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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA

NATURAL RESOURCES DEFENSE COUNCIL, *et al.* Plaintiffs, v. DIRK KEMPTHORNE, Secretary, U.S. Department of the Interior, *et al.* Defendants. SAN LUIS & DELTA-MENDOTA WATER AUTHORITY and WESTLANDS WATER DISTRICT; CALIFORNIA FARM BUREAU FEDERATION; GLENN-COLUSA IRRIGATION DISTRICT, *et al.*; CALIFORNIA DEPARTMENT OF WATER RESOURCES, and STATE WATER CONTRACTORS, Defendant-Intervenors.	Case No. 05-CV-01207 OWW TAG DECLARATION OF CHRISTINA SWANSON, Ph.D. IN SUPPORT OF PLAINTIFFS' PROPOSED INTERIM REMEDIES Date: August 21, 2007 Time: 9:00 a.m. Courtroom: 3 Judge: Hon. Oliver W. Wanger

I, Christina Swanson, declare as follows:

1. I am a fisheries biologist with over 15 years of experience working with Sacramento-San Joaquin watershed fish species, including fourteen years as a full-time or part-time researcher at the University of California, Davis and eight years with The Bay Institute. I received a bachelor's degree in Biology from Cornell University and a Ph.D. in Biology from University of California, Los Angeles. Throughout my professional career, I have conducted applied research and published numerous scientific journal articles and technical memoranda on temperature tolerances, habitat requirements and environmental management of delta smelt, impacts of water diversions on native fishes, and development of fish screen design and operational criteria. I currently serve on the California Bay-Delta Authority's Adaptive Management Planning Team for Delta ecosystem restoration. In 2003, I was appointed by the National Marine Fisheries Service to the Central Valley Technical Recovery Team, a team of scientists charged with developing recovery criteria and strategies for Endangered Species Act-listed salmonids in the watershed. I was awarded the Distinguished Professional Achievement Award by the California-Nevada chapter of the American Fisheries Society in 2003 and was elected President of the chapter for 2004-2005. I have previously been recognized as an expert in fish biology by this Court in *Save San Francisco Bay Ass'n v. U.S. Dept. of Interior*, CIV-F-97-6140, CIV-F-98-5261.

2. Delta smelt have been a consistent focus of my research, as indicated by my *Curriculum Vitae* (a copy of which is appended hereto for the Court's convenience. I have authored or co-authored eight peer-reviewed articles and more than a dozen additional articles and technical papers and have delivered eighteen related presentations on the species at various regional, national and international conferences. In October 2006, I attended the 4th Biennial CALFED Science Conference, where I delivered a presentation on Delta ecosystem restoration and attended numerous sessions presenting the latest science on the pelagic organism decline in the Delta and the impacts of CVP/SWP project operations on the Delta ecosystem and delta smelt. In 2007, I co-authored two letters with Dr. Peter B. Moyle of the University of California, Davis, that were submitted to the state and federal fisheries and water project agencies suggesting the need for additional protection for the species and making specific recommendations for water project operational changes to

reduce project related mortality and improve delta smelt habitat conditions (true copies of both letters are attached as Exhibits A and B). The discussion that follows accurately reflects my understanding of the best available science on delta smelt and of the information reported in recent meetings and teleconferences regarding the species' status, recommended protection actions, and resultant water management operations. I have personally reviewed all of the referenced literature, and I have attached a list of references along with true and correct copies of meeting notes cited herein for the Court's convenience.

3. Delta smelt are found only in the upper reaches of California's San Francisco Bay-Delta Estuary. In the estuary, the species is monitored for its abundance and distribution by four independent surveys conducted by the California Department of Fish and Game ("CDFG"). The 20-mm survey collects larval and young juvenile delta smelt during the March-July period. The summer townet survey ("TNS"), from which one of two delta smelt abundance indexes is calculated, collects juvenile delta smelt during the early summer (June-July). The fall midwater trawl ("FMWT"), from which the second delta smelt abundance index is calculated, collects sub-adult and adult delta smelt during the September-December period. The recovery index used by the U.S. Fish and Wildlife Service ("USFWS") in their delta smelt risk assessment matrix ("DSRAM") is also calculated from the September and October results of the FMWT survey. The spring kodiak trawl survey collects adult delta smelt during the spawning season (January-February). Table 1 and Figure 1 below, created by me using data publicly available on the CDFG website and in Delta Smelt Working Group ("DSWG") notes, summarizes recent and historical delta smelt abundance data from the CDFG surveys.

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Table 1. Abundance of delta smelt since 1967 as measured by the California Department of Fish and Game spring kodiak trawl survey ("kodiak" are spawning adult delta smelt,; the survey measures the total number of delta smelt caught), 20-mm survey (20-mm, larval and juvenile delta smelt, total number of delta smelt collected in first eight surveys), summer townet survey (TNS Index, juvenile delta smelt, abundance index), fall mid water trawl survey (FMWT Index, adult delta smelt, abundance index), and the USFWS recovery index (calculated from FMWT data). *=lowest on record. **=second lowest on record. ***=third lowest on record. ND=survey not conducted for that year. NA= data not yet available. Data sources: California Department of Fish and Game, DSWG 5/14/07 Meeting Notes, DSWG 5/15/07 Briefing Statement (attached as Exhibits C and D).

Year	Kodiak	20-mm	TNS Index	FMWT Index	USFWS Recovery Index	Comments
1967	ND	ND	ND	414	139	
1968	ND	ND	ND	696	251	
1969	ND	ND	2.5	315	128	
1970	ND	ND	32.5	1673	598	
1971	ND	ND	12.5	1303	352	
1972	ND	ND	11.1	1265	551	
1973	ND	ND	21.3	1145	305	
1974	ND	ND	13.0	ND	ND	
1975	ND	ND	12.2	697	239	
1976	ND	ND	50.6	360	22	
1977	ND	ND	25.8	481	146	
1978	ND	ND	62.5	572	108	
1979	ND	ND	13.3	ND	ND	
1980	ND	ND	15.8	1653	312	
1981	ND	ND	19.8	374	78	
1982	ND	ND	10.7	330	37	
1983	ND	ND	2.9	132	17	
1984	ND	ND	1.2	182	51	
1985	ND	ND	0.9***	110	29	
1986	ND	ND	7.9	212	70	
1987	ND	ND	1.4	280	72	
1988	ND	ND	1.2	174	67	
1989	ND	ND	2.2	366	76	
1990	ND	ND	2.2	364	81	
1991	ND	ND	2.0	689	171	
1992	ND	ND	2.6	156	26	
1993	ND	ND	8.2	1078	400	Delta smelt listed as threatened under ESA
1994	ND	ND	13	102	19**	
1995	ND	598***	3.2	899	252	1995 Biological Opinion released
1996	ND	3413	11.1	127	28	
1997	ND	1807	4.0	303	62	
1998	ND	587**	3.3	420	169	
1999	ND	2231	11.9	864	322	
2000	ND	2469	8	756	265	After modest recovery in 1990s, delta smelt abundance begins decline
2001	ND	1020	3.5	603	314	
2002	891	621	4.7	139	33	
2003	681	621	1.6	210	101	
2004	951	651	2.9	74***	25	
2005	493***	720	0.3*	26*	4*	2005 Biological Opinion released; record low TNS, FMWT and Recovery Indexes
2006	287*	1084	0.4**	41**	21***	FMWT abundance index 93% lower than 1993-2000 average
2007	398**	98*	NA	NA	NA	2005 Biological Opinion invalidated; larval and juvenile numbers drop 90% from 2006

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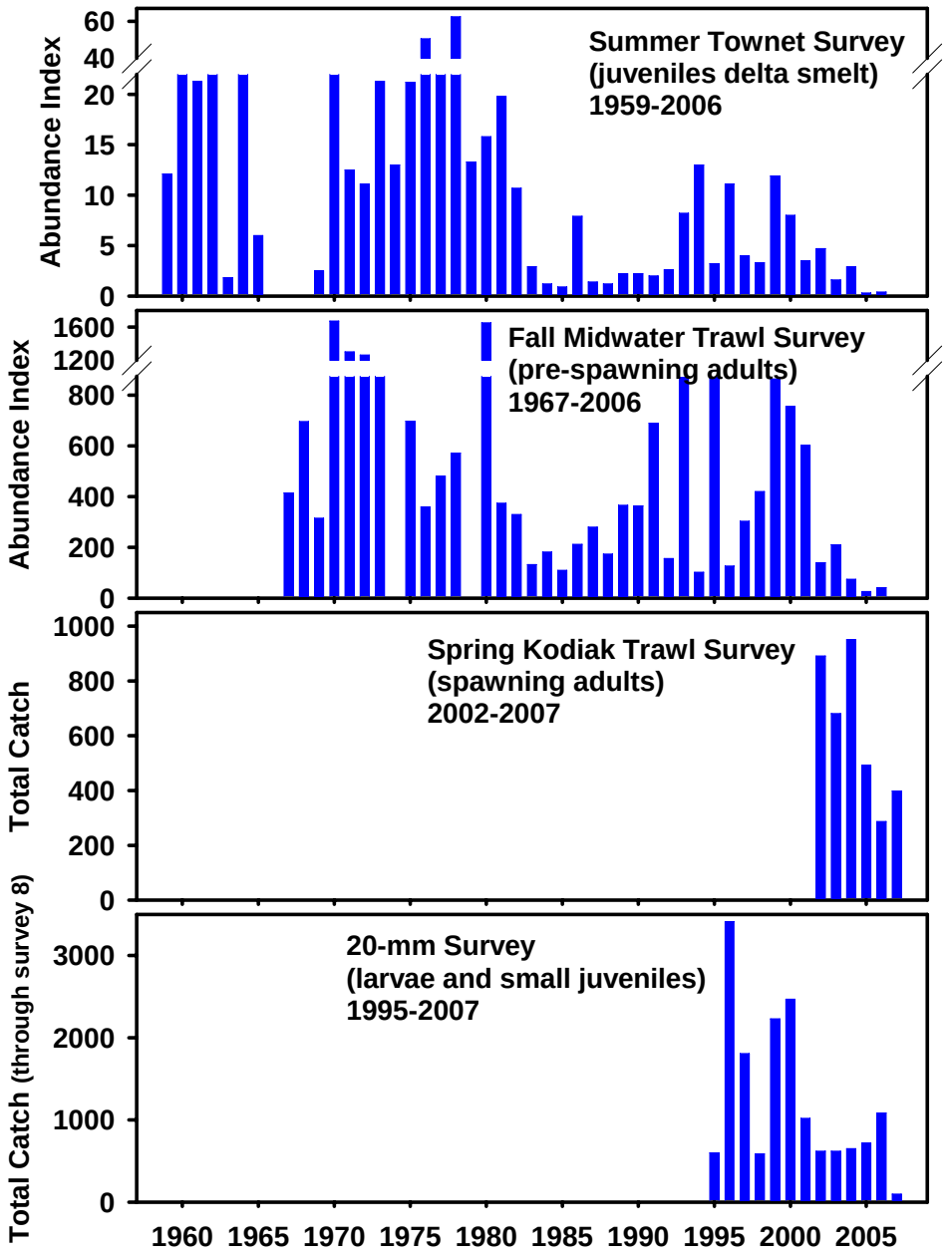

Figure 1. Graphic representation of the data contained in Table 1.

4. As recently as thirty years ago, the delta smelt was one of the most common and abundant of the pelagic fishes in the estuary. In the early 1980s, its population declined by more than 80 percent, leading to threatened listings under both the federal and state Endangered Species Acts in 1993. During the 1990s, delta smelt abundance fluctuated and then increased in response to improved habitat conditions following the 1987-1992 drought. The species' abundance began to

decline again in the 2000s. In 2002, delta smelt abundance declined drastically, dropping more than 80 percent from average levels measured during the previous three years. In 2005, abundance of delta smelt measured by the FMWT fell to its second consecutive record low and was just 2.4 percent of the abundance measured when the species was listed under the state and federal Endangered Species Acts in 1993. In 2006, neither the FMWT nor TNS abundance indexes showed any meaningful improvement. In early 2007, results from the 20-mm survey indicated that the already low delta smelt population had again dropped by 90 percent.

5. Delta smelt are environmentally sensitive because of their short life span, limited diet, low fecundity for a fish producing planktonic larvae, poor swimming ability, and the limited geographic range of suitable habitat at the interface between salt and fresh water in the estuary. In addition to these characteristics, the species is highly vulnerable to extinction because of its present small population size. As noted by Moyle (2002), a substantial population is necessary to keep delta smelt from becoming extinct. In 2004, USFWS reported that delta smelt had fallen to an "unprecedented low number" (USFWS 2004). For the past three consecutive years, the population abundance of the species has been at record low levels according to multiple independent surveys conducted by CDFG. Population viability and extinction risk analyses reported by Bennett (2005) predicted a 26-30 percent probability that the delta smelt population would fall to just 800 fish (compared to the recent record low population of an estimated 25,000 fish in 2005) in the next 20 years. These high probabilities of extinction for delta smelt exceed criteria established by the International Union for Conservation of Nature and Natural Resources for an "endangered" species.

6. Multiple factors are thought to be contributing to the continuing population decline of the species, including reductions in freshwater inflows and outflows to the estuary; direct and indirect adverse impacts of Delta water diversions and exports; effects of water management operations on estuarine habitat quality; reductions in abundance of prey food organisms; lethal, sub-lethal and indirect effects of toxic substances; disease, competition, and predation; and loss of genetic integrity. Delta smelt also exhibit a strong stock recruitment relationship, meaning that the abundance of adult fish measured in the fall is strongly dependent on the abundance of juvenile fish surveyed earlier in the year; when juvenile abundance is low, the abundance of adults measured later

in the year will also be low. Likewise, the abundance of juvenile fish is strongly dependent on the numbers of adult fish that produced them; when abundance of adult fish is low, the abundance of juvenile fish measured the following summer will also be low. In recent years, the low and declining abundances of the juvenile and adult delta smelt life stages has contributed to the low and declining population of the species (Figure 2).

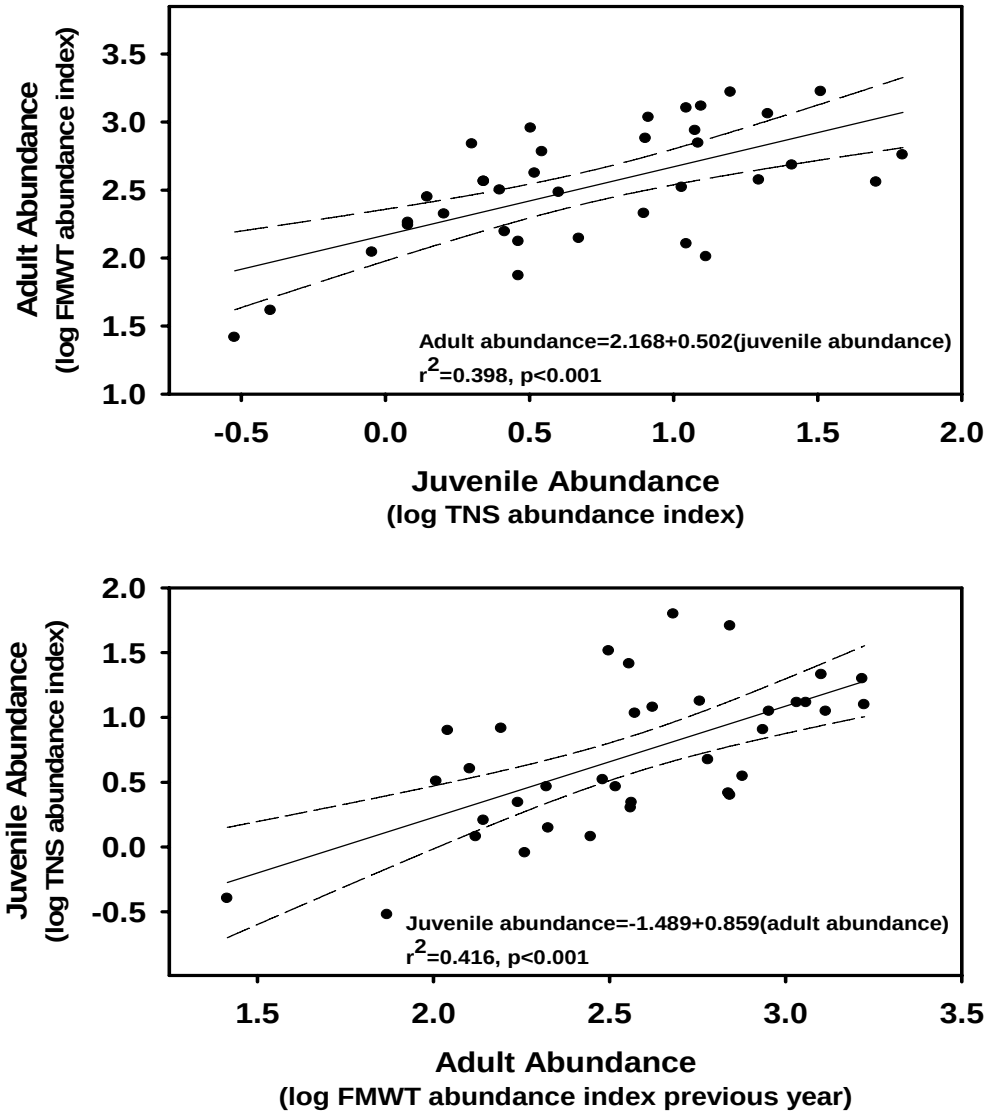

Figure 2. The relationship between the abundance of adult delta smelt (log FMWT Index) and the abundance of juvenile measured earlier in the same year (log TNS Index) (top panel) and between the abundance of juvenile delta smelt (log TN Index) and the abundance of the adult fish that produced them (log FMWT Index for the previous year) (bottom panel). Regression line and 95 percent confidence interval are shown for each plot. Regression equation and associated statistics are shown with each graph. Data are for 1969 to 2006. Data source: California Department of Fish and Game.

7. Recent analyses by scientists with the California Department of Water Resources ("CDWR") indicate that overall habitat quality and the area of habitat in the estuary suitable for delta smelt have declined during the past fifteen years (Feyrer *et al.* 2007). Using water temperature, salinity, turbidity and delta smelt catch data from the CDFG FMWT survey, these scientists constructed an "environmental quality" index that related those environmental factors to the presence of delta smelt. Their results showed a long-term decline in fall habitat quality since the early 1990s and a more recent, sharp decline in the 2000s, coincident with the recent precipitous decline in the delta smelt population (Figure 3). The decline in habitat quality was largely driven by reduced freshwater outflows and resultant increased salinity in the western Delta (*i.e.*, X2, the location of the two parts per thousand low salinity zone and a commonly used surrogate measurement for freshwater outflow from the Delta into the upper Bay, was located farther upstream).

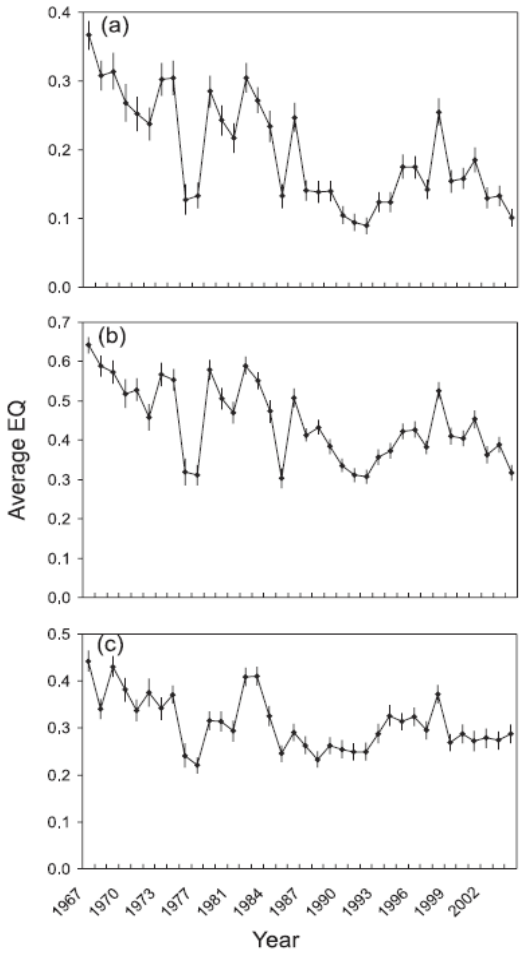

Figure 3. Overall habitat quality, as measured by the "environmental quality" (EQ) index developed by Feyrer *et al.* 2007 for delta smelt (middle panel) has declined. Source: Feyrer et al. 2007, Figure 5.

8. Scientists from the Contra Costa Water District (Guerin *et al.* 2006) found that this decline in habitat quality due to reduced fall freshwater outflows into the Delta significantly and negatively affected delta smelt abundance. These researchers found that, since the late 1980s, low freshwater outflows and associated elevated western Delta salinity during the fall correspond to consistently low population abundance of juvenile delta smelt measured by CDFG's townet survey the following year. Reduced outflows result in higher salinity in the Delta, adversely affecting delta smelt habitat and, conversely, providing favorable conditions for the invasive overbite clam, which is thought to compete with delta smelt for planktonic food. Guerin *et al.* also reported that the frequency of occurrence of reduced fall freshwater outflows and elevated salinity in the Western Delta had increased during the past ten years (Figure 4).

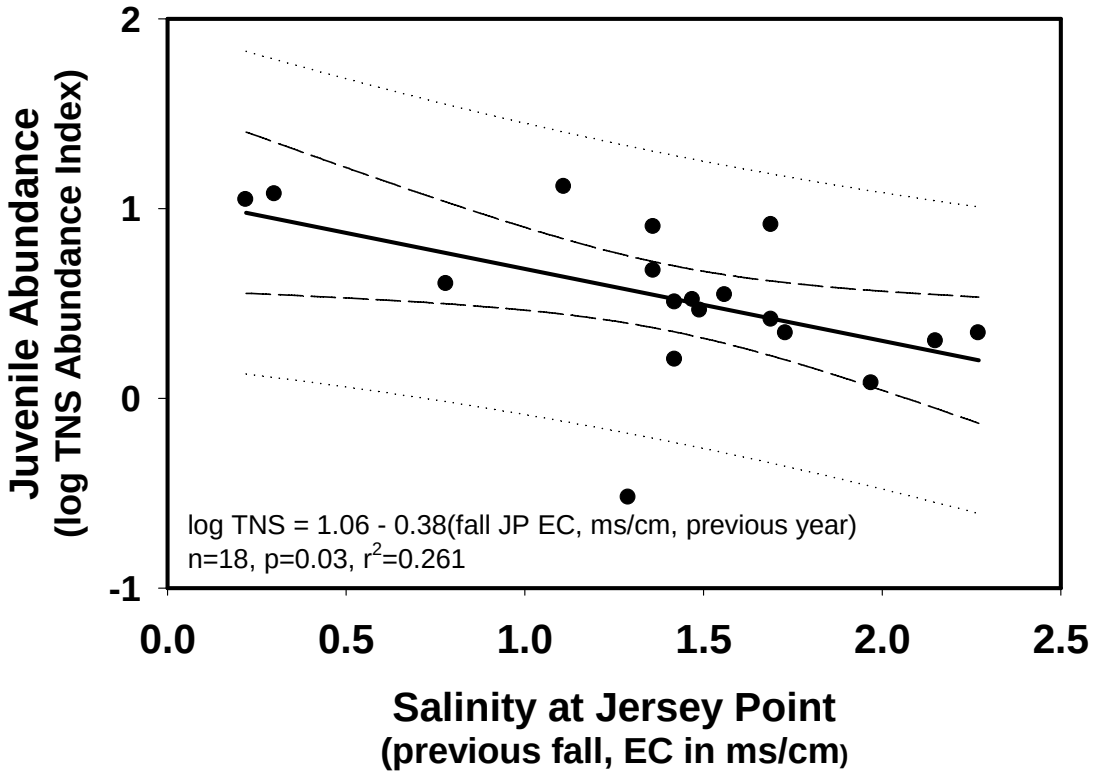

Figure 4. The relationship between fall salinity in the western Delta (Jersey Point EC [ms/cm], October-December) and abundance of juvenile delta smelt measured the following year (log TNS Abundance Index). Data are for 1988-2005. Regression equation and associated statistics, 95 percent confidence limits and the prediction limits are shown with the graph. Data sources: California Department of Fish and Game, Contra Costa Water District.

9. Seasonal water exports from delta smelt critical habitat (i.e., the Delta) by the State Water Project ("SWP") and the federal Central Valley Project ("CVP") in the current decade are as much as 48 percent higher than in the early 1990s (Figure 5). The recent decline of delta smelt coincides with these significant increases in Delta water exports during the winter and early spring, the period when the species moves into the Delta to spawn; higher incidental take of delta smelt at the export facilities (Figure 6); and concomitant increased alterations in internal Delta flow patterns, in particular reversed flows (or negative flows, where the net water flow is in the upstream direction rather than in the normal downstream direction) in the two main channels, Old and Middle Rivers, leading directly to the SWP and CVP pumps (Figure 7).[1] Herbold *et al.* 2005, Smith *et al.* 2006, Ruhl *et al.* 2006. During the 2002-2005 period when the delta smelt population collapsed, Old and Middle River reverse flows averaged -8,539 cfs in January, -7,473 cfs in February, and -6,382 cfs in March. In many winter months during this period, reverse flows were the highest (*i.e.*, most negative) ever measured. Hydrodynamic analyses of Delta flows and exports using the CDWR particle tracking model indicate that virtually all larval and juvenile delta smelt present in the southern regions of the Delta, the part of the species' critical habitat closest to the pumps, are likely to be entrained and lost under flow and export conditions similar to those measured in the Delta during the past six years. Herbold *et al.* 2005. Other recent analyses (Simi and Ruhl 2005, Ruhl *et al.* 2006) showed that the numbers of delta smelt taken at the SWP and CVP pumps was directly related to the magnitude of reverse flows on Old and Middle Rivers: the higher the magnitude of the reverse flow, the greater then number of delta smelt killed at the pumps (Figure 8).

10. In 2003, CDFG expressed concern that entrainment of delta smelt at the CVP and SWP could be a major source of population impacts and estimated losses of juvenile delta smelt to SWP and CVP operations range from 11 to 46 percent of the population every year (CDFG 2003). In that same year, direct loss of adult delta smelt at the pumps in relation to the species' population

[1] Flows on Old and Middle Rivers are influenced by several factors, including SPW and CVP export rates (higher exports result in higher magnitude reverse flows), San Joaquin River inflows to the Delta (low San Joaquin River inflows result in higher magnitude reverse flows), operation of the Head of Old River Barrier (reverse flows are worse when the barrier is installed and closed), and the operations of the three south Delta agricultural barriers (reverse flows are worse when the barriers are installed and their flap gates closed to operate tidally).

reached its highest level in more than ten years (Herbold *et al.* 2005; Figure 6, bottom panel) and was comparable to the high incidental take levels measured in the early 1980s, which are implicated in the first population decline measured for the species (Bennett 2005).

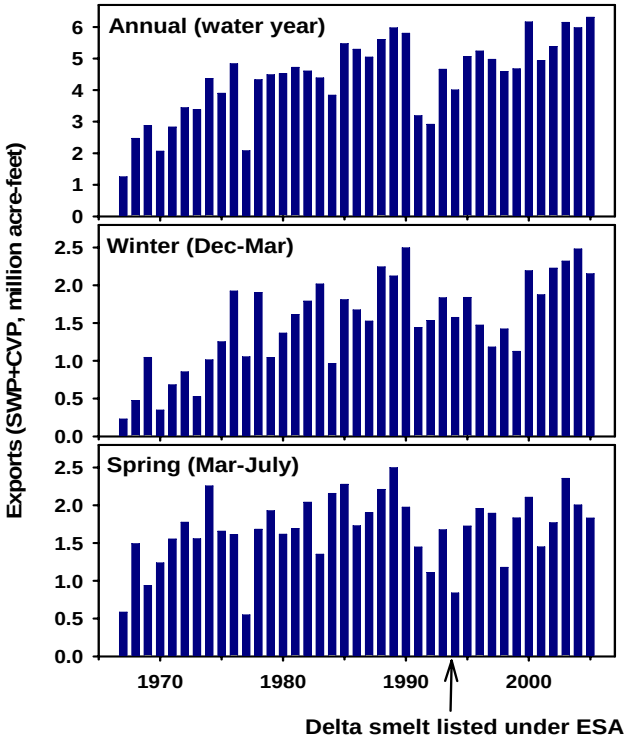

Figure 5. Combined water exports (million acre-feet, MAF) of the Central Valley Project and the State Water Project from 1967-2006. The upper panel shows total export volumes for each water year. The middle panel shows exports for the winter period (December-March). The lower panel shows springtime exports (March-July). Data source: California Department of Water Resources, Dayflow.

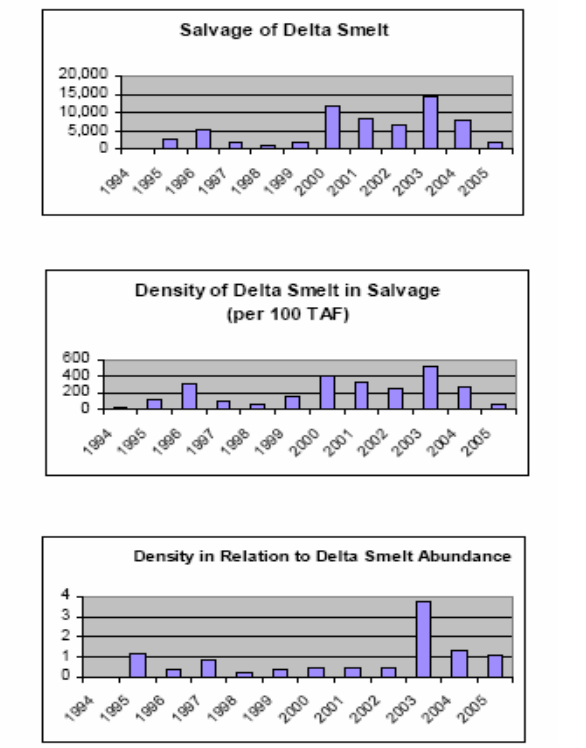

Figure 6. Recent patterns in incidental take (or salvage) of delta smelt during the November-March period. Top panel: total salvage (# fish); middle panel: salvage density (# of fish/thousand acre-feet); and bottom panel: salvage density in relation to preceding FMWT abundance Index (salvage density/FMWT Index previous year). Source: Herbold *et al.* 2005, Figure 3.

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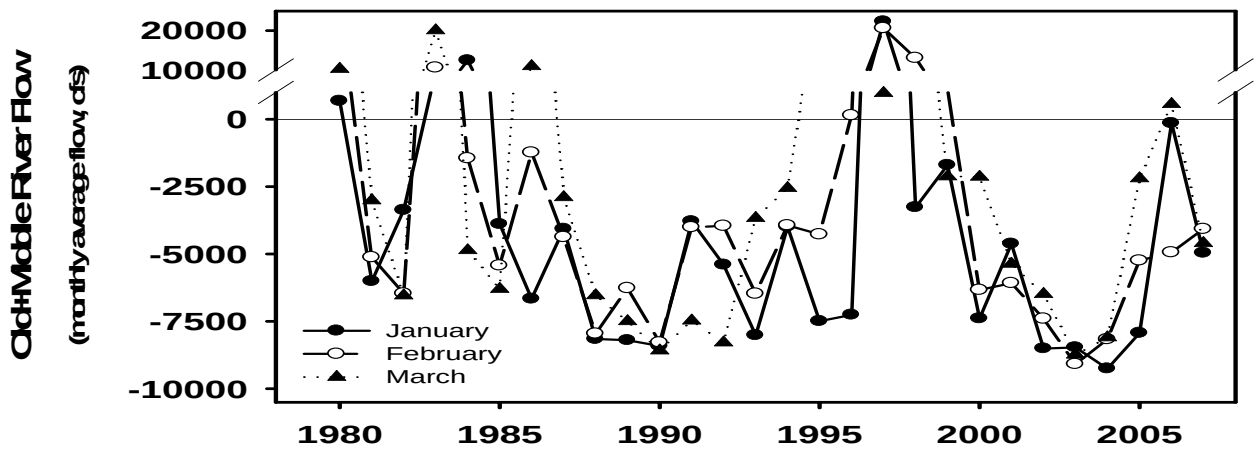


Figure 7. Trends in combined Old and Middle River flows (cfs) during delta smelt spawning season (January-March) from 1980-2007. Each point is the monthly average flow. Data sources: U.S. Geological Survey and Contra Costa Water District.

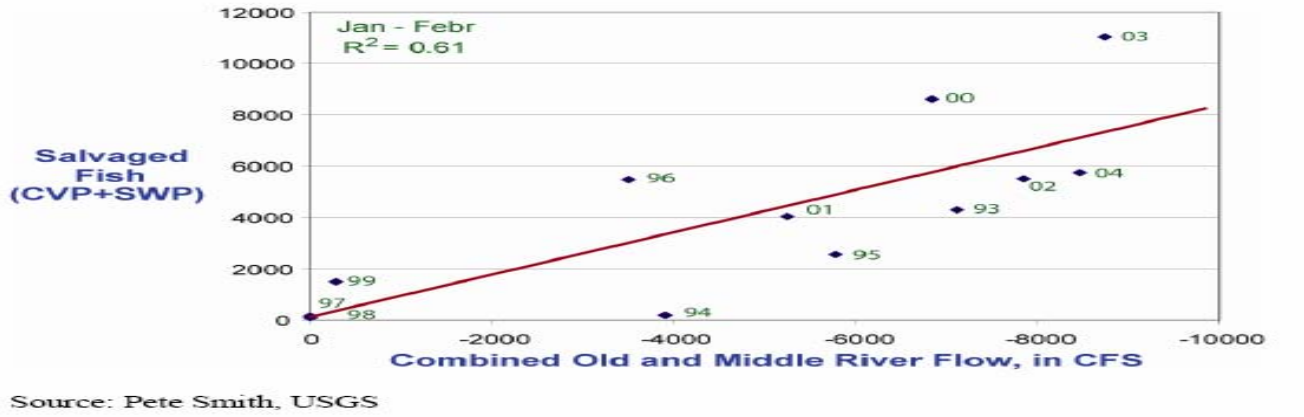


Figure 8. The relationship between numbers of delta smelt taken at the SWP and CVP export facilities and combined Old and Middle River flows (cfs). Delta smelt take increases linearly with increasing magnitudes of negative flow on Old and Middle Rivers. Source: DSWG notes, October 10, 2006, Attachment 2 (a true and correct copy of these notes is attached as Exhibit T).

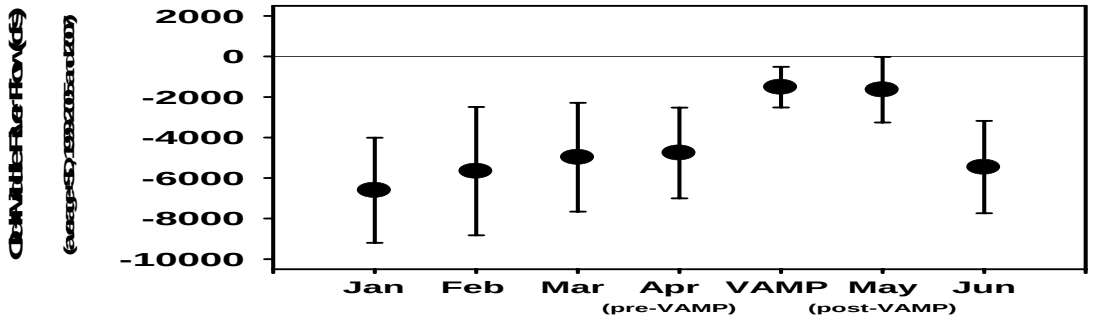


Figure 9. Average (+1 standard deviation) flows on Old and Middle Rivers (combined) during the months preceding and following the Vernalis Adaptive Management Program (VAMP) for the past eight years (1999-2005 and 2007; 2006 has been excluded from this analysis because it was very wet year in which Old and Middle River flows were generally positive). Data sources: U.S. Geological Survey and Contra Costa Water District.

11. Current science suggests that the seasonal timing of increased exports is a key factor in the species' recent decline. Armor *et al.* 2005, Armor 2006, Bennett 2006, Herbold *et al.* 2005, Herbold *et al.* 2006. The latest research by Dr. William Bennett of the University of California, Davis, summarized by Bennett at the October 2006 CALFED Conference, showed that larger adult delta smelt migrated into the Delta, became reproductively mature, and spawned earlier in the season than smaller fish in the population. However, despite clear evidence of reproductive readiness and spawning by these fish in March and early April, as well as results from CDFG 20-mm surveys showing larval delta smelt present in the Delta in March and early April,[2] Bennett reported that virtually none of the early hatched larvae survived to contribute to the delta smelt population. The *only* delta smelt that survived until the summer and were collected by summer and fall CDFG surveys were those hatched during the 31-day period in April and May when San Joaquin River inflows to the Delta were increased and SWP and CVP exports were curtailed as required by the State Water Resources Control Board to meet seasonal water quality objectives for fish and wildlife beneficial uses (*i.e.*, the Vernalis Adaptive Management Program, or "VAMP"), which is usually implemented from April 15 to May 15 (http://www.sjrg.org/background.htm).

12. Bennett concluded that the high export rates, low San Joaquin River inflows and associated high magnitude reverse flows on Old and Middle Rivers in the months prior to and after the VAMP were the major contributors to this massive recruitment failure observed in recent years. The mechanism for the species' recruitment failure was the lethal entrainment of both the early spawning adults and, although not reported as incidental take, their larvae and young juvenile offspring. He further concluded that the repeated, near total loss of the most productive and robust component of the delta smelt population was a major contributor to the species' recent precipitous population decline during the 2000s. Bennett also found that the VAMP, as currently implemented, provides little or no real benefit to this important cohort of the delta smelt population because it is

[2] The CDFG spring kodiak trawl survey detected "spent" female delta smelt (i.e., female fish that have completed spawning) in early March in 2002 (survey #3), in mid-February in 2003 (survey #1), in the second week of March in 2004 (survey #3) and in late February in 2005 (survey #2). The CDFG 20-mm survey detected larval delta smelt in early April in 2002 (survey #2), late March in 2003 (survey #1), late March and Early April in 2004 (survey #1), and in mid-March in 2005 (survey #1). I accessed the results of each of these surveys from the CDFG Delta Branch website at http://www.delta.dfg.ca.gov/.

implemented too late in the spring to protect either the early spawning adults or their progeny. Bennett *et al.* 2006.

13. In 1993, when the delta smelt was listed as threatened under both the state and federal Endangered Species Acts, the USFWS identified 21 major federal, state, local or private organization proposals for increased exports (USFWS 1993. 58 Fed.Reg. 12854-12864). By 2006, the multiple scientific analyses described above clearly documented that modification and destruction of delta smelt habitat by adverse alteration in freshwater inflows, freshwater outflows, and water exports and diversions had increased significantly since 1993. During the past several years, the magnitudes of these harmful impacts have reached higher levels than have been recorded during the entire 48-year period for which data on delta smelt population abundance exist.

14. As evidenced by the delta smelt's current status and imminent risk of extinction, the measures included in the 1995 Biological Opinion and the 2005 Biological Opinion have clearly been insufficient to protect, much less recover, the species. These measures and the limited protection actions implemented to date have failed to prevent further degradation of delta smelt habitat (*e.g.*, reduced fall outflows, discussed above (¶ 7) and in Feyrer *et al*. 2007) or to prevent increased water project operation-related morality to the fish.

15. Further, in recent years, many of the specific protection actions recommended by the USFWS' own DSWG, a team of scientists that includes representatives from federal and state fisheries and water project agencies, have not even been implemented. In 2005, for example, two out of three recommendations for protective actions made by the DSWG based on the risk criteria in the DSRAM were not implemented by the state and federal water project agencies in the form recommended by DSWG (despite adequate water assets in the Environmental Water Account). In January of 2005, at least three of the risk criteria were exceeded, and the monthly incidental take limit was nearly exceeded before an export reduction was implemented, an inexplicable delay given the high level of concern based on the then record low FMWT Index. When the reduction was finally implemented, neither the recommended export level nor duration of export reduction was implemented by the Water Operations Management Team ("WOMT"), which opted instead for a smaller and shorter export curtailment. Later in the spring, the DSWG-recommended export level

for the 31-day VAMP was rejected by the WOMT, which allowed for exports 50 percent greater than the recommended level. Three weeks later, the SWP unilaterally discontinued its export curtailment before the VAMP period was concluded. The following summer, the abundance of juvenile delta smelt reached a record low and, when adult fish were surveyed in the fall, their numbers were also at new record lows. Poage 2005.

16. In May 2007, early results of the CDFG 20-mm survey indicated that the delta smelt population, as measured by the total number of larval and juvenile delta smelt collected by the survey to that date, had dropped by more than 90 percent compared to numbers of young delta collected during previous years. In response to these new data, the DSWG submitted a briefing statement to the WOMT declaring that the species had "become critically imperiled" and an "emergency response is warranted." Based on the recent research results described above, as well as ongoing fish distribution, salvage, water quality monitoring results, and results of particle tracking modeling exercises conducted by CDWR scientists to simulate flow, exports, and potential fish salvage, the DSWG recommended that water project operations be modified to achieve "non-negative" flows in Old and Middle River. The objective was to prevent "further entrainment" of delta smelt into the SWP and CVP facilities and into the southern Delta (Exhibit D (DSWG 5/15/07 Briefing Statement)). The DSWG also specified that this protection action be implemented until southern Delta temperatures reached 25 degrees centigrade.

17. In response to the recommendation, water management operations were slightly adjusted but the DSWG-recommended objective of non-negative flows was not achieved until more than one week later (and then it was achieved for only a single day). Based on regularly updated flow, water temperature, and delta smelt salvage data, the DSWG repeated their recommendation several times in subsequent weeks (May 22 Data Assessment Team ("DAT") teleconference summary (Exhibit E), May 30 DAT teleconference summary (Exhibit F), and June 5 DAT teleconference summary (Exhibit G)). However, with the exception of three non-consecutive days in early June, the DSWG- recommended protective action was not implemented and reverse flows in Old and Middle Rivers persisted. Throughout this period, water temperatures remained below 25 degrees centigrade and nearly 500 delta smelt were killed at the SWP and CVP water export

facilities, compared to the fewer than 50 delta smelt that had been collected by CDFG in more than two months of sampling to that date.

18. On June 12, the DSWG recommended exports be increased unless any delta smelt were taken at either facility (June 12 DAT teleconference summary, Exhibit H). The following day, more than 50 delta smelt were killed at the export facilities and, contrary to the DSWG recommendation that exports be immediately reduced if delta smelt were taken, exports were instead increased to levels greater than the specified 2,500 cfs.

19. On June 19, based on the continued take of delta smelt, the DSWG again recommended project operations be modified to achieve non-negative flows on Old and Middle Rivers (June 19 DAT teleconference summary, Exhibit I). The recommendation was not implemented and instead reverse flows worsened, exceeding -4,000 cfs within days. Delta smelt take increased, exceeding more than 900 total fish within days. By the end of June, nearly 2,000 delta smelt had been taken and reverse flows on Old and Middle River were approaching -6,000 cfs. With the exception of single day in June, water temperatures remained below 25 degrees centigrade. On July 1, despite that fact that south Delta water temperatures remained well below the 25 degrees centigrade criterion and delta smelt salvage continued, combined SWP and CVP exports were nearly doubled, reverse flows exceeded -9,000 cfs, and hundreds more delta smelt were taken.

20. On July 3, the DSWG again recommended that water project operations be modified, this time to achieve Old and Middle River flows of -5,000 cfs (July 3 DAT teleconference summary, attached as Exhibit J). This recommendation was not implemented, exports remained at maximum levels, Old and Middle River flows exceeded -10,000 cfs, and delta smelt continued to be salvaged.

21. Between May 1 and July 19, 2007, 2,648 juvenile delta smelt have been reported killed at the SWP and CVP water export facilities, compared to a total of 136 delta smelt collected by the CDFG 20 mm survey during more than three months of sampling (7/17/07 DAT teleconference summary, attached as Exhibit X). Table 2 below shows the daily combined Old and Middle River flow, water temperature, SWP and CVP exports, and cumulative delta smelt salvage data for May 1, 2007 to July 19, 2007.

Table 2. Data are from the USGS (Old and Middle River flow), California Data Exchange Center (temperature, calculated as specified by the DSWG in their notes), the U.S. Bureau of Reclamation's Central Valley Operations monthly reports (delta smelt salvage and export rates for May, June and July 2007, attached as Exhibits K, L, and M)

Date (2007)	Old+Middle River (cfs)	Temperature (degrees centigrade)	Exports (SWP+CVP)	Cumulative Salvage (since May 1, 2007)	Comments and DSWG Recommendations for protection of delta smelt
May 1	-2,176	19.8	1,380	12	
May 2	-2,028	19.5	1,432	12	
May 3	-1,765	18.7	1,525	12	
May 4	-1,790	18.3	1,522	12	
May 5	-1,148	18.2	1,519	12	
May 6	-1,503	18.4	1,528	12	
May 7	-1,774	19.1	1,372	12	
May 8	-1,548	20.0	1,429	12	
May 9	-1,112	20.6	1,504	12	
May 10	-949	20.7	1,385	24	
May 11	-1,346	20.6	1,387	72	
May 12	-1,413	20.1	1,379	72	
May 13	-1,301	20.1	1,637	84	
May 14	-1,990	20.5	1,505	84	
May 15	-1,992	20.6	1,374	84	DSWG: 0 cfs on Old and Middle River
May 16	-2,030	20.6	1,154	84	
May 17	-1,932	20.6	1,130	84	
May 18	-1,638	20.7	1,169	84	
May 19	-1,226	20.8	1,128	84	
May 20	-1,218	20.9	1,122	84	
May 21	-603	20.8	1,127	84	
May 22	85	20.5	1,125	84	DSWG: 0 cfs on Old and Middle River
May 23	-245	20.4	1,646	108	
May 24	-753	21.0	1,208	132	
May 25	-921	21.3	1,209	134	
May 26	-858	21.6	1,203	180	
May 27	-943	21.7	1,114	228	
May 28	-1,461	22.0	1,174	248	
May 29	-1,323	22.1	1,168	318	DSWG: 0 cfs on Old and Middle River
May 30	-727	21.8	1,169	388	
May 31	-712	21.5	1,117	428	
June 1	-670	21.4	852	428	
June 2	-442	21.6	853	428	
June 3	42	21.9	854	428	
June 4	-124	22.0	858	428	
June 5	-407	21.3	851	428	DSWG: 0 cfs on Old and Middle River
June 6	523	21.0	850	428	
June 7	251	21.1	847	428	
June 8	-293	21.2	845	428	
June 9	-594	21.4	849	428	
June 10	-1,000	21.8	935	455	
June 11	-1,029	22.0	936	464	
June 12	-1,157	22.5	942	494	DSWG: 2,500 cfs exports unless delta smelt salvaged
June 13	-1,992	23.3	2,098	551	
June 14	-2,713	24.1	2,616	560	
June 15	-2,634	24.6	2,671	578	
June 16	-2,420	24.4	2,672	587	
June 17	-2,597	24.5	3,192	767	
June 18	-3,509	25.0	3,089	857	

Date (2007)	Old+Middle River (cfs)	Temperature (degrees centigrade)	Exports (SWP+CVP)	Cumulative Salvage (since May 1, 2007)	Comments and DSWG Recommendations for protection of delta smelt
June 19	-3,510	24.7	4,203	947	DSWG: 0 cfs on Old and Middle River
June 20	-2,138	24.0	4,471	956	
June 21	-1,940	23.8	4,457	986	
June 22	-3,360	23.7	4,951	1,043	
June 23	-4,750	23.6	5,223	1,058	TRO to require implementation of DSWG recommendations denied
June 24	-4,750	23.3	4,798	1,082	
June 25	-4,940	23.4	4,471	1,082	
June 26	-5,330	23.9	4,592	1,112	
June 27	-5,270	23.9	5,101	1,432	
June 28	-5,280	23.7	5,126	1,469	
June 29	-5,130	23.8	5,155	1,547	
June 30	-5,860	23.6	5,791	1,937	
July 1	-8,370	23.6	9,227	2,195	
July 2	-9,670	23.7	10,686	2,506	
July 3	-9,450	24.0	9,927	2,519	DSWG: -5,000 cfs on Old and Middle River
July 4	-9,170	24.5	10,218	2,537	
July 5	-9,480	25.1	9,741	2,558	
July 6	-10,080	25.1	10,113	2,567	
July 7	-9,120	24.9	9,909	2,579	
July 8	-10,070	24.8	9,803	2,585	
July 9	-10,940	24.4	10,161	2,591	
July 10	-10,830	23.5	10,031	2,597	
July 11	-10,430	23.1	10,585	2,597	
July 12	-10,110	22.9	10,644	2,603	
July 13	-9,960	23.0	10,815	2,603	
July 14	-10,490	23.2	11,350	2,609	
July 15	-10,620	23.5	12,340	2,615	
July 16	-10,350	23.4	10,794	2,639	
July 17	-10,580	23.4	11,254	2,645	
July 18	-10,510	23.3	11,437	2,648	
July 19	-10,520	23.4	11,684	2,648	

22. CDWR Deputy Director Jerry Johns has suggested that delta smelt taken at the SWP during June and July were individuals already trapped inside the SWP's Clifton Court Forebay since late May or early June and that therefore the increasing take of fish that occurred when the SWP began increasing its export rates in mid-June did not represent an additional impact on the species (Declaration of Jerry Johns in Support of the California Department of Water Resources Interim Remedy Proposal, Docket No. 399 at ¶ 18). Mr. Johns further suggested that delta smelt may actually reside and spawn in Clifton Court Forebay. As far as I am aware, there is no evidence to support either of these contentions. In fact, current monitoring programs at the SWP facilities, which detect and count only fish that are larger than 20 mm in length, explicitly cannot determine whether delta smelt are spawning in the Forebay because they do not sample or collect larval of

small juvenile delta smelt. In addition, prior to increasing exports in mid-June, the SWP maintained a low level of pumping by drawing water from Clifton Court Forebay without opening the gates to draw in water from Delta channels. In my opinion, it is likely that any delta smelt already entrained into Clifton Court Forebay would have been salvaged as the Forebay was drained during this period. When SWP exports increased later in the month, rough analysis conducted by CDWR (reported in the July 3 DAT teleconference summary, Exhibit J) indicated that water in Clifton Court Forebay was completed replaced every two to three days.

23. Despite the unfavorable environmental conditions known to occur in Clifton Court Forebay, delta smelt that are salvaged at the SWP and CVP facilities are almost certainly alive at the time they are collected, for at least two reasons. First, the primary fish "screens" at both the SWP and CVP facilities are louvers, rather than the more effective "positive barrier" fish screens used in most modern screened water diversions. Louvers function as a "behavioral barrier," relying on the behavior of the fish to avoid the turbulent field located immediately in front of the louvers that is generated by the flow of water through the louvers. The spacing between the adjacent louvers is approximately two centimeters, ample space to allow a small, slender-bodied fish like delta smelt to slip through. In order for the fish to be diverted into the salvage facilities rather than passing directly through the louvers it must respond behaviorally to the louvers and the turbulent flow field. Since dead fish, by definition, would not be able to respond behaviorally to the louver's turbulent field, it is highly unlikely that fish that were dead would be successfully diverted into the SWP or CVP salvage facilities for counting. Moreover, based on my own research and first-hand experience handling and rearing delta smelt, dead delta smelt are negatively buoyant and tend to sink to the bottom. Assuming this is also true in Delta waters, it is unlikely that dead, negatively buoyant delta smelt would be entrained into the fish salvage facilities from Clifton Court Forebay.

24. As part of my research at the University of California, Davis, I conducted studies on the environmental tolerance limits, physiology and behavior of delta smelt. Results of my studies of delta smelt temperature tolerances were used as one basis for the 25 degrees centigrade temperature criterion identified by the DSWG in a number of their recommendations. The 25 degrees centigrade temperature criterion has been repeatedly mischaracterized by the DSWG, Dr. Charles Hanson, and

others as the "lab-lethal" limit for delta smelt, apparently on the basis of my research (Exhibit D (DWSG 5/15/07 Briefing Statement); Declaration of Charles H. Hanson in Support of Opposition to Application for Temporary Restraining Order (Docket No. 369) at ¶¶ 9-14; 6/15/07 Declaration of Cay Collette Goude (Docket No. 340) at ¶ 4). This is an incorrect interpretation of the results of temperature tolerance studies I conducted with the species and reported in the peer-reviewed scientific journal article of which I was the lead author (Swanson *et al*. 2000). In brief, the results of my laboratory experiments showed that the upper temperature tolerance limit of delta smelt depended on what temperature the fish had been living at for the period (at least one week) before the exposure to elevated temperature: fish that had been living in warm water were better able to tolerate temperature increases and had higher upper temperature tolerance limits than fish that had been living in cooler water. In my studies, delta smelt that had been living in (*i.e.*, were "acclimated" to) a moderately warm temperature, 21 degrees centigrade, tolerated temperatures up to 28 degrees centigrade. In contrast, delta smelt acclimated to a lower temperature, 17 degrees centigrade, only tolerated temperatures up to 25 degrees centigrade.

25. Appropriate application of these results to predicting temperature tolerance limits for delta smelt in the central and south Delta would first consider the fact that those fish are clearly already "acclimated" to warm water (since the seasonal increase in Delta water temperatures to 25 degrees centigrade is gradual and occurs over many weeks and months) and would therefore use the higher reported upper tolerance limit of 28 degrees centigrade rather than the tolerance limit measured for fish acclimated to the colder water temperature. Second, unlike the laboratory conditions used in my experiments, which provided the fish with no thermal "refugia" to escape the increasing water temperature, water temperatures in Delta channels vary with depth, distance from shore, and shading. The temperature criterion established by the DSWG explicitly measures surface temperatures during the afternoon hours, the location and time of day at which water temperatures are typically the warmest. The assumption that delta smelt are actually exposed to that temperature fails to consider the ability and likely behavioral response of the fish to seek cooler areas in the channels (as discussed during the 7/3/07 DAT call, *see* Exhibit J). For these reasons, the

characterization of 25 degrees centigrade as "lethal" to delta smelt in the south and central Delta is incorrect and unsupported by any laboratory or field studies of which I am aware.

26. According to DSWG notes, the other basis for the 25 degrees centigrade criterion was results of multiple years of fish survey and water temperature monitoring that indicated that juvenile delta smelt were rarely found in areas where the water temperature exceeded 25 degrees centigrade (June 8, 2007 DSWG notes (Exhibit N), footnote to decision tree (Exhibit O); *see also* Exhibit D of the Declaration of Charles H. Hanson in Opposition to Plaintiffs' Motion for a Temporary Restraining Order (Docket No. 369), bottom graph for 1973-2005). This is consistent with the seasonal and life-history stage-related movement of delta smelt, which hatch in upper Delta channels in the spring when water temperatures are cool and then begin a slow and diffuse movement downstream to brackish (*i.e.*, slightly salty) waters at the Sacramento-San Joaquin River confluence and in Suisun Bay, concurrent with the seasonally increasing air and water temperatures in the Delta.

27. I am not aware of any research or data on the temperature preferences of delta smelt, or any information that suggests that young delta smelt make this downstream movement in response to water temperature. In addition, other than my own research, I am not aware of any information to suggest that water temperatures near or above of 25 degrees centigrade are stressful to delta smelt that are acclimated to warm temperatures. Therefore, the statements by Dr. Hanson (Docket No. 369 at ¶ 9) that as water temperatures approach 25 degrees centigrade, delta smelt "experience high levels of stress and/or mortalities" and that this temperature-induced stress "bio-accumulates in the individual fish" are not supported by any laboratory or field studies of which I am aware and are probably incorrect.

28. In another peer-reviewed journal article of which I was the lead author, I described the swimming capabilities and behavior of delta smelt (Swanson *et al.* 1998). Results of my studies showed that delta smelt are intermittent swimmers and unable to swim against strong currents. Young delta smelt are thought to rely on channel flows to facilitate their downstream migration from the upper Delta where they hatched to the confluence and Suisun Bay. Therefore, in Delta channels with large, twice daily tidal flows, net downstream flows (*i.e.*, the net flow of water excluding the effects of the tides) are an important environmental condition for successful downstream migration.

High water export rates at the SWP and CVP pumps, particularly when in combination with low inflows from the San Joaquin River, cause net flow on several key southern and central Delta channels to be reversed (*i.e.*, negative flow, where the water flows "upstream"). Under these conditions, young delta smelt (as well as other fishes and planktonic organisms) are transported upstream towards the export pumps rather than downstream towards the confluence and Suisun Bay. For a number of fish species including delta smelt, recent research by state and federal agency scientists has shown that the numbers of fish taken at the SWP and CVP facilities is directly related to the magnitude of reverse flows in two Delta channels that lead directly to the pumps, Old River and Middle River (Sommer 2007; *see also* Figure 8).

Development of Plaintiffs' Proposed Interim Remedy Actions

29. Plaintiffs' proposed interim remedies, described below and in Appendix 2 to this declaration, are based on: (a) the present critically imperiled status of the delta smelt; (b) the clear need for protective actions that do more than "minimize harm" and instead provide beneficial habitat conditions and eliminate to the greatest extent possible water project-related mortality of individual fish; and (c) the best available science on the effects of water management operations on individual fish and the species. In my opinion, implementation of all of these actions is necessary to protect the delta smelt from jeopardy pending the preparation of an adequate biological opinion on the effects of the joint operations of the CVP and SWP on this critically endangered fish. I also believe that the delta smelt would not be at its present critically low abundance and that the magnitudes and durations of the specific protective actions that I recommend would not have been necessary if the USFWS had, at a minimum, required implementation of the numerous protection actions recommended by state and federal scientists in the DAT (since 2000), the DSWG (since 2004), the California Resources Agency Action Matrix (November 2006, attached as Exhibit P), the Pelagic Fish Action Plan (March 2007, Exhibit Q) and by other academic and non-governmental organization scientists (*e.g.*, Exhibits A and B) during the past several years.

30. In March 2007, I co-authored a letter with Dr. Peter B. Moyle, University of California, Davis, to the federal and state fisheries and water project agencies expressing concern about the species' continued decline and emphasizing the need for addition protection. We wrote:

> We are writing to urge you to take immediate actions to protect delta smelt and improve their habitat during this critical year and until plans for long-term management and recovery of the species are developed and implemented. Given the current precarious state of the species, these actions should go beyond those designed to minimize poor environmental conditions and harmful water management operations and instead provide conditions that are beneficial to the species. (Exhibit A)

31. The letter included specific recommendations for changes in water management operations that were based on the best available science and were, in fact, similar to those already identified by agency scientists and the DSWG. None of our recommendations were implemented and we received no meaningful reply from the agencies. Two months later, in their May 15, 2007, Briefing Statement, following review of this spring's 20-mm survey results that indicated the abundance of this year's larval and juvenile delta smelt stock had fallen another 90 percent, the DSWG stated that "For an annual species such as delta smelt, failure to recruit a new year-class is an urgent indicator that the species has become critically imperiled and an emergency response is warranted" (Exhibit D). The recommendation of the DSWG was identical to that made by Dr. Moyle and myself in our letter. Because the DSWG-recommended "emergency response" was not implemented, even more aggressive protective actions in the coming year will be needed. Failure to implement the interim remedy actions described below would, I believe, jeopardize the continued existence of the species and would constitute "an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." 50 CFR § 402.02.

32. The objectives of the interim remedies described below are to (a) eliminate or minimize to the greatest extent possible direct mortality of delta smelt larvae, juveniles and adults at the SWP and CVP export facilities; (b) improve delta smelt habitat conditions during the winter, spring, early summer and fall; and (c) improve monitoring and detection of delta smelt at the SWP and CVP export facilities and provide additional information for triggering and timing the interim remedy actions, as well as any other protective actions determined to be necessary by the DSWG.

33. The key scientific results and conclusions that were the bases for the recommended interim actions are:

a) Research by Dr. William Bennett that indicated that export-related loss of early spawning adult delta smelt and their larvae hatched before the VAMP export curtailment (typically April 15-May 15) had resulted in repeated, large-scale recruitment failure of a large component of the delta smelt population and contributed to the recently observed catastrophic population decline (Armor *et al.* 2005, Armor 2006, Bennett 2006, Herbold *et al.* 2005, Herbold *et al.* 2006). Bennett found that only delta smelt hatched during the VAMP period survived to contribute to the population.

b) Research by USGS scientists that showed that entrainment and take of delta smelt at the SWP and CVP export facilities is a direct linear function of the magnitude of reverse (or negative) flows in Old and Middle River channels leading to the pumps, meaning that take increases as flows in Old and Middle River become more negative. Since 1993, take of delta smelt was consistently low only under conditions where Old and Middle River flows are greater (i.e., less negative) than -3,500 cfs. (Smith *et al.* 2006, Ruhl *et al.* 2006, and Figure 8).

c) My own review of Old and Middle River flow data that showed that since 1999, when the VAMP was first implemented, average Old and Middle River flows during the 31-day period were -1,515 cfs, compared to much higher magnitude reverse flows in the months preceding VAMP (-6,603 cfs for January, -5,860 cfs for February, -4,970 for March, and -5,263 for April 1-15) and after VAMP (-1,643 for May 16-31, and -5,460 cfs in June). The results of this review are also shown in Figure 9.

d) Results of USGS analyses and of particle tracking modeling discussed by the DSWG that showed that installation and operation of the south Delta agricultural barriers and

the Head of Old River Barrier exacerbated reverse flows on Old and Middle Rivers and increased entrainment of fish (as modeled by particles).

e) Research by scientists at CDWR (Feyrer *et al*. 2007) and Contra Costa Water District (Guerin *et al.* 2006) that showed that reduced Delta outflows during the fall and the upstream shift of low salinity habitat used by delta smelt, indicated by X2 located upstream of 80 km, resulted in degraded habitat quality for delta smelt and low population abundance measured the following year.

Plaintiffs' Recommended Interim Remedy Actions for Protection of Delta Smelt

34. The first three recommended interim actions are for continued and improved monitoring of delta smelt. The USFWS should require:

1. Continued full implementation of all CDFG surveys for delta smelt, including (but not limited to) the FWMT, summer townet, spring kodiak, and 20-mm surveys (Action 1);
2. Increased frequency of sampling for entrained fish at the CVP fish protective facilities to a minimum of 25 percent of the time (Action 2); and
3. Implementation of a monitoring program for detection of larval delta smelt (i.e., delta smelt <20 mm in length) at both the SWP and CVP fish protective facilities (Action 3).

The increased sampling effort at the CVP (Action 2) is necessary because the current program has a low level of detection that, given current low population abundance of delta smelt, is likely to fail to detect delta smelt when they are in fact present and being taken. New sampling efforts to detect the presence of larval and small juvenile delta smelt at the SWP and CVP facilities are essential to increase detection of young delta smelt in the southern Delta, improve information on delta smelt distribution during this critical life stage, and trigger changes in water project operations necessary to protect the species. Additional monitoring for delta smelt at the export facilities is also important given concerns reported by the DSWG that "[w]ith delta smelt at such apparent low numbers,

confidence in the ability of the survey to adequately sample for delta smelt is questionable; further, such low numbers severely limit the validity of inferences that may be drawn from the survey data. As an example, surveys have not collected delta smelt at south Delta stations, but larval delta smelt have been salvaged at both the State and Federal facilities, which means that they occur in south Delta channels below levels at which they can be reliably detected by routine survey sampling" (DSWG 6/11/07 Meeting Notes; attached as Exhibit R).

35. The next seven interim remedy actions are for seasonal changes in water project operations triggered by environmental conditions, distribution of the fish as determined by multiple surveys, salvage monitoring and new sampling for small delta smelt at the export facilities, and physiological information on maturation state and onset of spawning from fish collected in the spring kodiak survey. Relative to the known effects of these factors on delta smelt survival and entrainment rates, these actions will provide the increased level of protection needed to prevent jeopardy to the species:

- Actions 4, 5, 6, and 7 are designed to sequentially protect pre-spawning adults, spawning adults and larvae, and larval and juvenile delta smelt from lethal entrainment at the SWP and CVP export facilities by requiring low to moderate reverse flows on Old and Middle Rivers. The specific levels of allowable reverse flows, which are based on the scientific information described above and evaluation of recent historic reverse flow conditions, represent substantial improvements in flow and environmental conditions compared to those measured during the 2000s.

- Actions 8 and 9 prohibit the installation and closure or operation of the south Delta agricultural barriers and the Head of Old River Barrier, which are known to exacerbate reverse flows and increase entrainment risk for delta smelt, until mid-June or when survey and salvage monitoring indicate the delta smelt population has moved out of the southern Delta.

- Action 10 is designed to improve habitat quality for delta smelt during the fall by requiring sufficient outflow to maintain low-salinity habitat downstream of the confluence (i.e., X2 downstream of 80 km).

Comparison of Plaintiffs' Proposed Interim Remedy Actions with the USFWS Delta Smelt Action Matrix for Water Year 2008 and Other Previously Recommended Protection Actions

36. Plaintiffs' Actions 1, 2 and 3: Recommendations for additional monitoring to improve detection capability and provide additional resolution for determined delta smelt distribution within the estuary are not included in the USFWS Delta Smelt Action Matrix. Instead, the USFWS Matrix relies on existing monitoring programs that are, according to the DSWG, of "questionable" value for determining either delta smelt presence/absence or relative distribution given the species' current low abundance (Exhibit R (DSWG 6/11/07 Meeting Notes)). For example, in spring and summer of 2007, regular surveys were unable to detect the presence of delta smelt in the southern Delta despite the fact that high numbers of delta smelt were salvaged at the SWP and CVP export facilities during the same period. The USFWS proposal to rely on data from the existing surveys as sufficient "real-time information" to guide their determination of entrainment risk for the fish and the level of protection to be implemented (as allowable Old and Middle River flow for USFWS Delta Smelt Action Matrix Actions 4 and 5) is therefore deeply flawed and will not be sufficient to provide the protection necessary to avoid jeopardizing the species.

37. All of plaintiffs' proposed interim remedy recommendations for changes in water management operations described here are the same as, or very similar to, those already identified by CDWR in their March 2007 Pelagic Fish Action Plan (Exhibit Q; "Water Project Operations Actions" summarized on pages 5-6 of the report), or to specific analyses and/or recommendations made by the DSWG during the past year (see, *e.g.*, Exhibits C, D, S, T, V, W, Y (2/9/07 Meeting Notes), and Z (10/30/06 Meeting Notes)).

38. For Plaintiffs' Action 4, the initial 10-day requirement for non-negative Old and Middle River flows (i.e., 0 cfs) is very similar to a proposed protection action reviewed by the DSWG, which they described as preferred, writing "eliminating net upstream OR/MR flow likely would be better for delta smelt" (DSWG 12/11/06 Meeting Notes, attached as Exhibit S). The flow

for this initial 10-day period identified in USFWS Delta Smelt Action Matrix Action 1, -2,000 cfs, is less protective than that preferred by the DSWG and by that recommended in the interim remedies outlined here. The Old and Middle River flows specified by Action 4 for the period following this initial response, -3,500 cfs, are identical to the level proposed by the DSWG (10/10/06 and 12/11/06 Meeting Notes, attached as Exhibits T and S), in CDWR's Pelagic Fish Action Plan (Exhibit Q), and in the California Resources Agency Action Matrix (Exhibit P). Flow levels for this period included in the USFWS Delta Smelt Action Matrix as Action 2, -4,500 cfs, are less protective than the level previously recommended by the DSWG (-3,500 cfs; Exhibits T and S), less protective than those in the California Resources Agency Action Matrix (Exhibit P), and less protective than the level outlined in the Pelagic Fish Action Plan (Exhibit Q). In addition, the USFWS' proposed use of a 14-day running average to calculate and manage Old and Middle River flows will result in regular daily and multi-day Old and Middle River flows far greater (*i.e.*, more negative) than the -4,500 cfs target specified and be less protective of delta smelt. The issue of using 14-day, 7-day, and 5-day average to calculate and manage Old and Middle River flows has already been addressed by the DSWG following a request by the WOMT to use the longer averaging period (March 27, 2007, as reported in the 4/2/07 DSWG Meeting Notes, attached as Exhibit U). The DSWG evaluated the effects of the different averaging periods and concluded that "such additional variation might very well reduce protection of delta smelt"; they explicitly recommended that the water project operators continue "to use a five-day average flow when tracking Old and Middle River flows."

39. Plaintiffs' Action 5, management of Old and Middle River flows at -1,500 cfs triggered by the onset of delta smelt spawning, is more protective than USFWS Delta Smelt Action Matrix Action 3, which would allow reverse flows up to -4,000 cfs and base the decision regarding flow levels on unreliable data on spawning adult and larval delta smelt distributions (see Exhibit R (DSWG Meeting Notes 6/11/07)). The action proposed by the USFWS during this period before VAMP is substantially less protective that the similarly timed action outlined in earlier proposals for delta smelt protection, including both the California Resources Agency Action Matrix (Exhibit P) and the Pelagic Fish Action Plan (Exhibit Q, which recommended 0 cfs Old and Middle River flows for at least two weeks prior to VAMP). Implementation of this action is also uncertain, given the

USFWS proposal to leave the decision to implement the action to the WOMT (Declaration of Jerry Johns in Support of the California Department of Water Resources Interim Remedy Proposal, Attachment A to Exhibit A (Docket No. 399-2), #4). In addition, the USFWS' proposed use of a 14-day running average to calculate and manage Old and Middle River flows will result in regular daily and multi-day Old and Middle River flows far greater (*i.e.*, more negative) than whatever target flow is recommended and be less protective of delta smelt (DSWG Meeting Notes 4/2/07, Exhibit U).

40. Plaintiffs' Action 6, full implementation of the VAMP, is not specified by the USFWS Delta Smelt Action Matrix.

41. Plaintiffs' Action 7, continued management of Old and Middle River flows at -1,500 cfs until delta smelt have moved downstream, is more protective than USFWS Delta Smelt Action Matrix Action 4, which does not specify any potential limits of water project operations or Old and Middle River flows and, as with USFWS Delta Smelt Action Matrix Action 3, bases any decisions regarding the unspecified protection actions on unreliable data on larval and juvenile delta smelt distributions (see DSWG 6/11/07 notes, Exhibit S). As with USFWS Delta Smelt Action Matrix Action 3, implementation of any protective action during this period is uncertain, given the USFWS proposal to leave the decision to implement the action to the WOMT (Johns Dec, Attachment A to Exhibit A (Docket No. 399-2), #4). Neither the California Resources Agency Action Matrix (Exhibit P) nor the Pelagic Fish Action Plan (Exhibit Q) specifies a protective action during this period. However, in 2007 the DSWG repeatedly recommended reducing reverse flows in late May and June to levels more protective than those specified here (although the recommended action was not implemented).

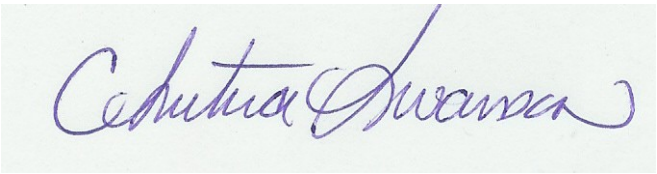
42. Plaintiffs' Actions 8 and 9, delaying installation of the south Delta barriers, is essentially identical to that included in the USFWS Delta Smelt Action Matrix Action 5, as well as recommended actions included in the Pelagic Fish Action Plan (Exhibit Q).

43. Plaintiffs' Action 10, requiring sufficient Delta outflow to maintain X2 at or downstream of 80 km, is identical to protections proposed in the California Resources Agency Action Matrix (Exhibit P) and the Pelagic Fish Action Plan (Exhibit Q), except for the fact that the Pelagic Fish Action Plan proposes to maintain the improved habitat conditions for the entire May-

December period rather than the shorter September-December period outlined in Action 10. This action is also similar to protective actions discussed by the DSWG (DSWG 7/10/06 and 8/21/06 Meeting Notes, attached as Exhibits V and W).

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

DATED: July 23, 2007



Christina Swanson, Ph.D.

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Index to Attachments

Appendices

Exhibits