Pumps Agreement", 1986) is an agreement with CDFG where the Department pays for direct losses of steelhead, Chinook salmon, and striped bass based on measured losses at Banks Pumping Plant. These payments have been used provide for fisheries mitigation and habitat enhancements. Examples of completed projects include installation of fish screens, and replacement of spawning gravel.
7. The Delta Smelt Biological Opinion of 1995 (this was later superseded by one in 2005) provides the Department with FESA incidental take coverage for delta smelt for the SWP and CVP. This included restrictions on operation of SWP and CVP facilities, including export restrictions.

Summary

When considered in context with the analysis of the four events outlined above and compliance with environmental programs relevant to the SWP which were already in place, the proposed project from 1996-2003 had a ***less-than-significant impact*** on special-status fish species in the Sacramento-San Joaquin Delta due to effects of the water supply management practices.

Mitigation Measure

None required.

Future Impacts

Increases in export of water from the Delta could alter streamflows and increase entrainment of fish at the pumping facilities. The export of water from the Delta has the potential to impact special-status species of fish as they move up and downstream through the Delta, or into and out of spawning habitats within the Delta.

Delta exports to contractors south of the Delta can be affected both by the altered allocation procedures and Table A transfers and retirements, and by the water supply management practices. The future effects of these two sets of Monterey Amendment provisions are evaluated in two separate analyses. These analyses are described in the two sections below, followed by a summary of the net effects of all Monterey Amendment provisions on Delta exports.

Analysis of Effects of Table A Transfers and Retirements and Altered Water Allocation Procedures using CALSIM II Simulations

The retirements and transfers of Table A amounts and altered water allocation procedures that are a part of the proposed project would change both the total quantity of SWP water delivered and the quantities of SWP water delivered to individual contractors. These changes in deliveries could affect Delta exports.

Deliveries to contractors south of the Delta vary annually depending on hydrology and reservoir storage. Table 7.3-16 shows annual deliveries to contractors south of the Delta with the proposed project and under the baseline scenario. Under 2020 conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 23,000 AF, with delivery changes by year type ranging from decreases of about 53,000 AF in wet years to increases of about 6,000 AF in critically dry years. Delivery changes can be made from south-of-Delta storage and may not change Delta exports. However, to provide the most conservative impact analysis, it is assumed that any increase in delivery would be made by increased exports. As a percent of baseline scenario Delta exports under 2020 conditions, the Table A retirements and transfers and altered water allocation procedures would be estimated to decrease Delta exports by an annual average of about 0.71 percent, with delivery changes by year type ranging from a decrease of 1.28 percent in wet years to an increase of 0.46 percent in critically dry years.

Analysis of Effects of Water Supply Management Practices

In addition to the altered water allocation procedures and the transfers and retirement of Table A amounts analyzed above, the Monterey Amendment contains other provisions, i.e., the water supply management practices, which could change deliveries of SWP water to contractors. Changes in deliveries could in turn result in changes in exports from the Delta at Banks Pumping Plant. Monterey Amendment-induced changes in SWP operations and deliveries to SWP contractors resulting from the water supply management practices are described in Chapter 6.

Contractors took advantage of the water supply management practices from 1996 to 2004 and would be expected to continue to employ all or most of them in the future. Because the water supply management practices were actually used from 1996 to 2004, an analysis of the effects of these water supply management practices in that historical period offers insight into their likely future effects.

The Department conducted a historical water supply management practices analysis to determine whether storage outside contractors' service areas, extended carryover storage, the turnback pool and flexible storage in Castaic Lake and Lake Perris, would have resulted in increased pumping at the Banks Pumping Plant from 1996 to 2004 compared to the baseline scenario. The Department determined that the water supply management practices provisions would have increased pumping in a few months from 1996 to 2004. Increased pumping was infrequent from 1996 and 2004 because there were only a few months when these provisions would have resulted in an added SWP demand at a time when the contractors would otherwise have had all the SWP water they could use or store and all SWP reservoirs south of the Delta were full or at their storage targets. Increased pumping during these occasions from 1996 to 2004 would have reduced Delta outflow compared to outflow under the baseline scenario.

The future analysis differs from that performed for the 1996-2004 period by assuming that from 2004 on into the future, the contractors would have essentially filled within-service-area storage that could have been used from 1996 to 2004. Thus the future (2003-2020) analysis uses the 449,000 AF estimate of water supply management practices from 1996 to 2004 without offset for the ability to bank added water within their service areas.

Using the period from 1996 to 2004 (see note below), the Department's future analysis showed that the water supply management practices would have reduced total Delta outflow by a total of 449,000 AF over this nine-year period, or an average of about 50,000 AF per year. Because there would be a greater amount of added pumping under these assumptions, there are nine separate instances of Banks continuing to pump at a higher rate with the proposed project. Those nine reductions in Delta outflow would occur as follows: 1) December 9 through December 16, 1996, 2) January 3 through January 13, 1998, 3) November 1 through November 14, 1998, 4) December 1, 1998 through January 3, 1999, 5) January 14 through January 26, 1999, 6) February 24 through March 31, 1999, 7) February 1 through March 31, 2000, 8) March 19 through March 26, 2001, and 9) March 25 through March 30, 2004. (See discussion on these nine separate events below.) The years 1996 through 1999 were classified as wet years, 2000 was above normal, 2000 and 2001 were dry, 2003 was above normal, and 2004 was below normal. A table is included for each event that shows daily information to better understand conditions during the event (Tables 7.3-26 to 7.3-34).

See discussion for the 1996 to 2003 period of analysis, above, on November through March fish movement, and fish salvage issues. The same information is also pertinent in this section.

Below is an event by event discussion of nine time periods from 1996 to 2004 where the water supply management practices of the proposed project may induce additional pumping at Banks Pumping Plant.

Note: The March 25 to March 30, 2004, event occurs outside of the 1996-2003 timeframe designated for this analysis. However, 2004 is included as an additional data point for projecting the potential future impacts of the water supply management practices of the proposed project when increased pumping could occur, thus providing a more thorough analysis.

TABLE 7.3-26

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 1

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
2-Dec-96	4,855	9,613	17,178	0	0	-6,280			
3-Dec-96	5,239	10,373	15,989	0	0	-6,720			
4-Dec-96	4,160	8,237	21,653	0	0	-6,730			
5-Dec-96	5,492	10,874	40,836	0	0	-7,770			
6-Dec-96	6,482	12,834	79,168	0	0	-7,480			
7-Dec-96	6,627	13,121	83,400	0	0	-7,070			
8-Dec-96	6,569	13,007	81,562	0	4	-6,850			
9-Dec-96	6,492	12,854	78,657	0	0	-6,930	x	8,894	11.307%
10-Dec-96	6,582	13,032	96,759	0	0	-5,710	x	9,072	9.376%
11-Dec-96	3,927	7,775	126,482	0	0	-3,550	x	3,815	3.017%
12-Dec-96	5,723	11,332	157,406	0	0	-3,510	x	7,372	4.683%
13-Dec-96	6,330	12,533	203,863	0	0	-3,450	x	8,573	4.205%
14-Dec-96	5,164	10,225	252,537	0	0	-2,324	x	6,265	2.481%
15-Dec-96	6,676	13,218	248,092	0	0	-2,375	x	9,258	3.732%
16-Dec-96	5,,482	10,854	227,793	0	0	-2,938	x	6,894	3.027%
17-Dec-96	2,165	4,287	216,525	0	0	-629			
18-Dec-96	892	1,766	191,098	0	0	1,882			
19-Dec-96	805	1,594	172,030	0	0	1,893			
20-Dec-96	393	778	160,455	0	0	1,411			
21-Dec-96	2,166	4,289	166,720	6	0	446			
22-Dec-96	3,077	6,092	188,906	0	0	1,191			
23-Dec-96	1,254	2,483	218,049	0	0	3,820			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-27

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 2

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
25-Dec-97	7,276	14,406	14,389	36	334	-9,090			
26-Dec-97	7,275	14,405	12,929	30	4	-9,100			
27-Dec-97	7,235	14,325	12,387	12	12	-8,820			
28-Dec-97	7,235	14,325	11,462	8	36	-9,050			
29-Dec-97	7,241	14,337	10,324	24	12	-9,280			
30-Dec-97	7,236	14,327	9,755	36	0	-9,290			
31-Dec-97	7,233	14,321	9,656	0	24	-9,320			
1-Jan-98	7,224	14,304	9,409	12	12	-9,530			
2-Jan-98	7,217	14,290	13,149	0	12	-9,140			
3-Jan-98	7,214	14,284	15,709	0	20	-8,240	x	10,324	65.717%
4-Jan-98	6,744	13,353	30,076	6	6	-7,730	x	9,393	31.231%
5-Jan-98	6,203	12,282	43,631	0	6	-7,400	x	8,322	19.073%
6-Jan-98	6,046	11,971	50,975	12	18	-8,180	x	8,011	15.716%
7-Jan-98	6,722	13,310	42,889	32	18	-8,780	x	9,350	21.800%
8-Jan-98	7,068	13,995	37,048	12	12	-9,010	x	10,035	27.086%
9-Jan-98	7,250	14,355	35,391	8	12	-9,210	x	10,395	29.372%
10-Jan-98	7,246	14,347	39,285	12	126	-8,700	x	10,387	26.440%
11-Jan-98	7,292	14,438	42,922	16	98	-8,320	x	10,478	24.412%
12-Jan-98	7,340	14,533	80,832	0	90	-8,500	x	10,573	13.081%
13-Jan-98	7,465	14,781	118,687	8	12	-6,710	x	10,821	9.117%
14-Jan-98	76	150	148,787	0	0	-2,672			
15-Jan-98	76	150	170,551	0	0	-594			
16-Jan-98	74	147	209,504	0	0	229			
17-Jan-98	69	137	239,693	0	0	1,281			
18-Jan-98	76	150	260,661	0	0	1,353			
19-Jan-98	70	139	269,036	0	0	2,476			
20-Jan-98	74	147	259,226	0	0	2,730			

Notes:

a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.

b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-28

SOUTH DELTA AND

SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]
EVENT 3

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
25-Oct-98	5,726	11,337	25,621	0	6	-5,650			
26-Oct-98	4,335	8,583	29,300	0	20	-5,850			
27-Oct-98	4,263	8,441	30,062	0	18	-5,260			
28-Oct-98	3,709	7,344	33,094	0	12	-4,250			
29-Oct-98	3,889	7,700	21,384	0	0	-4,790			
30-Oct-98	3,911	7,744	20,954	0	0	-4,830			
31-Oct-98	3,549	7,027	20,214	0	14	-4,850			
1-Nov-98	5,644	11,175	13,613	0	18	-6,140	x	8,205	60.276%
2-Nov-98	4,481	8,872	17,244	0	0	-6,610	x	5,902	34.229%
3-Nov-98	3,428	6,787	18,485	0	0	-5,220	x	3,817	20.651%
4-Nov-98	2,484	4,918	18,523	0	48	-4,480	x	1,948	10.518%
5-Nov-98	2,995	5,930	16,895	0	24	-4,550	x	2,960	17.520%
6-Nov-98	3,018	5,976	16,856	0	6	-4,720	x	3,006	17.832%
7-Nov-98	3,611	7,150	19,562	0	0	-5,440	x	4,180	21.366%
8-Nov-98	4,512	8,934	21,538	0	24	-4,770	x	5,964	27.689%
9-Nov-98	2,574	5,097	25,988	0	0	-4,430	x	2,127	8.183%
10-Nov-98	1,974	3,909	28,530	0	6	-4,130	x	939	3.290%
11-Nov-98	2,568	5,085	28,831	0	12	-4,110	x	2,115	7.335%
12-Nov-98	2,007	3,974	26,346	0	0	-3,830	x	1,004	3.810%
13-Nov-98	2,316	4,586	24,701	0	0	-4,090	x	1,616	6.541%
14-Nov-98	1,911	3,784	26,429	0	0	-4,000	x	814	3.079%
15-Nov-98	1,570	3,109	28,437	0	0	-2,870			
16-Nov-98	873	1,729	32,791	0	0	-1,887			
17-Nov-98	767	1,519	36,280	0	0	-644			
18-Nov-98	1,028	2,035	38,519	0	0	322			
19-Nov-98	1,587	3,142	39,153	0	0	128			
20-Nov-98	1,609	3,186	44,069	0	0	-225			
21-Nov-98	1,377	2,726	46,688	0	0	-341			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-29

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 4

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
24-Nov-98	0	0	69,480	0	0	2,210			
25-Nov-98	0	0	78,596	0	4	1,218			
26-Nov-98	1,495	2,960	80,669	0	0	-15			
27-Nov-98	1,545	3,059	84,916	0	0	65			
28-Nov-98	2,585	5,118	73,763	0	0	-131			
29-Nov-98	2,847	5,637	77,210	0	0	-1,197			
30-Nov-98	2,288	4,530	84,493	0	6	-1,901			
1-Dec-98	1,315	2,604	93,163	0	0	84	X	419	0.450%
2-Dec-98	1,735	3,435	98,784	0	0	-14	x	419	0.425%
3-Dec-98	1,880	3,722	112,300	0	0	-408	x	419	0.373%
4-Dec-98	1,991	3,942	121,671	0	0	89	x	419	0.345%
5-Dec-98	1,998	3,956	124,607	0	0	329	x	419	0.337%
6-Dec-98	1,997	3,954	129,718	0	0	709	x	419	0.323%
7-Dec-98	1,993	3,946	132,165	0	0	785	x	419	0.317%
8-Dec-98	2,000	3,960	131,464	0	0	815	x	419	0.319%
9-Dec-98	1,991	3,942	130,698	0	0	808	x	419	0.321%
10-Dec-98	1,908	3,778	126,158	0	0	545	x	419	0.332%
11-Dec-98	1,786	3,536	121,940	0	0	-29	x	419	0.344%
12-Dec-98	1,907	3,776	118,545	0	0	-105	x	419	0.354%
13-Dec-98	1,952	3,865	115,721	0	4	-236	x	419	0.362%
14-Dec-98	1,985	3,930	112,466	0	0	599	x	419	0.373%
15-Dec-98	1,992	3,944	110,205	0	0	288	x	419	0.381%
16-Dec-98	2,045	4,049	107,752	8	0	152	x	419	0.389%
17-Dec-98	3,619	7,166	99,667	0	0	-1,359	x	419	0.421%
18-Dec-98	4,673	9,253	88,716	0	0	-2,920	x	419	0.473%
19-Dec-98	2,814	5,572	85,568	6	0	-875	x	419	0.490%
20-Dec-98	1,301	2,576	83,802	0	0	506	x	419	0.500%
21-Dec-98	1,309	2,592	79,941	0	0	867	x	419	0.525%
22-Dec-98	462	915	78,679	0	0	553	x	419	0.533%
23-Dec-98	3,179	6,294	69,546	0	0	170	x	419	0.603%
24-Dec-98	3,167	6,271	64,083	0	0	-171	x	419	0.654%
25-Dec-98	2,216	4,388	59,362	0	0	-490	x	419	0.706%
26-Dec-98	822	1,628	57,424	0	0	-403	x	419	0.730%
27-Dec-98	2,714	5,374	50,969	0	0	-966	x	419	0.823%
28-Dec-98	1,832	3,627	51,098	0	0	-925	x	419	0.821%
29-Dec-98	1,989	3,938	49,393	2	0	-968	x	419	0.849%
30-Dec-98	1,697	3,360	47,815	0	0	-1,085	x	419	0.877%
31-Dec-98	1,961	3,883	46,221	0	8	-742	x	419	0.907%
1-Jan-99	1,992	3,944	44,663	4	0	-284	x	129	0.289%
2-Jan-99	2,010	3,980	43,429	0	0	-436	x	129	0.297%
3-Jan-99	1,995	3,950	43,235	0	0	-233	x	129	0.298%

4-Jan-99	1,152	2,281	44,354	0	0	166			
5-Jan-99	935	1,851	44,629	0	0	149			
6-Jan-99	271	537	42,427	0	0	-364			
7-Jan-99	114	226	40,935	0	0	-152			
8-Jan-99	192	380	39,065	0	0	130			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-30

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 5

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
9-Jan-99	30	59	38,264	0	0	-264			
10-Jan-99	203	402	36,323	0	0	-987			
11-Jan-99	207	410	35,511	0	0	-1,290			
12-Jan-99	203	402	35,436	0	0	-764			
13-Jan-99	180	356	31,987	0	0	-1,669			
14-Jan-99	2,579	5,106	26,112	0	0	-3,960	x	129	0.494%
15-Jan-99	2,823	5,590	31,310	0	0	-5,100	x	129	0.412%
16-Jan-99	2,496	4,942	32,797	0	0	-4,660	x	129	0.393%
17-Jan-99	2,495	4,940	34,911	0	12	-4,140	x	129	0.370%
18-Jan-99	2,497	4,944	48,031	0	0	-4,350	x	129	0.269%
19-Jan-99	2,498	4,946	66,611	0	12	-4,330	x	129	0.194%
20-Jan-99	3,002	5,944	90,864	0	0	-4,250	x	129	0.142%
21-Jan-99	2,505	4,960	134,412	0	0	-2,887	x	129	0.096%
22-Jan-99	2,497	4,944	144,692	0	0	-3,460	x	129	0.089%
23-Jan-99	2,491	4,932	144,201	0	0	-3,137	x	129	0.089%
24-Jan-99	2,490	4,930	147,530	0	0	-2,688	x	129	0.087%
25-Jan-99	2,690	5,326	147,556	0	0	-2,792	x	129	0.087%
26-Jan-99	2,939	5,819	140,635	0	0	-1,574	x	129	0.092%
27-Jan-99	44	87	141,645	0	0	196			
28-Jan-99	119	236	131,826	0	0	468			
29-Jan-99	168	333	122,899	0	0	86			
30-Jan-99	200	396	112,668	0	0	-466			
31-Jan-99	194	384	114,781	0	1	327			
1-Feb-99	297	588	106,888	0	0	960			
2-Feb-99	222	440	98,220	0	0	-68			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-31

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 6

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
17-Feb-99	71	141	202,946	0	0	3,230			
18-Feb-99	75	149	250,478	0	0	2,860			
19-Feb-99	0	0	266,433	0	0	3,080			
20-Feb-99	79	156	268,692	0	0	2,890			
21-Feb-99	0	0	271,306	0	0	3,350			
22-Feb-99	519	1,028	268,522	0	0	3,160			
23-Feb-99	1,397	2,766	202,946	0	0	2,105			
24-Feb-99	2,552	5,053	232,535	3	4	792	x	1,400	0.602%
25-Feb-99	2,994	5,928	208,393	42	12	706	x	1,400	0.672%
26-Feb-99	3,400	6,732	196,844	19	36	293	x	1,400	0.711%
27-Feb-99	4,006	7,932	188,383	0	60	-589	x	1,400	0.743%
28-Feb-99	2,395	4,742	186,227	32	4	-344	x	1,400	0.752%
1-Mar-99	2,372	4,697	187,961	32	8	99	x	581	0.309%
2-Mar-99	2,217	4,390	196,149	0	0	-632	x	581	0.296%
3-Mar-99	1,793	3,550	204,734	8	0	-325	x	581	0.284%
4-Mar-99	3,204	6,344	205,225	22	34	-157	x	581	0.283%
5-Mar-99	3,477	6,884	201,311	12	54	-1,584	x	581	0.288%
6-Mar-99	3,999	7,918	196,844	0	69	-2,607	x	581	0.295%
7-Mar-99	4,274	8,463	188,138	0	20	-2,170	x	581	0.309%
8-Mar-99	3,110	6,158	182,924	11	9	-2,389	x	581	0.317%
9-Mar-99	3,146	6,229	179,641	12	34	-1,744	x	581	0.323%
10-Mar-99	2,042	4,043	175,299	3	46	-1,713	x	581	0.331%
11-Mar-99	3,292	6,518	165,690	0	68	-2,031	x	581	0.350%
12-Mar-99	3,245	6,425	159,253	0	36	-2,243	x	581	0.365%
13-Mar-99	4,676	9,258	146,946	0	12	-3,610	x	581	0.395%
14-Mar-99	5,176	10,248	138,640	0	23	-3,970	x	581	0.419%
15-Mar-99	3,395	6,722	135,977	0	24	-3,340	x	581	0.427%
16-Mar-99	3,562	7,053	129,874	9	6	-2,361	x	581	0.447%
17-Mar-99	2,978	5,896	123,685	0	24	-2,505	x	581	0.469%
18-Mar-99	2,693	5,332	116,058	0	32	-2,740	x	581	0.500%
19-Mar-99	2,677	5,300	107,930	0	0	-2,326	x	581	0.538%
20-Mar-99	1,668	3,303	104,859	3	6	-1,854	x	581	0.554%
21-Mar-99	2,474	4,899	94,969	2	11	-2,362	x	581	0.611%
22-Mar-99	1,431	2,833	90,732	4	12	-2,287	x	581	0.640%
23-Mar-99	1,665	3,297	83,974	0	0	-2,196	x	581	0.691%
24-Mar-99	2,247	4,449	78,735	0	18	-2,740	x	581	0.737%
25-Mar-99	2,009	3,978	78,976	0	30	-2,283	x	581	0.735%
26-Mar-99	1,888	3,738	88,413	6	30	-1,545	x	581	0.657%
27-Mar-99	1,886	3,734	100,400	0	2	-1,103	x	581	0.578%

28-Mar-99	2,754	5,453	101,711	0	16	-2,452	x	581	0.571%
29-Mar-99	4,237	8,389	96,580	0	32	-3,400	x	581	0.601%
30-Mar-99	3,946	7,813	92,929	0	32	-2,840	x	581	0.625%
31-Mar-99	3,859	7,641	87,146	0	15	-2,495	x	581	0.666%
1-Apr-99	4,083	8,084	78,614	0	28	-2,530			
2-Apr-99	3,596	7,120	72,090	0	40	-2,520			
3-Apr-99	5,088	10,074	64,712	0	28	-2,940			
4-Apr-99	4,647	9,201	60,752	32	128	-3,731			
5-Apr-99	5,189	10,274	61,675	0	27	-4,060			
6-Apr-99	3,237	6,409	66,427	0	24	-2,691			
7-Apr-99	3,022	5,984	65,714	12	78	-1,981			

Notes:

a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.

b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-32

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 7

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
1-Feb-00	7,499	14,848	78,586	39	27	-8,110	x	414	0.53%
2-Feb-00	7,492	14,834	78,083	10	6	-8,810	x	414	0.53%
3-Feb-00	7,493	14,836	79,182	75	15	-9,400	x	414	0.52%
4-Feb-00	7,281	14,416	76,822	93	21	-8,530	x	414	0.54%
5-Feb-00	7,400	14,652	72,769	108	15	-8,430	x	6,491	8.92%
6-Feb-00	7,393	14,638	68,853	81	36	-7,860	x	6,554	9.52%
7-Feb-00	7,174	14,205	65,463	78	15	-8,160	x	3,784	5.78%
8-Feb-00	6,671	13,209	61,909	108	3	-7,620	x	5,037	8.14%
9-Feb-00	6,316	12,506	59,065	66	27	-7,610	x	5,204	8.81%
10-Feb-00	7,011	13,882	61,255	36	63	-8,750	x	3,918	6.40%
11-Feb-00	6,976	13,812	78,523	72	15	-9,180	x	5,187	6.61%
12-Feb-00	6,642	13,151	110,037	51	15	-8,600	x	4,609	4.19%
13-Feb-00	7,227	14,309	148,809	201	375	-9,480	x	8,688	5.84%
14-Feb-00	7,698	15,242	202,324	380	288	-8,450	x	6,336	3.13%
15-Feb-00	7,913	15,668	324,512	374	624	-6,290	x	7,519	2.32%
16-Feb-00	8,806	17,436	321,960	300	93	-7,260	x	10,501	3.26%
17-Feb-00	9,059	17,937	316,143	300	204	-7,140	x	9,714	3.07%
18-Feb-00	9,229	18,273	284,090	172	97	-6,510	x	3,991	1.40%
19-Feb-00	8,705	17,236	255,747	254	190	-6,190	x	6,662	2.60%
20-Feb-00	8,165	16,167	238,533	504	147	-6,240	x	10,110	4.24%
21-Feb-00	9,487	18,784	217,887	420	150	-5,600	x	5,340	2.45%
22-Feb-00	9,182	18,180	219,455	290	189	-5,030	x	7,738	3.53%
23-Feb-00	8,059	15,957	249,789	392	104	-4,630	x	3,026	1.21%
24-Feb-00	5,998	11,876	280,322	196	175	-2,954	x	414	0.15%
25-Feb-00	5,811	11,506	272,494	143	56	-2,045	x	414	0.15%
26-Feb-00	5,669	11,225	267,690	165	84	-3,396	x	414	0.15%
27-Feb-00	5,987	11,854	274,470	202	88	-2,961	x	414	0.15%
28-Feb-00	5,995	11,870	317,695	230	186	-1,951	x	414	0.13%
29-Feb-00	5,998	11,876	320,289	151	40	-2,375	x	414	0.13%
1-Mar-00	5,995	11,870	316,206	171	39	-1,463	x	419	0.13%
2-Mar-00	6,550	12,969	297,784	192	33	-2,130	x	419	0.14%
3-Mar-00	7,962	15,765	271,872	126	81	-3,440	x	419	0.15%
4-Mar-00	8,718	17,262	255,238	120	117	-4,670	x	419	0.16%
5-Mar-00	8,902	17,626	250,397	96	66	-4,490	x	419	0.17%
6-Mar-00	7,854	15,551	262,011	111	84	-3,160	x	419	0.16%
7-Mar-00	8,120	16,078	262,398	57	51	-2,594	x	419	0.16%
8-Mar-00	8,540	16,909	269,821	120	104	-2,360	x	419	0.16%
9-Mar-00	4,028	7,975	283,544	81	54	-280	x	419	0.15%
10-Mar-00	3,936	7,793	274,339	61	50	1,335	x	419	0.15%

11-Mar-00	2,860	5,663	264,809	57	30	1,437	x	419	0.16%
12-Mar-00	5,009	9,918	242,934	54	66	-168	x	419	0.17%
13-Mar-00	5,299	10,492	224,245	27	84	-701	x	419	0.19%
14-Mar-00	3,201	6,338	211,232	24	69	1,294	x	419	0.20%
15-Mar-00	2,678	5,302	193,979	54	81	1,259	x	419	0.22%
16-Mar-00	3,090	6,118	171,339	21	45	911	x	419	0.24%
17-Mar-00	3,205	6,346	154,212	9	27	682	x	419	0.27%
18-Mar-00	5,422	10,736	138,879	12	100	-1,615	x	419	0.30%
19-Mar-00	6,679	13,224	124,025	9	36	-3,400	x	419	0.34%
20-Mar-00	6,640	13,147	115,824	48	1,044	-3,110	x	419	0.36%
21-Mar-00	4,807	9,518	107,692	41	1,579	-2,490	x	419	0.39%
22-Mar-00	5,878	11,638	94,230	18	219	-4,010	x	419	0.45%
23-Mar-00	4,707	9,320	88,740	27	141	-4,160	x	419	0.47%
24-Mar-00	4,270	8,455	84,932	3	150	-2,702	x	419	0.49%
25-Mar-00	4,381	8,674	80,596	3	99	-1,670	x	419	0.52%
26-Mar-00	4,529	8,967	72,280	6	87	-2,352	x	419	0.58%
27-Mar-00	5,793	11,470	64,817	10	93	-3,790	x	419	0.65%
28-Mar-00	5,198	10,292	60,463	39	405	-3,700	x	419	0.69%
29-Mar-00	5,546	10,981	55,078	42	181	-4,370	x	419	0.76%
30-Mar-00	6,674	13,215	49,619	24	222	-5,130	x	419	0.85%
31-Mar-00	5,716	11,318	47,338	27	153	-5,310	x	419	0.89%

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-33

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 8

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
12-Mar-01	8,470	16,771	59,343	96	126	-4,920			
13-Mar-01	7,825	15,494	53,603	216	78	-6,260			
14-Mar-01	7,430	14,711	47,447	162	117	-5,777			
15-Mar-01	7,212	14,280	41,362	186	144	-5,800			
16-Mar-01	6,670	13,207	36,289	291	219	-5,529			
17-Mar-01	6,239	12,353	32,516	132	108	-5,281			
18-Mar-01	6,502	12,874	26,718	90	117	-5,130			
19-Mar-01	6,579	13,026	24,285	33	150	-5,290	x	6,096	25.104%
20-Mar-01	6,678	13,222	22,481	63	75	-5,720	x	6,292	27.990%
21-Mar-01	6,675	13,217	21,768	108	102	-5,830	x	6,287	28.879%
22-Mar-01	6,679	13,224	21,265	126	225	-5,450	x	6,294	29.600%
23-Mar-01	6,675	13,217	19,745	39	432	-5,660	x	6,287	31.839%
24-Mar-01	6,672	13,211	17,794	24	183	-6,170	x	6,281	35.295%
25-Mar-01	6,669	13,205	19,139	51	216	-6,140	x	6,275	32.785%
26-Mar-01	6,584	13,036	18,762	51	177	-6,190	x	6,106	32.545%
27-Mar-01	5,799	11,482	19,786	24	87	-6,160			
28-Mar-01	5,398	10,688	19,863	60	129	-6,740			
29-Mar-01	4,791	9,486	18,974	42	240	-6,430			
30-Mar-01	3,798	7,520	17,836	36	75	-6,080			
31-Mar-01	3,597	7,122	16,676	18	285	-6,020			
1-Apr-01	3,379	6,690	16,192	12	129	-5,930			
2-Apr-01	3,190	6,316	16,852	54	1,830	-4,880			

Notes:

a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.

b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

TABLE 7.3-34

SOUTH DELTA AND SALVAGE CONDITIONS DURING MONTEREY AMENDMENT WATER SUPPLY MANAGEMENT PRACTICES-INDUCED PUMPING EVENTS FROM 1996 TO 2004[a]

EVENT 9

Date	Historical Conditions						Estimated Monterey Amendment-Induced Banks Pumping		
	Banks Pumping (cfs)	Banks Pumping (AF)	Delta Outflow (AF)	Delta Smelt Salvage	Splittail Salvage	Old and Middle River Flow (cfs)	Days with Induced Banks Pumping	Estimated Increase in Banks Pumping[b] (AF)	Increased Pumping as % of Delta Outflow
18-Mar-04	6,687	13,240	60,861	0	30	-7,715			
19-Mar-04	6,595	13,058	57,917	0	15	-7,628			
20-Mar-04	6,640	13,147	55,460	0	48	-7,657			
21-Mar-04	6,685	13,236	53,454	0	24	-7,706			
22-Mar-04	6,669	13,205	50,989	0	56	-5,574			
23-Mar-04	6,121	12,120	49,730	0	90	-5,237			
24-Mar-04	5,108	10,114	53,506	0	66	-5,439			
25-Mar-04	5,973	11,827	55,266	0	96	-6,734	x	3,115	5.636%
26-Mar-04	6,458	12,787	52,260	0	42	-7,125	x	4,075	7.797%
27-Mar-04	5,462	10,815	51,902	0	30	-6,459	x	2,103	4.051%
28-Mar-04	6,371	12,615	44,506	0	18	-7,010	x	3,903	8.769%
29-Mar-04	6,629	13,125	38,679	0	67	-8,032	x	4,413	11.410%
30-Mar-04	6,438	12,747	31,939	0	30	-7,241	x	4,035	12.634%
31-Mar-04	4,656	9,219	32,104	0	12	-6,231			
1-Apr-04	4,399	8,710	27,987	0	36	-7,612			
2-Apr-04	4,349	8,611	27,922	0	24	-6,642			
3-Apr-04	4,394	8,700	28,676	0	6	-5,958			
4-Apr-04	4,188	8,292	30,338	0	0	-6,501			
5-Apr-04	4,363	8,639	33,403	0	0	-7,331			
6-Apr-04	4,369	8,651	35,939	0	12	-8,167			

Notes:
a. Based on results from the water supply management practices analysis, which is intended to estimate what the impacts would have been of the Monterey Amendment water supply management practices on Delta exports from the Banks Pumping Plant from 1996 to 2004.
b. The estimated increase in Banks Pumping shown is part of the actual historical pumping that occurred during this period.

Event 1: December 9, 1996 through December 16, 1996 (Table 7.3-26)

The only delta smelt salvage occurred five days after the water supply management practices induced pumping, but this is still within the timeframe of possible impact due to the water management practices pumping. The only splittail salvage occurred on the day prior to the event. Based on this minimal salvage, there would be no affect on salvage.

Event 2: January 3, 1998 through January 13, 1998 (Table 7.3-27)

Old and Middle river flows were in the -5,000 to -10,000 cfs ranges for the entire impact period, and prior to the impact period. These flows reversed to positive flow after the impact period, perhaps the cause for the zero salvage found at this point. Delta outflow was also on the increase during and after the impact period. Additionally, after the impact period, Banks pumping was less than 100 cfs, for all these reasons the zero salvage found is not surprising.

The water supply management practices induced pumping would have sustained the same pumping levels that were found prior to the impact period. During the impact period, water supply management practices induced pumping would have been as much as 65 percent of the Delta outflow. Based on the fact that the water supply management practices would have sustained similar pumping patterns to those that occurred prior to the impact period, the water supply management practices would have possibly aided in the salvage numbers. Salvage numbers for delta smelt and splittail both increased during the water supply management practices induced pumping, and decreased to zero once the pumping was reduced to below 100 cfs.

Event 3: November 1, 1998 through November 14, 1998 (Table 7.3-28)

Old and Middle river flows were in the -4,500 cfs range for the entire impact period, and Delta outflow was relatively minimal. Banks Pumping Plant pumping was on a general decline during the impact period. Despite the fact that the water supply management practices would have resulted in pumping a high percentage of water as compared to the Delta outflow, there was no Delta smelt salvage in this time period, and the splittail salvage was sporadic, even before the impact period. Based on this, the water supply management practices would probably not have contributed to the salvage.

Event 4: December 1, 1998 through January 3, 1999 (Table 7.3-29)

Salvage was limited during this time period. The delta smelt and splittail cohorts that were salvaged correlate loosely with times of switch in Old and Middle river flows from positive to negative flows. During this event, the water supply management practices would probably not have contributed to salvage.

Event 5: January 14, 1999 through January 26, 1999 (Table 7.3-30)

Salvage was limited during this event. The only delta smelt salvage is found after the impact period, and that is only one fish. The splittail cohorts that were salvaged could possibly be due to negative flows in the Old and Middle rivers. During this event, the water supply management practices would probably not have contributed to salvage.

Event 6: February 24, 1999 through March 31, 1999 (Table 7.3-31)

There was no salvage in the week prior to the impact period; however, it was at this same time the flows in the Old and Middle river changed from positive to negative. Also, at this time, overall pumping at Banks Pumping Plant, independent of the water supply management practices, increased. During the week prior to February 24, pumping at Banks Pumping Plant was down to zero twice, and in the 70 cfs range three times. Pumping at Banks Pumping Plant ramped up to 2,552 cfs on the day that water supply management practices-induced pumping would have begun. It was at this time salvage numbers began to increase.

The general increase in pumping might have contributed to increased salvage. During this event, it is difficult to determine if the water supply management practices-induced pumping contributed to increased salvage. Salvage numbers increase after the impact period is over, probably due to an overall increase in pumping at Banks Pumping Plant.

Event 7: February 1, 2000 through March 31, 2000 (Table 7.3-32)

Old and Middle river flows were between -5,000 and -10,000 cfs during the first half of the impact period. Old and Middle river flows reach positive numbers for a few days from March 10 to March 17, but then go back negative. This could explain the number of splittail that are salvaged on March 20 and 21.

Overall pumping at Banks Pumping Plant ranges from mid 2,000's to low 9,000's cfs during this period. The water supply management practices would have had a variable impact on the overall pumping, ranging from 10,087 AF (5,508 cfs) to 419 AF (212 cfs). The 419 AF (212 cfs) would be the contribution from March 1 to March 31.

Overall, salvage numbers are high during this period, and seem to increase about a week after the water supply management practices would have increased the pumping. If the water supply management practices would have had an impact on salvage numbers, this is around the time a jump in salvage would have been anticipated. During this event, it is possible the water supply management practices would have had an impact on salvage of delta smelt and other species.

Event 8: March 19, 2001 through March 26, 2001 (Table 7.3-33)

Old and Middle river flows were between -5,000 and -10,000 cfs during the impact period. During this period, the water supply management practices would have contributed to about half of the overall pumping at Banks Pumping Plant, keeping the pumping about the same as the week prior to the impact period. With the water supply management practices sustaining pumping levels at around 6,500 cfs, and Old and Middle river flows between -5,000 and -10,000 cfs, it is not surprising that salvage numbers during the impact period are similar to the week prior. There is a large cohort of splittail that get salvaged after the impact period, possibly be due to a further increase in negative Old and Middle river flows. During this event, it is possible the water supply management practices would have had an impact on salvage of delta smelt and other species.

Event 9: March 25, 2004 through March 30, 2004 (Table 7.3-34)

No delta smelt were salvaged during this period. Old and Middle river flows were between -5,000 and -10,000 cfs, during, prior, and after the impact period. Banks Pumping Plant pumping dropped during the impact period to levels of 6,500 cfs to 5,500 cfs; this seemed to coincide with a drop in salvage of splittail. However, the post-impact time period also saw an increase in Delta outflow.

The water supply management practices induced pumping had no impact on delta smelt in 2004, as there was no salvage during or following Event 9. The water supply management practices may have contributed to splittail salvage during this event for the same reasons as explained in event 4 of the 1995-2003 analysis.

For the reasons stated above, the incremental pumping may have increased splittail salvage at some times. It is possible to conclude that the water supply management practices (thus the proposed project) under 2003 conditions may have contributed to increases in salvage under certain conditions.

Water Supply Management Practices Impact Summary (Future)

Based on the nine events discussed above, the water supply management practices of the proposed project would have contributed to salvage numbers during certain pumping events, especially during February and March.

The degree of fish salvage that would be attributable to the proposed project in relation to total pumping is difficult to estimate. As noted in the mitigation section below, the CVP and SWP Delta facilities are being reviewed as part of the Operations Criteria and Plan (OCAP) reconsultation process. However, reviewing average annual total projected Banks Pumping Plant pumping and determining the relationship of the proportion of that pumping that might be attributable to the proposed project is important. Banks pumping is estimated to average about 3,200,000 AF per year in the future, based on CALSIM output, and the approximate estimated future added pumping at Banks due to the water supply management practices of the proposed project is about 50,000 AF per year, or 1.6 percent of annual average total Banks pumping. If the same percentage is applied to the current EWA Program asset level of about 300,000-350,000 AF, the proportion of the EWA Program attributable to the water supply management practices of the proposed project would be about 5,500 AF.

In developing fisheries mitigation for the proposed project, several other factors were also examined. The first was to see if the added pumping attributable to the proposed project would occur at times of high fish sensitivity, and the other was to provide for tracking actual future water management actions of the proposed project.

Analysis of the 50,000 AF of added pumping at Banks resulting from the water supply management practices found that about 12,000 AF would generally occur in November and December, when the fish species of concern are seldom near the pumps (except for longfin smelt), with the remaining 38,000 AF of pumping occurring in the January-April period, when fish concerns are greater. Thus the degree of impact of the water supply management practices of the proposed project as a fraction of Banks pumping would be less than the 1.6 percent cited above, or about 1.2 percent.

Based on the analysis, increased future pumping due to the proposed project under 2020 conditions could change Delta flow patterns, disrupt movement of species of fish, and increase entrainment losses of adult delta smelt, longfin smelt, splitail, striped bass, and salmonid smolts. The actual magnitude of this impact depends on the Delta outflow and the relative reduction generated by increased pumping. The fishes most susceptible to November-March hydrodynamic changes and export increases are outmigrating salmonids and delta smelt moving upstream to spawn. Increased entrainment of a special status species that resulted from the proposed project under 2020 conditions would be considered an adverse effect and would reduce a species' abundance. Delay of upstream or downstream migration could be considered an interference with the movement of resident and migratory species.

<u>Environmental Programs</u>

The following summarizes environmental programs either already in place or forthcoming that are relevant to the SWP (thus the proposed project) and Delta fisheries for the 2003-2020 timeframe:

1. The Anadromous Fisheries Biological Opinion of 2004 (replaces the biological opinion of 1995) provides FESA incidental take coverage for Sacramento River winter-run Chinook

salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead trout. This also includes operation restrictions of SWP facilities in the Delta. The federal and State agencies have reinitiated consultation on the salmonids opinion and a new biological opinion is scheduled to be adopted at the end of 2008. The new consultation will cover newly listed species, such as green sturgeon.

2. The Delta Pumping Plant Fish Protection Agreement ("Four Pumps Agreement", 1986) is an agreement with CDFG where the Department pays for direct losses of steelhead, Chinook salmon, and striped bass based on measured losses at Banks Pumping Plant. These payments will continue to be used to provide for fisheries mitigation and habitat enhancements. Examples of these projects include installation of fish screens, and replacement of spawning gravel.

3. The Delta Smelt Biological Opinion of 2005 (superseding the 1995 biological opinion) provides the Department with FESA incidental take coverage for delta smelt for the SWP and CVP. This includes restrictions on operation of SWP and CVP facilities, including export restrictions during the spring. This also establishes a delta Smelt Working Group that will determine an adaptive management approach to delta smelt protection among resource agencies. The USFWS concluded that any adverse impacts form the OCAP for the SWP and the CVP will be minimized or avoided by conservation and management measures incorporated ionto the project plan. The OCAP addresses operational impacts on delta smelt by committing the two projects to take early protective actions for the species. The OCAP incorporates the EWA into the delta smelt protective actions. In 2007, the United States District Court in Fresno found the Biological Opinion to be invalid but it did not vacate the opinion. The court is imposing a court-ordered remedy pending completion of reconsultation and a new Biological Opinion. The new biological opinion is scheduled to be adopted at the end of 2008. The new opinion will cover any newly listed or proposed-to-be-listed species, such as the longfin smelt.

4. The Delta Smelt Action Plan of 2005, jointly prepared by the Department and CDFG, describes current and future work needed to guide efforts to protect and restore delta smelt.

5. The Department, in conjunction with CDFG, will continue to develop the Bay-Delta Conservation Plan (BDCP) to provide the most comprehensive protection for the Delta ecosystem. The BDCP will address multiple Delta issues to conserve natural communities at the ecosystem level and provide for species recovery. The formal planning agreement was signed in 2006 consistent with provisions of the California Natural Community Conservation Planning Act and the FESA Section 10 for a HCP.

6. The Pelagic Fish Action Plan of 2007 was jointly prepared by the Department and CDFG under the direction of the Resources Agency. This plan incorporates the latest scientific information regarding protective actions for pelagic fish related to SWP operations.

7. The Adaptive Management Process results in the Department working with CDFG, USFWS, and NMFS to coordinate SWP operations with fishery needs. This process deals with real-time fish monitoring data and SWP operations. Often, the fish protection provided by this process goes beyond regulatory requirements. The following forums allow the SWP and CVP operations to be modified to prevent impacts to species of special concern:

    a. Data Assessment Team,

    b. Salmon Decision Process,

    c. Delta Smelt Working Group, and the

   d. Water Operations Management Team.

8. The IEP is closely associated with the Adaptive Management Process. Several State, including the Department, and federal agencies have been involved in the IEP since 1970. The IEP guides many of the actions taken by the Adaptive Management Process. The various agencies invest in the IEP to provide real-time monitoring data.

9. The Delta Risk Management Study (DRMS) was put into place to help the State determine how to make the Delta sustainable in the future. The 2000 CALFED Record of Decision presented its Preferred Program Alternative that described actions, studies, and conditional decisions to help fix the Delta. Included in the Preferred Program Alternative for Stage 1 implementation was the completion of a DRMS that would look at sustainability of the Delta, and that would assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences, and develop recommendations to manage the risk. For more information, refer to the following website: http://www.drms.water.ca.gov/.

10. Delta Vision is intended to identify a strategy for managing the Delta as a sustainable ecosystem that would continue to support environmental and economic functions that are critical to the people of California. Although it builds on work done through the CALFED Bay-Delta program, Delta Vision will broaden the focus of past efforts within the Delta to recommend actions that will address the full array of natural resource, infrastructure, land use, and governance issues necessary to achieve a sustainable Delta. For more information, refer to the following website: http://deltavision.ca.gov/.

11. In 2004, NOAA Fisheries released a biological opinion on the CVP and SWP long-term operations as described in the OCAP Biological Assessment. This biological opinion covers endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Southern Oregon/Northern California Coast coho salmon, threatened Central Valley steelhead, threatened Central California Coast steelhead, and critical habitat for Sacramento River winter-run Chinook salmon and coho salmon. This biological opinion is based on information provided by the U.S. Bureau of Reclamation and the Department. Project operations alter the quantity, timing, and quality of water passing into the Delta, thereby affecting conditions under which juvenile and adult salmonids live. This biological opinion determines whether or not SWP and CVP project effects are likely to jeopardize the continued existence of the affected ESA-listed salmon and steelhead or result in the destruction or adverse modification or designated critical habitat.

Summary

As compared to baseline conditions, potential exists for the proposed project to have an adverse impact on Delta fish species by increasing salvage at the Skinner facility as a result of higher pumping at Banks during certain periods when San Luis Reservoir would otherwise be full. This impact is *potentially significant*.

<u>Mitigation Measures</u>

Implementation of the following mitigation measure in combination with environmental programs already in place or forthcoming that are relevant to the SWP would reduce this impact to **a *less-than-significant level***.

7.3-5 *The Department shall implement operational assets that could be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon that would limit any adverse impact resulting from the proposed project on special status Delta fish species as a result of higher pumping at Banks during periods when San Luis Reservoir, absent of the proposed project, would be full.*

The Department (as discussed in the foregoing section discussing the 1996-2003 timeframe) will continue to operate the SWP and its facilities in accordance with all statutory requirements. To ensure compliance to all environmental guidelines, the Department follows a set of mitigation and environmental programs (some already in place and some forthcoming). Any additional pumping due to the proposed project under 2020 conditions in the Delta will be addressed by requirements that govern the operation of the Delta facilities of the SWP. In the immediate short-term time frame, the operational remedies imposed by the United States District Court, Eastern District of California, in Fresno will govern SWP operations to provide protection for the listed fish that are subject of that litigation.

Conclusion of current consultation on the OCAP with USFWS and NOAA Fisheries is expected to provide new Biological Opinions for delta smelt, salmon, and green sturgeon that would replace the court's order regarding operation of the project. The new Biological Opinion would then continue to provide the mitigation required to address the impacts of this proposed project.

As part of the resources to provide that fish protection, both in the remedy phase and for the longer term under new Biological Opinions, the Department has already committed the operational assets that are currently a part of the EWA. These assets may be deployed through a continuation of the EWA, through an equivalent type of program, or through another program that would replace the EWA and provide the fish protection required by the court and the Biological Opinions on delta smelt and Chinook salmon.

The operational assets that are being committed as mitigation with respect to this proposed project are defined as follows, with the current EWA-related definitions embodied in the text:

- EWA has a 50 percent share of SWP export pumping of water classified as (b)(2) and Ecosystem Restoration Program (ERP) water from upstream releases;
- EWA shares the use of SWP pumping capacity in excess of the SWP's needs to meet contractor requirements with the CVP on an equal basis, as needed (such use may be under Joint Point of Diversion provisions in the Project Agencies water right permits);
- EWA assets include any water acquired through export/inflow ratio flexibility; and
- EWA has exclusive use of 500 cfs increase in authorized Banks Pumping Plant capacity in July through September (from 6,680 to 7,180 cfs).

Operational assets have averaged 82,000 AF per year in actual EWA operations from 2001-2006.

In addition to the operational assets defined above, some public funding does remain to acquire water in 2008 (State) and possibly through 2010 (federal). Also, it is anticipated that the Department will complete a water purchase from Yuba County Water Agency for 2008-2015 as part of the Yuba Accord that would provide 60,000 AF per year for EWA or equivalent fish protection purposes. The remainder of the assets required to complete an adequate program for fish protection would be identified through the OCAP ESA reconsultation process, and would address SWP operations including the impacts of the proposed project.

7.3-6 Implementation of the proposed project could potentially affect special-status fish species in the Sacramento-San Joaquin Delta due to Delta outflow changes.

1996 — 2003

The Delta is home to dozens of fish species, both native and introduced. All of the special-status species of fish previously discussed (Section 7.3.2.1) either pass through the Delta during migration as adults and juveniles or are permanent residents like delta smelt.

Several provisions of the Monterey Amendment have the potential to affect Delta outflow. They include the provisions that altered water allocation procedures and facilitated retirement and transfer of Table A amounts, which can affect flow in the Feather and Sacramento rivers, Delta inflow, and Delta exports; and the water supply management practices, which can affect Delta exports. Because Delta outflow is dependent on both Delta inflow and Delta exports, it can be affected by all of these provisions. In general, Delta outflow is equal to Delta inflow minus Delta exports. Therefore, the net effect of the proposed project on Delta outflow would be the changes resulting from the proposed project on Delta inflow minus the changes from the proposed project on Delta exports.

<u>Effects of Proposed Project on Delta Inflow</u>

Changes in Delta inflow resulting from the proposed project would be equal to its changes in Sacramento River flows (see Impact 7.3-3). Changes in Sacramento River flows would result from changes in deliveries to contractors north of the Delta, due to the altered water allocation procedures and the Table A retirements and transfers. Table 7.3-17 shows the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the baseline scenario under 2003 conditions, by year type and over all year types.

Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions and decreased Delta inflow. Table 7.3-18 shows Sacramento River flows for the baseline scenario under 2003 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. Under 2003 conditions, Sacramento River flows, and thus Delta inflow and Delta outflow, are estimated to decrease on average by about 1,630 AF, with the greatest impact occurring in wet years with a decrease of 2,940 AF. The largest (and only) Delta inflow and Delta outflow increase is 203 AF per year, occurring in dry years. As a percentage of baseline scenario Delta outflow, the largest reduction is 0.016 percent, occurring in critically dry years.

Under some limited circumstances, there could be minor operational changes to Sacramento River flows and Delta inflow in response to the slight delivery changes to SWP contractors north of the Delta. When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in upstream reservoir releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger such changes are: the E/I ratio, Delta water quality constraints, and South Delta water levels.

Effects of Proposed Project on Delta Exports

Delta exports to contractors south of the Delta are analyzed in two different ways (see Impact 7.3-5). The first analysis uses CALSIM II and post-processing of model results, which was used to evaluate the effects of the altered allocation procedures and the Table A retirements and transfers. The second is a historical operations analysis which analyzes nearly all provisions of the Monterey Amendment, including the Table A retirements and water supply management practices. This latter analysis is intended to provide an estimate of the actual effects of the proposed project on Delta exports from 1996 to 2004, and is based on actual operations and delivery data during that period.

Based on this historical operations analysis, the Department estimates that from 1996 to 2004, these Monterey Amendment provisions resulted in the SWP pumping a total of about 44,000 AF more at the Banks Pumping Plant than it would have under the baseline scenario. Thus, from 1996 to 2004, these Monterey Amendment provisions increased Delta exports and reduced Delta outflow by a total of about 44,000 AF. The increase in Delta exports and reduction in Delta outflow occurred during four events: January 13, 1998; February 24 through March 31 of 1999, February 22 through March 31 of 2000, and March 23 through March 30 of 2004.

Summary of Effects of Proposed Project on Delta Outflow

The Table A retirements and transfers and the altered allocation procedures that are part of the Monterey Amendment would have very little effect on annual or monthly Delta inflow, and thus Delta outflow, compared to the baseline scenario under 2003 conditions.

The Table A retirements and the water supply management practices that are a part of the proposed project resulted in an estimated reduction in Delta outflow of a total of 44,000 AF from 1996 to 2004. The estimated reduction represents about 0.03 percent of total Delta outflow during that period.

Most of the time, the SWP diverts water from the Delta at the Banks Pumping Plant at the maximum possible rate consistent with compliance with Delta water quality standards. From time-to-time, in the wetter months, water is available in the Delta in amounts in excess of that needed to meet Delta environmental standards and the needs of the SWP and its contractors. That is, all the SWP reservoirs south of Delta are full or at their storage targets and all contractors' SWP current water needs have been met. It is only at such times that the Monterey Amendment could result in pumping of water that would otherwise have contributed to Delta outflow under the baseline scenario. From 1996 to 2004, these conditions occurred in January 1998, February and March 1999, February and March 2000, and March 2004.

A statistical correlation exists between Delta outflow as measured by the average location of the X2 salinity position and the population of certain fish species such as longfin smelt. Review of the X2 position under baseline conditions reveals that as expected, X2 moves further into San Francisco Bay under periods of high outflow and moves upstream into the Delta during periods of low outflow. The changes in X2 location between the proposed project and baseline scenario under 2003 conditions are plus or minus 100 meters. These changes in X2 location are based on CALSIM II model results and so reflect the effects of only the altered allocation procedures and the Table A retirements and transfers. The increase in Delta exports estimated in the historical operations analysis would decrease Delta outflow by a like amount and would be expected to shift the position of X2 upstream by a small but undetermined amount in the wet winter months when the extra pumping occurred. These changes are immeasurable in the field, and thus is not considered a substantial alteration of habitat used by special-status species of fish.

The standards of significance established for this proposed project require that a potentially significant impact be identified for any proposed project-related action that will adversely affect, either directly or through habitat modifications, any species protected under the State or federal Endangered Species acts or considered a candidate, or special-status by the USFWS, CDFG, or NOAA Fisheries. The evaluations in this discussion rely on a potential change in available habitat resulting from a substantial alteration in Delta inflow or outflow or a substantial increase in SWP exports from the Delta. Changes in Delta outflow attributable to the proposed project under 2003 conditions are minor and none are likely to substantially alter available habitat. Also, the San Joaquin and American River flows will not be impacted. Therefore, the proposed project under 2003 conditions will have a ***less-than-significant impact*** on fisheries resources from changes in Delta outflow.

<u>Mitigation Measures</u>

None required.

Future Impacts

The proposed project under 2020 conditions has the potential to alter Delta outflow. The net effect of the proposed project on Delta outflow would be the changes resulting from the proposed project on Delta inflow minus the changes from the proposed project on Delta exports.

<u>Effects of Proposed Project on Delta Inflow</u>

Changes in Delta inflow resulting from the proposed project would be equal to its changes in Sacramento River flows (see Impact 7.3-3). Changes in Sacramento River flows would result from changes in deliveries to contractors north of the Delta, due to the altered water allocation procedures and the Table A retirements and transfers. Tables 7.3-16 and 7.3-17 show the estimated changes in total average annual deliveries to the five contractors located north of the Delta with the proposed project compared to the baseline scenario under 2020 conditions, by year type and over all year types.

Increases in deliveries to the contractors north of the Delta would result in decreased river flows downstream of those diversions and decreased Delta inflow. Table 7.3-18 shows Sacramento River flows for the baseline scenario under 2020 conditions. This table identifies possible changes in river flow based on the delivery changes from Table 7.3-17, and then tabulates those potential flow changes as a percentage of the baseline river flows. Under 2020 conditions, annual Sacramento River flows, and thus Delta inflow and Delta outflow, would be estimated to decrease on average by 7,070 AF. Delta inflow and Delta outflow would be estimated to decrease by amounts ranging from 920 AF in critically dry years to 11,950 AF in wet years. As a percentage of baseline scenario Delta outflow, the largest reduction would be 0.0542 percent, occurring in below normal years.

Under some limited circumstances, there could be minor operational changes to Sacramento River flows and Delta inflow in response to the slight delivery changes to SWP contractors north of the Delta. When the Delta is in balanced conditions and one of several constraints governs Delta operations, there could be changes in upstream reservoir releases or in Delta pumping in response to the changes in diversions to the five upstream-of-Delta contractors. The constraints that might trigger such changes are: the E/I ratio, Delta water quality constraints, and South Delta water levels.

Effects of Proposed Project on Delta Exports

Delta exports to contractors south of the Delta can be affected both by the altered allocation procedures and Table A retirements and transfers, and by the water supply management practices, which are all a part of the Monterey Amendment. The effects of these two sets of Monterey Amendment provisions are evaluated in two separate analyses, as described in more detail in Impact 7.3-5.

The effects of the altered allocation procedures and Table A retirements and transfers on Delta exports, based on CALSIM II and post-processing of model results, are shown in Table 7.3-16. Due to these provisions, under 2020 conditions, total deliveries to contractors south of the Delta would be estimated to decrease by an annual average of about 23,000 AF, with delivery changes by year type ranging from decreases of about 53,000 AF in wet years to increases of about 6,000 AF in critically dry years. Delivery changes can be made from south-of-Delta storage and may not change Delta exports and Delta outflow.

The effects of the water management provisions on Delta exports are analyzed in a historical analysis, based on historical operations and delivery data from 1996 to 2004. This water supply management practices analysis was used to determine whether these provisions would have resulted in increased pumping at the Banks Pumping Plant from 1996 to 2004 compared to the baseline scenario. Because the water supply management practices were actually used from 1996 to 2004, an analysis of the effects of these water supply management practices in that historical period offers insight into possible future effects. The water supply management practices analysis showed that these provisions would have resulted in an estimated increase in exports at Banks Pumping Plant of a total of 449,000 AF over the nine-year period from 1996 to 2004 (refer to note above in description of events regarding the inclusion of 2004), or an average of 50,000 AF per year. This increase in exports occurred during 9 events out of this nine-year period. These increases in exports were small relative to total exports at Banks Pumping Plant, and typically occurred in wet months when Delta outflow was high. Delta outflow would be reduced by the amount of the increase in Delta export during those events.

Summary of Effects of Proposed Project on Delta Outflow

The Table A retirements and transfers and the altered allocation procedures that are a part of the Monterey Amendment would result in an average annual increase in Delta outflow compared to the baseline scenario under 2020 conditions. This increase in Delta outflow is the net result of a reduction in average annual Delta inflow due to additional exports to contractors north of the Delta, and a reduction in average annual exports at the Banks Pumping Plant due to reduced exports to contractors south of the Delta. Under 2020 conditions, the net increase in average annual Delta outflow resulting from these provisions would be estimated to be about 15,900 AF (the net of a 7,070 AF decrease in Delta inflow and Delta outflow, and a 23,000 AF decrease in Delta exports and increase in Delta outflow). By year type, the net effect of these provisions would range from an increase in Delta outflow of about 41,000 AF in wet years, to a decrease of about 11,700 AF in below normal years.

Some of the water supply management practices that are a part of the proposed project would have reduced Delta outflow between 1996 and 2004. These water supply management practices are conservatively estimated to reduce Delta outflow by about 50,000 AF per year.

Because the two analyses used to evaluate the two sets of Monterey Amendment provisions are different (one based on a model analysis and the other on historical data from 1996 through 2004), analysis results by year type cannot readily be combined. However, in general, the increases in Delta outflow due to the Table A retirements and transfers and altered water allocation procedures are larger in wetter years, which are the same year types when decreased Delta outflow due to the water supply management practices would likely be larger.

Review of the X2 position under 2020 baseline conditions reveals that as expected, X2 moves further into San Francisco Bay under periods of high outflow and moves upstream into the Delta during periods of low outflow. The changes in X2 location between the proposed project and baseline scenario under 2020 conditions are plus or minus 100 meters. These changes in X2 location are based on CALSIM II model results and so reflect the effects of only the Table A retirements and transfers and the altered allocation procedures. The increase in Delta exports estimated in the historical operations analysis would decrease Delta outflow by a like amount and would be expected to shift the position of X2 upstream by a small but undetermined amount in the wet winter months when the extra pumping would likely occur. The reductions in outflow would occur in some wet months of wet years at the time when Delta outflow is at its seasonal maximum. These changes are immeasurable in the field, and thus is not considered a substantial alteration of habitat used by special-status species of fish.

This is not of sufficient magnitude to be considered a substantial change in fish habitat. Therefore, the proposed project under 2020 conditions would have a ***less-than-significant impact*** on fisheries resources from changes in Delta outflow.

<u>Mitigation Measures</u>

None required.

7.3-7 Implementation of the proposed project could potentially affect recreational fisheries in Lake Perris and Castaic Lake.

1996 — 2003

Article 54 of the Monterey Amendment provides that the three contractors that can obtain water from Lake Perris and Castaic Lake may borrow water from those reservoirs provided the borrowing contractor replaces the water within five years. This is referred to as the flexible storage provision. By agreement, MWDSC is the only contractor that can withdraw water from Lake Perris under Article 54. See discussion in 6.4.3.1 for a further description of the effect of this provision on SWP operations. This provision of the proposed project could result in changes in storage at Lake Perris and Castaic Lake that could adversely affect important recreational fisheries.

Castaic Lake water elevations have generally increased on average from 1996 to 2003 (Figure 7.3-1). There has been over 20 vertical feet more water stored in Castaic Lake on average in the months of May through December since 1996 than in the period 1975 through 1995 prior to implementation. Similarly, storage in Lake Perris has increased since 1996 (Figure 7.3-2). Summertime storage at Lake Perris has increased by about eight to nine vertical

Figure 7.3-1. Average Monthly Water Surface Elevation at Castaic Lake

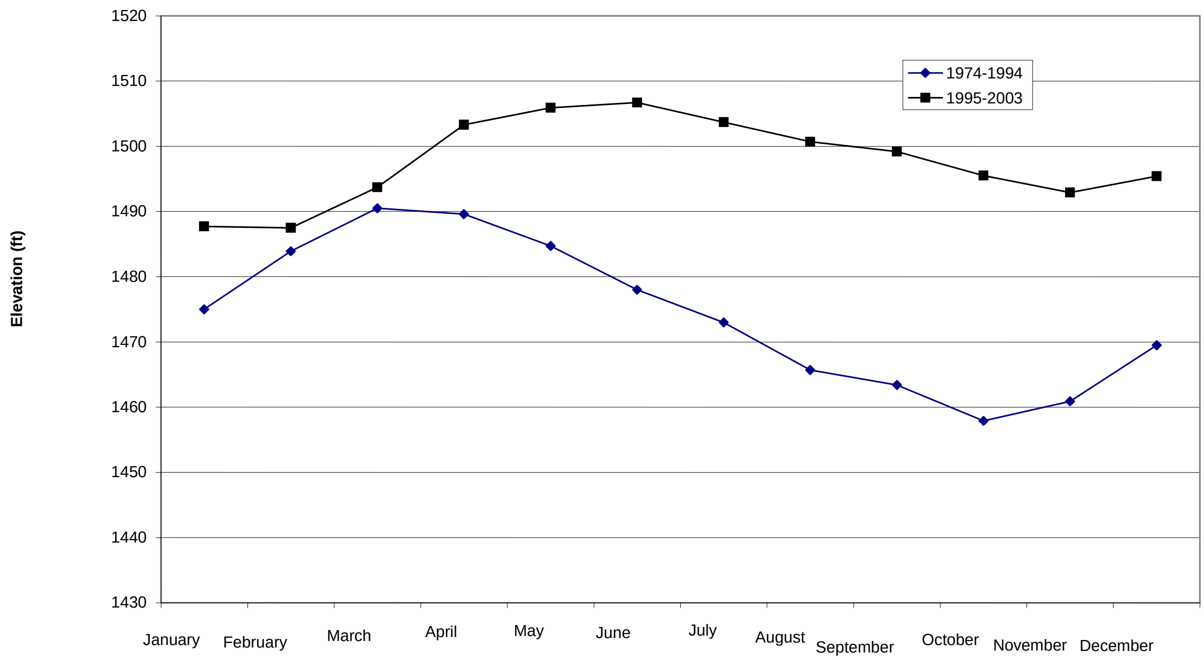
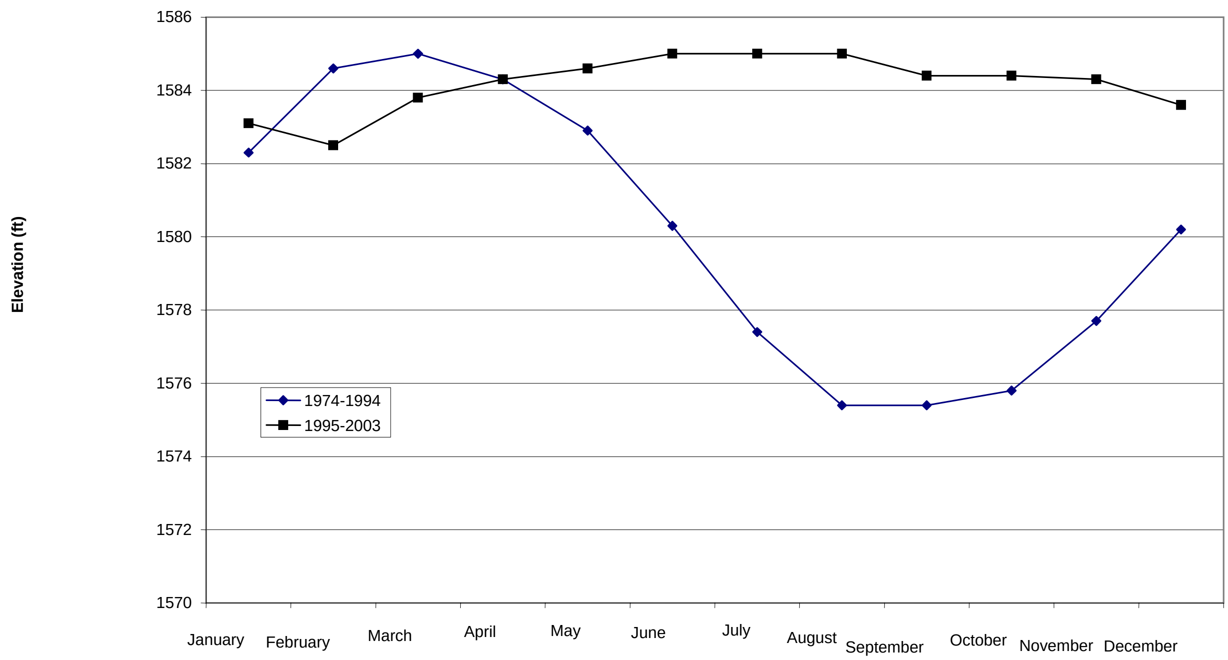


Figure 7.3-2. Average Monthly Water Surface Elevation at Lake Perris.



feet in the months of July through October. The reasons for this change were discussed in the Section 7.1. This increased level of storage has created a more stable reservoir elevation during the spring months. This is the period when most of the reservoir fish are reproducing and stable water levels are a benefit. Any changes in the amount of actual spawning habitat available would depend on shoreline configurations of the reservoir.

From 1996 to 2004, of the three eligible contractors, MWDSC and Castaic Lake WA took advantage of the flexible storage provision and borrowed water from Castaic Lake (Ventura County FCD did not utilize the provision) (Table 6-26 in Chapter 6). Castaic Lake WA withdrew water from Castaic Lake on three occasions but only small amounts were borrowed (395 to 2,589 AF). MWDSC withdrew water from Castaic Lake on three occasions. Withdrawals ranged from 14,300 to 77,804 AF. Two of these events were between December and February. This is outside the spawning season and not likely to effect the fisheries. One withdrawal event in March-April 2001 accounted for 50,000 AF. Review of the reservoir storage/elevation curve indicates that a reduction of 50,000 AF could have reduced the water surface elevation by about 30 feet. Because this event occurred during the spawning season, it could have exposed spawning beds of resident fish resulting in reduced reproductive success. What is unknown is the rate of withdrawal. In actions unrelated to the Monterey Amendment, the Department has typically followed recommended guidelines on drawdowns within Castaic Lake to prevent adverse impacts to fisheries resources and recreational uses and is as follows:

- March – seven foot water level over a seven day period (one foot per day);
- April and May – four foot water level drop over a four day period (one foot per day);
- June through September 15 – seven foot water level over a seven day period (one foot per day); and
- September 16 through February – two foot water level drop per day.

If these rates were followed, any eggs in existing nests should have had time to hatch. (It is important to note that the drawdown rates are not part of the required operation of Castaic, but are merely recommendations that are typically followed and may not be followed in the future.) These drawdown rates were likely based on the largemouth bass incubation and nest residency times which are seven and eight days respectively.[74] These times vary with temperature, decreasing as water warms. Other common, recreationally important species such as bluegill, black crappie, white crappie, and green sunfish have generally shorter incubation and nest occupancy periods than largemouth bass. Juvenile fish could have then moved into appropriate habitat based on water surface elevations. Assuming these rates were followed, and the fact there are no special-status species of fish within Castaic Lake, this withdrawal would have had a ***less-than-significant impact*** on the reservoir fisheries.

Relatively smaller amounts of water were borrowed by MWDSC from Lake Perris from 1996 to 2003. Only one of these occurred during the spring when 8,181 AF was borrowed from March 2000 to May 2000. This may have reduced the reservoir surface elevation by about ten feet over the course of three months. While this could dewater spawning habitat, the rate of reduction appears to be slow enough to allow eggs already in place to have hatched before being exposed. Therefore, this event is considered a ***less-than-significant impact*** to the reservoir fisheries.

Operational guidelines put into place in June 2003 establish maximum drawdown rates for Lake Perris of 0.5 foot per day between March 15 and May 1 with the total elevation change not to exceed three feet.[75] Compliance with these guidelines should limit impacts to reservoir fisheries resulting from borrowing of water. Payback of water is not subject to the same restrictions.

Mitigation Measures

None required.

Future Impacts

The effects of borrowing of water on water surface elevations in the two reservoirs in the future will depend on the extent to which the contractors that can borrow from the reservoir make use of Article 54 and future hydrologic conditions. Table 6-27 in Chapter 6 shows MWDSC's expected future use of flexible storage in Castaic Lake and Lake Perris. It is quite possible that future borrowing would drawdown the reservoirs to a greater extent than occurred from 1996 to 2003, a relatively wet period.

If the contractors borrowed the maximum amounts of water provided for under Article 54 and the water was not replaced for the maximum permitted duration of five years, 160,000 AF would be borrowed from Castaic Lake, about half its maximum capacity of 323,700 AF, and 65,000 AF would be borrowed from Lake Perris, about half it maximum capacity of 131,500 AF. The reservoirs would remain drawndown for five years. Although this worst-case condition could occur, it would be unlikely (see Section 6.4.3.1).

If the worst-condition were to occur, the initial reduction in reservoir elevation would reduce available open water habitat for recreationally important fish by almost half. Although detailed bathymetry is not available, it is expected that spawning habitats would also be substantially reduced. In addition, long-term drawdown could impact the density of fish populations; when reservoirs are drawndown fish would be more crowded. Available habitat would be reduced and the functional aquatic ecosystem would be degraded. Additionally, it is likely that more crowded and degraded habitat condition would reduce the populations of targeted sport fish (no endangered, rare, or threatened fish species are known to exist at Lake Perris or Castaic Lake), there is no evidence to indicate that populations would drop below self-sustaining levels or that effects would threaten to eliminate the recreational fishery, particularly for trout, which is restocked annually. According to the standards of significance, the borrowing of water from Lake Perris and Castaic Lake would have a ***less-than-significant impact*** on the aquatic ecosystem and fish populations of economic and social value.

Mitigation Measures

None required.

7.3-8 Implementation of the proposed project could potentially affect fisheries resources at Lake Oroville.

1996 — 2003 and Future Impacts

Under normal operations, the SWP reservoirs are operated to meet target storage levels at certain times of the year while meeting contractor demands and other required releases. Releases from Lake Oroville would be unlikely to be modified due to small changes in deliveries that do not affect Delta water quality, minimum flow requirements, or other operational constraints of the SWP. The small changes are mostly below the measurement threshold of most river gauges and Lake Oroville release controls, and the Department would therefore have a difficult time modifying releases to exactly match the very small increment of the delivery changes.

If such changes did occur, they would be unlikely to exceed the annual differences in total deliveries to the five contractors located north of the Delta, as shown in Table 7.3-17. The maximum annual impact on Lake Oroville storage, should storage be affected, would be less than 12,000 AF in any year. Lake Oroville storage is seldom drawn below 1,000,000 AF, and at full capacity will hold 3,537,000 AF. Any impact would be less than 1 percent of storage, and would be insignificant.

Any decrease in Delta inflow due to increased deliveries to contractors north of the Delta could possibly trigger added Delta releases above the baseline under conditions where the E/I ratio governs, water quality standards require added releases, or south Delta water levels require added releases. In dry or critically dry year types, the change could trigger export reductions instead of increased releases. The releases could be triggered for a few days from the American River under some conditions, but are more likely to be triggered from Lake Oroville. The release quantity attributable to the proposed project could be up to the increased annual delivery amount shown in Table 7.3-17, but would likely be less since such triggering events would typically be of short duration.

Such added releases are expected to occur infrequently (less than annually). To the extent they do occur, they could affect reservoir storage. Because these added releases are linked to changes in delivery north of the Delta, impacts would not exceed 12,000 AF in any year.

As stated above, Lake Oroville would not undergo any significant changes in operation due to any aspect of the proposed project. The changes that would occur at Lake Oroville would not adversely affect any special-status species of fish, or significantly reduce populations of fish species having economic or social value, or adversely affect any habitat or other sensitive natural community. Therefore, the proposed project under 2003 and 2020 conditions will have a ***less-than-significant impact*** on Lake Oroville fisheries resources.

Mitigation Measures

None required.

7.3-9 Implementation of the proposed project could potentially affect fisheries resources at San Luis Reservoir.

1996 — 2003 and Future Impacts

Under normal operations, the SWP reservoirs are operated to meet target storage levels at certain times of the year while meeting contractor demands and other required releases. San Luis Reservoir is the SWP's primary water storage facility south of the Delta and is greatly influenced by imported water from the Delta. Because of this, and its proximity to the Delta pumping facilities, any species that is found in the Delta can be found in San Luis Reservoir.[76]

The Department and the Reclamation equally share storage capacity in the reservoir. Due to water quality issues (see Section 7.1), the Department and Reclamation cooperate to try to maintain the reservoir low point above 300,000 AF.

The proposed project would not change the Department's operating objectives with respect to San Luis Reservoir but it could affect water storage and water surface elevations in the reservoir. The CALSIM II model was used to estimate the effects of the Table A transfers and retirements and the altered water allocation procedures on storage in San Luis Reservoir. Figure 7.1-5 shows average monthly storage in San Luis Reservoir with the Table A transfers and retirements and the altered water allocation procedures with the proposed project and under the baseline scenario under 2003 conditions. Figure 7.1-9 shows the same data for the 2020 conditions (future). The differences between storage under the two scenarios are relatively small, but could increase average water surface elevations by ten to twenty feet. The results are similar for the future scenario.

As a result of the flexible storage provision of the Monterey Amendment, the Department established a limit on drawdown of Castaic Lake and Lake Perris. Under some circumstances, this could affect storage and water levels in San Luis Reservoir. The effects of the flexible storage provision on storage and water surface elevations in San Luis Reservoir would be small because the extra storage in Castaic Lake and Lake Perris would represent only a small percentage of storage in San Luis Reservoir.

From 1996 to 2003, the Department's analysis of historical data showed that several of the water supply management practices increased deliveries of SWP water. The practices delayed the Department's filling of its San Luis Reservoir space by a few months and the contractors' use of the water supply management practices lowered SWP storage in San Luis Reservoir by several tens of thousands of AF in some months. This is expected to continue into the future, although at a lesser extent because storage outside contractors' service area would occur less frequently (see Impact 7.1-1). However, this is not anticipated in adversely impact water temperature sufficiently to affect the reservoir's designation as a warm-water fishery.

Although the proposed project may have reduced storage in San Luis Reservoir at times from 1996 to 2003 (and is anticipated to do so in the future) relative to the baseline condition, total storage in the reservoir by the SWP and the CVP did not (and probably will not) fall below 300,000 AF.

As stated above, San Luis Reservoir for the 1996-2003 period and into the future has experienced and will likely continue to experience lowered water levels due to the proposed project. However, these changes will be minimal. Also, San Luis Reservoir will not undergo any significant changes in operation due to any aspect of the proposed project. The changes that would occur at San Luis Reservoir would not adversely affect any special-status species of fish (there are no populations of special-status fish species present in the reservoir), or significantly reduce populations of fish species having economic or social value, or adversely affect any habitat or other sensitive natural community. Therefore, the proposed project under 2003 and 2020 conditions will have a ***less-than-significant impact*** on San Luis Reservoir fisheries resources.

<u>Mitigation Measures</u>

None required.

ENDNOTES

1. Although legally defined as ending at the eastern end of Chipps Island, the Delta as it is used within this document refers to the limit of upstream tidal influence and downstream into the San Francisco Estuary, an area significantly larger than the legal description.

2. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

3. CDFG (California Department of Fish and Game) 2003d. Special Animals list, July 2003. Available online at: http://www.dfg.ca.gov/hcpb/species/lists.shtml

4. CDFG (California Department of Fish and Game) 2003a. California Natural Diversity Database, Commercial Version, Rarefind query results, information dated 5-5-2003.

5. CDFG (California Department of Fish and Game) 2003b. California Natural Diversity Database, Commercial Version, Rarefind query results, information dated 7-29-2006.

6. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

7. USFWS (U.S. Fish and Wildlife Service) 1995. Sacramento-San Joaquin Delta native fishes recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon.

8. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

9. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

10. BRT (Biological Review Team), 2005. Green Sturgeon (*Acipenser medirostris*) Status Review Update. Santa Cruz Laboratory, Southwest Fisheries Science Center, NOAA Fisheries.

11. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

12. CDFG (California Department of Fish and Game) 2002b. Sacramento winter-run Chinook salmon, Biennial Report 200-2001. Habitat Conservation Division, Native Anadromous Fish and Watershed Branch.

13. CDFG (California Department of Fish and Game) 2000e. Status of rare, threatened, and endangered animals and plants of California, 2000.

14. CDFG (California Department of Fish and Game) 2002b. Sacramento winter-run Chinook salmon, Biennial Report 200-2001. Habitat Conservation Division, Native Anadromous Fish and Watershed Branch.

15. CDFG (California Department of Fish and Game) 2003b. California Natural Diversity Database, Commercial Version, Rarefind query results, information dated 7-29-2006.

16. CDFG (California Department of Fish and Game) 2003b. California Natural Diversity Database, Commercial Version, Rarefind query results, information dated 7-29-2006.

17. Yoshiyama, R.M., F.W. Fisher, and P.B. Moyle. 1998. "Historical abundance and decline of Chinook salmon in the Central Valley region of California." N.Am. J. Fish. Mgmt. 18:487-521.

18. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

19. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

20. Yoshiyama RM, Gerstung ER, Fisher FW, Moyle PB. 1996. Historical and present distribution of Chinook salmon in the Central Valley drainage of California, pages 309-362. In: Sierra Nevada Ecosystem Project: final report to Congress, vol. III-Assessments, commissioned reports, and background information. Davis, CA: Centers for Water and Wildland Resources, University of California, Davis.

21. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

22. Anadromous Fish Restoration Program, 2006. Merced River – Watershed Information. Available online at: http://www.delta.dfg.ca.gov/afrp/ws_stats.asp? code=MERCR Accessed September 5, 2006.

23. Anadromous Fish Restoration Program, 2006. Merced River – Watershed Information. Available online at: http://www.delta.dfg.ca.gov/afrp/ws_stats.asp?code= STANR Accessed September 5, 2006.

24. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

25. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

26. McEwan D., and T.A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game, Inland Fisheries Division. April 1996.

27. McEwan D., and T.A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game, Inland Fisheries Division. April 1996.

28. Hallock RJ, Van Woert WF, Shapovalov L. 1961. An evaluation of stocking hatchery-reared steelhead rainbow trout (*Salmo gairdnerii gairdnerii*) in the Sacramento River system. CDFG Fish Bulletin. 114. 74 p.

29. Staley JR. 1976. American River steelhead. *Salmo gairdnerii gairdnerii*, management, 1956-1974. CDFG, Anadromous Fisheries Branch, Admin. Report 76-2, 41 pages.

30. McEwan D., and T.A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game, Inland Fisheries Division. April 1996.

31. McEwan D., and T.A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game, Inland Fisheries Division. April 1996.

32. Anadromous Fish Restoration Program, 2006. Merced River – Watershed Information. Available online at: http://www.delta.dfg.ca.gov/afrp/watersheds.asp STANR Accessed September 5, 2006.

33. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

34. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

35. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

36. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

37. CDFG (California Department of Fish and Game) 2000c. Longfin Smelt in San Francisco Bay. Central Valley Bay-Delta Branch. Available online at: http://www.delta.dfg.ca.gov/baydelta/monitoring/lf.asp

38. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

39. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

40. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

41. McEwan, Dennis and Jackson, and Terry. 1996. Steelhead Restoration and Management. Plan for California. California Department of Fish and Game, Sacramento.

42. CDFG (California Department of Fish and Game) 2003c. Threatened and endangered fishes – list and species accounts. Revised May 5, 2003. Available online at: http://www.dfg.ca.gov/hcpb/species/t_e_spp/tefish/tefisha.shtml

43. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

44. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

45. Kelly, R. 2003. Personal Communications. Phone conversation between Randy Kelly, CDFG Senior Fisheries Biologist, Region 4 and Demian Ebert, EIP Associates, on August 11, 2003 regarding the fishery of San Luis Reservoir.

46. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

47. Giusti, M. 2003. Personal Communications. Phone conversation between Michael Giusti, CDFG Assoc. Fisheries Biologist, Eastern Sierra Inland Deserts Region and Demian Ebert, EIP Associates, on August 11, 2003 regarding the fishery of Lake Perris.

48. California Department of Water Resources 1999. Bulletin 132-98, Management of the California State Water Project – Calendar Year 1998.

49. CDFG (California Department of Fish and Game) 2003a. California Natural Diversity Database, Commercial Version, Rarefind query results, information dated 5-5-2003.

50. California Department of Water Resources 1999. Bulletin 132-98, Management of the California State Water Project – Calendar Year 1998.

51. CDFG 2006. Striped bass abundance indices. Available online at: http://www.delta.dfg.ca.gov/Data/stbass/ Accessed June 27, 2006.

52. U.S. Department of the Interior. 2003. *Federal Register* 68:55139; September 22, 2003.

53. CDFG (California Department of Fish and Game) 2000f. California's plants and animals – Threatened and Endangered fishes, list and species accounts. Habitat Conservation Planning Branch. Available online at: http://www.dfg.ca.gov/hcpb/species/t_e_spp/tefish /tefisha.shtml

54. CDFG (California Department of Fish and Game) 2003d. Special Animals list, July 2003. Available online at: http://www.dfg.ca.gov/hcpb/species/lists.shtml

55. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

56. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

57. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

58. Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern of California. Final report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

59. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

60. CDFG (California Department of Fish and Game) 2003b. California Natural Diversity Database, Commercial Version, Rarefind query results, information dated 7-29-2006.

61. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

62. Seesholtz A, Cavallo BJ, Kindopp J, Kurth R. 2004. Juvenile fishes of the lower Feather River: distribution, emigration patterns, and associations with environmental variables. In: Feyrer F, Brown LR, Brown RL, Orsi JJ, editors. Early life history of fishes in the San Francisco Estuary and watershed. American Fisheries Society, Symposium 39, Maryland. P 141-166.

63. CDFG (California Department of Fish and Game) 2002b. Sacramento winter-run Chinook salmon, Biennial Report 200-2001. Habitat Conservation Division, Native Anadromous Fish and Watershed Branch.

64. Anadromous Fish Restoration Program, 2006. Available online at: http://www.delta.dfg.ca.gov/afrp/watersheds.asp

65. LPOC (Lake Perris Operational Committee) 2001. Memorandum of understanding regarding recreation, fish and wildlife, water supply, quality and operations at Lake Perris and Silverwood Lake facilities of the State Water Project.

66. LPOC (Lake Perris Operational Committee) 2003. Lake Perris operations guidelines, Effective date June 9, 2003.

67. LPOC (Lake Perris Operational Committee) 2003. Lake Perris operations guidelines, Effective date June 9, 2003.

68. CDFG (California Department of Fish and Game) 2002a. Striped Bass Information page, Archived questions of the month (10/2/2002). Available online at http://www.delta.dfg.ca.gov/stripedbass/ QuestionoftheMonth.asp?quid=0. Accessed March 21, 2006.

69. IEP (Interagency Ecological Program). 2004. IEP Newsletter. Available online at http://www.delta.dfg.ca.gov/afrp/SWRCB/3.%20Bryant%20&%20Souza_2004.pdf. Volume 17, Number 2, Spring 2004.

70. IEP (Interagency Ecological Program). 2004. IEP Newsletter. Available online at http://www.delta.dfg.ca.gov/afrp/SWRCB/3.%20Bryant%20&%20Souza_2004.pdf. Volume 17, Number 2, Spring 2004.

71. CDFG (California Department of Fish and Game) 2000c. Longfin Smelt in San Francisco Bay. Central Valley Bay-Delta Branch. Available online at: http://www.delta.dfg.ca.gov/ baydelta/monitoring/lf.asp

72. All data obtained from the CDFG Bay-Delta Program, Salvage ftp site. Available online at: http://www.delta.dfg.ca.gov/Data/Salvage/

73. The term “induced” used in this context and throughout the impact section refers to when pumping at Banks Pumping Plant continued at a higher rate as a result of additional exports related to the proposed project.

74. Moyle, Peter B. 2002. *Inland fishes of California*. Berkeley: University of California Press.

75. LPOC (Lake Perris Operational Committee) 2003. Lake Perris operations guidelines, Effective date June 9, 2003.

76. Kelly, R. 2003. Personal Communications. Phone conversation between Randy Kelly, CDFG Senior Fisheries Biologist, Region 4 and Demian Ebert, EIP Associates, on August 11, 2003 regarding the fishery of San Luis Reservoir.