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IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF CALIFORNIA

PACIFIC COAST FEDERATION OF FISHERMEN'S ASSOCIATION/INSTITUTE FOR FISHERIES RESOURCES, et al., Plaintiffs, **v.** **CARLOS M. GUTIERREZ, et al.,** Defendants.	Case No.: 1:06-CV-00245-OWW-GSA **DECLARATION OF SHEILA GREENE IN RESPONSE TO THE JULY 24, 2008 SCHEDULING ORDER**
SAN LUIS & DELTA MENDOTA WATER AUTHORITY, WESTLANDS WATER DISTRICT, CALIFORNIA FARM BUREAU FEDERATION, AND GLENN-COLUSA IRRIGATION DISTRICT, et al., and STATE WATER CONTRACTORS, THE CALIFORNIA DEPARTMENT OF WATER RESOURCES Defendant-Interveners.	

I, Sheila Greene declare:

1. I am an Environmental Scientist with the Department of Water Resources (DWR) and have worked in that capacity since 1988. I earned a Master's of Science degree in Biological

Sciences at California State University at Sacramento in 1991. I make this declaration based upon my personal knowledge and could and would testify under oath to the contents herein if called upon to do so.

2. I am the Interagency Ecological Program (IEP) and CALFED Science Program Science Advisor for the Division of Environmental Services (DES) of DWR. The IEP provides information on the factors that affect ecological resources in the Sacramento - San Joaquin Estuary. My general duties as IEP and CALFED advisor are coordination and communication of science issues within DWR and advising the DES Chief on science issues. I also serve as liaison between DWR, CALFED Science Program, and the IEP. Attached as Exhibit 1, is my curriculum vitae.

2004 National Marine Fisheries Service's Biological Opinion

3. I have reviewed the 2004 National Marine Fisheries Service's Biological Opinion regarding the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (2004 BiOp). The 2004 BiOp mis-represents the impact of the federal Central Valley Project (CVP) and the State Water Project (SWP) pumping operations in the southern Delta on out-migrating juvenile salmonids in at least two respects.

4. First, the 2004 BiOp percentage estimates of the interior Delta mortality confuses the total number of out-migrating juvenile salmon from the Sacramento Basin with the sub-set of these juvenile salmon that enter into the interior Delta. On page 194, the 2004 BiOp states that "current operations result in the loss of 42 percent of the winter-run Chinook salmon juvenile population, 37 percent of the spring-run Chinook salmon, and 39 percent of the steelhead juvenile population assuming that 33% of the population dies in the delta due to indirect effects of the project." (2004 BiOp at p. 194.) Table 10 on pages 194-195 of the 2004 BiOp purports to show the "Baseline Project Effects...shown as a percentage of the total juvenile population or adult population." The table further asserts that juvenile losses due to indirect Delta mortality can be assumed to be 33% of the juvenile population. (2004 BiOp at p. 195.) However, the 2004 BiOp derives this percentage estimate from the U.S. Fish and Wildlife Service studies reference on page 190 of the BiOp. (Brandes and McLain 2001; USFWS 2001-2004.) The mortality results of these studies relied upon by the 2004 BiOp are limited to fish that have already entered

the interior Delta and did not incorporate the mortality rate of the out-migrating juvenile salmon that remain in the mainstem of the Sacramento River. The 2004 BiOp relies on the National Marine Fisheries Service "Simple Model" that shows a 33% mortality associated in the interior Delta (2004 BiOp at p. 301, Appendix A, Table A10). Mortality estimates that are limited solely to salmon that enter the interior Delta cannot be extrapolated to provide mortality estimates for the entire out-migrating juvenile salmon populations, given that a percentage of the out-migrating juveniles will avoid the interior Delta and remain in the mainstem of the Sacramento River.

5. I have reviewed the February 2008 San Francisco Estuary and Watershed Science article authored by Wim J. Kimmerer and Matthew L Nobriga entitled "Investigating Particle Transport and Fate in the Sacramento-San Joaquin Delta Using a Particle Tracking Model." (Kimmerer and Nobriga 2008.) This article used the Delta Simulation Model-2 hydrodynamic model (DSM2 HYDRO) and its associated particle tracking model (PTM) to address a series of questions regarding hydrodynamics and entrainment risk at the SWP and CVP pumping facilities in the Delta, including "the probability of entrainment of neutrally-buoyant particles and (possibly) resident and migratory fish." (Kimmerer and Nobriga 2008 at p. 3.) Kimmerer and Nobriga concluded that under three scenarios of low Delta inflow and low project exports, high Delta inflow and low project exports, and high Delta inflow and high project exports over 80 % of the particles would remain in the mainstem of the Sacramento River and would exit the system at Chipps Island in the western Delta.[1/] Only under the fourth scenario of low Delta inflow and high project exports does the study show that the majority of the particles are entrained at the project pumping facilities in the southern Delta. (*Ibid.* at p. 11, Figure 5.) The particle tracking model used by Kimmerer and Nobriga may over-state the entrainment risks to out-migrating juvenile salmon, given that salmon smolt are not particles, have complex behaviors, and are strong swimmers. According to data cited by Kimmerer and Nobriga

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1. Kimmerer and Nobriga define high Delta inflow as 38,000 cfs and low Delta inflow as 12,000 cfs. The authors define high project exports as 10,000 cfs and low project exports as 2,000 cfs. (Kimmerer and Nobriga at p. 6 and 11, Table 2 and Figure 5.)

involving the release of tagged hatchery-reared salmon, the salmon "survival ratios are only weakly related to export flow and apparently not to inflow or river flow." (*Ibid.* at p. 19.)[2]

6. Second, the 2004 BiOp over-states the impacts of CVP and SWP Delta operations in that the BiOp's interior Delta juvenile loss estimates do not separate losses attributable to non-project causes such as predation, temperature, toxic conditions and local water diversions from losses attributable to project pumping operations. The 2004 BiOp recognizes that these non-project causes contribute to interior Delta mortality of juvenile salmon and that some of this interior Delta mortality "would occur with or without the project." (2004 BiOp at 194.)[3] However, the BiOp's summation of the projects' Delta effects on juvenile salmon in Table 10 does not disaggregate the non-project causes of interior Delta mortality from the project causes of interior Delta mortality, and therefore over-states the project contribution to such mortality. (*Ibid* at 195, Table 10.)

The Sacramento River Juvenile Chinook Salmon Emigration Model

7. The purpose of this model is to illustrate the emigration of juvenile Chinook salmon through the Delta, with the best available science used to estimate the proportion of fish that emigrate through the several pathways into the interior Delta and the mortality associated with such emigration. The model's starting point is the Sacramento River upstream of Sutter Slough near Hood. There are several emigration pathways for juvenile Chinook salmon through the Delta; the Sacramento River mainstem, Sutter and Steamboat sloughs, and the interior Delta through the Delta Cross Channel (DCC), Georgiana Slough, or Three Mile Slough. From the interior Delta, there are two pathways out of the Delta; to Chipps Island in the western Delta or to the SWP or CVP export facilities.

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2. This conclusion is consistent with the testimony of Bruce Oppenheim of the National Marine Fisheries Service where Mr. Oppenheim stated that "most" of the outmigrating juvenile salmon "would remain in the mainstem of the Sacramento River." (Oppenheim Testimony, 6/13/08 at p. 965.)

3. Mr. Oppenheim confirmed this conclusion in his testimony that interior Delta mortality of juvenile salmon would occur due to predation, local diversions, toxic conditions, and temperature stresses, even if the Delta Cross Channel and project pumping operations did not exist. (Oppenheim Testimony, 6/13/08 at pp. 967-968.)

8. This model combines the Sacramento River mainstem and Sutter and Steamboat sloughs because both pathways support a higher survival rate than the interior Delta and there is insufficient data to determine the difference between emigration through the Sacramento mainstem or the western sloughs at this time. The model also combines the three major pathways into the interior Delta because the interior Delta pathway supports a lower survival rate than the Sacramento River mainstem and there is insufficient data to determine the difference between emigration into the interior Delta through the DCC, Georgiana Slough, or Three Mile Slough at this time.

9. Starting at the Sacramento River near Hood, this model bases the proportion of fish that remain in the Sacramento mainstem and western sloughs on the particle tracking model analysis contained in Kimmerer and Nobriga 2008 described above. Kimmerer and Nobriga compared 24 combinations of Delta inflows and Delta exports to the proportion of particles that ended up at either Chipps Island or at the SWP or CVP pumps.

10. Particle tracking means particles are “neutrally buoyant” and only are affected by river hydrodynamics. There is no “biological behavior” associated with the results of the particle tracking model. The behavior of juvenile Chinook salmon, on the other hand, will affect their location in the Delta. However, at this time there is insufficient data to incorporate their behavior in this model. Given the insufficiency of behavioral data, particle tracking is the best available science to estimate the proportion of juvenile Chinook salmon that emigrate through the Delta. Based on the proportion the juvenile Chinook salmon that remain in the Sacramento mainstem and the western sloughs, the proportion that enters the interior Delta is simply one minus the proportion than remains in the Sacramento mainstem.

11. This model treats the survival of juvenile Chinook salmon in the Sacramento mainstem as a constant. Based on radio tagged experiments conducted by Vogel (2004)[4/], predation mortality was 23% in the Sacramento River. Assuming experimental fish are more susceptible

4. Vogel, D.A. 2004. “Juvenile Chinook Salmon Radio-Telemetry Studies in the Northern and Central Sacramento-San Joaquin Delta, 2002-2003". “Report to the National Fish and Wildlife Foundation, Southwest Region. January 2004. 44pp”.

to mortality due to their hatchery origin and handling, the model assumes that mortality of the fish that remain in the Sacramento River mainstem and western sloughs to be a constant 20%, resulting in an 80% survival rate. The model therefore assumes that the proportion of fish that remain in the Sacramento River mainstem and in the western sloughs that survive to emigrate to Chipps Island in the western Delta is the proportion of the fish that remain in the Sacramento River mainstem and the western sloughs multiplied by the Sacramento River survival rate.

12. Based upon Kimmerer and Nobriga 2008 and assumed inflow and exports, the model assumes that the proportion of juvenile Chinook salmon that enter the interior Delta is one minus the proportion that remains in the Sacramento River mainstem and western sloughs.[5/] Once the fish enter the interior Delta, they are exposed to a lower average survival rate than the fish that remain in the Sacramento River mainstem. The best available scientific analysis to estimate juvenile Chinook salmon survival in the interior Delta is a March 2008 study by Ken Newman of the U.S. Fish and Wildlife Service entitled "An Evaluation of Four Sacramento-San Joaquin River Delta Juvenile Salmon Survival Studies." (Newman 2008.) Newman 2008 was funded and peer-reviewed through the CALFED Science Program. Newman 2008 focused on "relative" interior Delta survival (relative to Sacramento River mainstem survival) and project exports. The study concluded that a relationship exists between relative interior Delta survival rates and project exports, however this relationship is subject to wide variations or confidence bands.

13. Notwithstanding that Newman 2008 is the best available science regarding juvenile Chinook salmon survival in the interior Delta, there are limitations in interpreting the results of the study. First, the model alternative without exports (random effects only) explained almost as much of the variation in relative interior Delta survival as the model alternative with exports (random effects and exports). In general, correlation is not the equivalent to causation, and the similarity of the model outcomes affirms this point. Second, Newman uses the natural log and logistic relationships as model alternatives. The differences among most of the model

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5. The assumed inflow and export data is based upon the projected inflow and export data for December, 2008, and January through March of 2009 provided by John Leahigh as set forth in his declaration filed concurrently with this declaration.

alternatives are small. The model used in this declaration is based on the logistic relationships and the multivariate normal distribution. The logistic relationship provides a more logical illustration of survival and mortality rates.

14. The results of the Newman 2008 analysis are in terms of "relative" interior Delta survival, which is defined as the ratio of interior Delta survival divided by Sacramento River mainstem survival. To estimate the "absolute" interior Delta survival under this model, the Sacramento River mainstem survival value is assumed, and the "absolute" interior Delta survival is "relative" interior Delta survival value multiplied by the Sacramento mainstem survival value described above.

15. As noted above, juvenile Chinook salmon that enter and survive the interior Delta can leave by two pathways; emigrate west to Chipps island or exit through the SWP and CVP export facilities in the South Delta. The model derives the proportion of fish that emigrate to Chipps Island from Kimmerer and Nobriga 2008. If juvenile Chinook salmon take the pathway to the export facilities, some of the fish will die (losses) and some will be released to the Bay-Delta Estuary (salvage). This model assumes an average expansion of one salvaged fish at the SWP salvage facilities to loss of about 4.3, and at the CVP salvage facilities of about 0.58. Of the fish that take the pathway to the SWP and CVP export facilities, about half of them die at the exports and about a half are released to the Bay-Delta Estuary.

16. Exhibit 2 is a summary of the results of the model setting forth the status of juvenile Chinook salmon as they emigrate through the Delta. The summary breaks down the results by water year type and by months (December through March). The environmental variables in the model are total Delta Inflow and SWP and CVP Delta Exports. The inflow and export values in the model are from the DWR projected operations described in the declaration of John Leahigh. The inflow and export projections represent three hydrologic conditions; dry, average and wet, for each of the months December 2008, January 2009, February 2009 and March 2009. For purposes of this model I assumed export projections based on the applicability of D-1641 and the Delta Smelt Interim Remedy Order. The model to helps illustrate the effects inflow and exports have on total survival through the entire Delta. In Exhibit 2, the rows of primary interest to these

proceedings are highlighted in orange, and are labeled "% Population Morality in the Interior Delta-Export Related", and "% Population Lost at the SWP and CVP Exports". Based on this model, the periods of greatest export-related mortality appear to be December in average and wet years, and January in a dry year. The total export-related mortality in a December in an average year is 19%, subject to wide variations or confidence bands. Likewise, the total export-related mortality in a January in a dry year is 11%, and the total export-related mortality in a December in a wet year is 7 ½ %, also subject to wide variations or confidence bands. In the remaining months and water year types, total export related mortality is significantly lower, ranging from 5% to .5%. These results are replicated in bar chart format in Exhibit 3, attached to this declaration.

17. The Delta Emigration Model, described above, results in some potential adverse impacts in December. However, juvenile Chinook emigration and loss vary widely in the month of December. In most years, juvenile Chinook are unlikely to be present at the export facilities in December. Sometimes the first significant storm events of the season occur in the month of December and sometimes not until after December. Sometimes there is juvenile loss at the exports after a significant storm event, and sometimes there is no loss after a significant storm event. Based on this wide variability, the agencies implementing the Salmon Decision Process developed criteria upon which to estimate juvenile Chinook emigration and loss at the exports and appropriate protective actions to minimize adverse impacts, such as, DCC closure and ultimately export reductions. The wide variability in juvenile Chinook occurrence in the Delta and at the exports in December, the criteria to estimate when they will occur in the Delta and at the exports, and the protective actions preclude the need for a prescriptive export limitation in December.[6/]

18. As Exhibits 2 and 3 disclose, the model's results offer substantially lower direct and indirect project-related mortality rates for juvenile Chinook salmon than the results displayed in Table 10 on pages 194-195 of the 2004 BiOp. The difference between the results of the above-

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6. This conclusion is consistent with the testimony of Bruce Oppenheim. (Oppenheim Testimony, 6/12/08, at p. 736).

described model and the results displayed in the 2004 BiOp can largely be explained by two reasons. First, the 2004 BiOp did not recognize that a significant portion of the out-migrating juvenile Chinook salmon entering the Delta would remain in the Sacramento River mainstem and that only a portion of the juvenile population would enter the interior Delta. Second, the 2004 BiOp, as set forth in Table 10, assumed that all interior Delta mortality of juvenile Chinook salmon was due to project export activity. Relying on Kimmerer and Nobriga 2008 and Newman 2008, the above-described model attempts to correct for these deficiencies in the 2004 BiOp and to provide an estimate, based upon best available science and subject to confidence bands, of juvenile Chinook salmon mortality resulting from their emigration through the Delta.

Post Salvage Release Predator Studies

18. I have reviewed the publicly available literature regarding the effect of predation on the post salvage release of salvage salmonids. There are two studies that address this biological issue; Orsi 1967 and Pickard 1982.[7/] According to these studies, the predation rate of juvenile fish from the fish facilities released into the river ranged from less than 10% to a maximum of 30% depending on the occurrence of predators at the point of release and the number of fish released.

19. The DWR is currently conducting post salvage handling, trucking, and release predator studies. However, these studies are not yet finalized and are not scheduled for release until December of 2008 at the earliest.

Pre-Salvage Mortality at Clifton Court Forebay

20. I have reviewed the November 1997 paper by M. Gingras entitled "Mark/Recapture Experiments at Clifton Court Forebay to Estimate Pre-Screening Loss to Entrained Juvenile Fishes," published as IEP Technical Report No. 55 (Gingras 1997). This study summarized 8 release and recapture experiments conducted to estimate juvenile Chinook salmon mortality in Clifton Court Forebay The resulting pre-screen mortality ranged from 63% to 99%, and

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7. See Orsi, J.J. 1967. "Predation Study Report", "DFG Memorandum Report, Stockton CA" and Pickard, A., A. Grover, F.A. Hall 1982. "An Evaluation of Predator Composition at Three Locations on the Sacramento River". "Interagency Ecological Study Program, Technical Report 2".

averaged 85%.

21. However, the author of Gingras 1997 expressly recognized that the "introduction of experimental fish directly into Clifton Court Forebay may contribute a large portion of observed pre-screen loss, regardless of other experimental and/or operational variables." Specifically, the author concluded that:

> "Introduction of experimental fish directly into Clifton Court Forebay may contribute a large portion of observed pre-screen loss, regardless of other experimental and/or operational variables (eg. release group size, experimental fish size, degree of habituation, and export rate). Experimental fish are typically subject to varying degrees of (1) temperature shock (Orsi 1971); Coutant 1973; Kjelson and Brandes 1989, (2) altered salinity, and (3) altered light regime, in addition to turbulent flow and predation at the radial gates. Habituated fish entrained into Clifton Court Forebay would only be subject to turbulent flow and predation near the radial gates. The combined and differential effect of these "acute stressors" on experimental fish should increase vulnerability to predation (Coutant 1969; Osri 1971; Olla et all 1992; Young and Cech 1993; Mesa 1994; Cech et al 1996)."

(Gingras 1997 at p. 15).

22. In light of Gingras 1997's recognition that introduction of experimental fish would increase the likelihood of predation found in the studies, it is my opinion that a pre-screen mortality rate of 75% at the SWP pumping facilities is a reasonable estimate of pre-screen mortality.

Summary and Conclusion

23. Based on my review of the 2004 BiOp, the work involved in the development of the Juvenile Chinook Salmon Delta Emigration Model, the results of that model, my understanding of the present regulatory baseline affecting SWP and CVP export operations, and my assumption that the project restrictions currently applicable to the projects for the protection of Delta smelt under this Court's interim remedy order remain in place at least until March 2009, it is my opinion that SWP and CVP operations through March of 2009 will not appreciably reduce the likelihood of either the survival or recovery of winter-run or spring-run Chinook salmon or Central Valley steelhead. Assuming the application of the present regulatory baseline affecting the SWP and CVP export operations, and this court's Delta Smelt Interim Remedy Order, it is my opinion that the adoption of Action 6 set forth in Christina Swanson's declaration of

5/27/2008, would not appreciably improve the likelihood of either the survival or recovery of winter-run or spring-run Chinook salmon or Central Valley steelhead.

I declare under penalty of perjury that the foregoing is true and correct and that this declaration is executed this 5th day of September, 2008, at Sacramento, California

Sheila Greene

SHEILA GREENE

EXHIBIT 1

Sheila Greene
CA Department of Water Resources
Division of Environmental Services
Staff Environmental Scientist
901 P Street, 444
Sacramento, CA 95688
916/651-9784

CIRRICULUM VITAE

Education

California State University-Sacramento	MS	1991	Biology
University of California-Davis	BS	1982	Limnology

Certificates

In-stream Flow Incremental Methodology	1993
Stream and Reservoir Temperature Modeling	1994

Work Experience at DWR Related to Delta Operations Effect on Chinook

- Assisted USFWS in developing a juvenile Chinook salmon Delta survival model (1987-1990) – The purpose of this effort was to analyze the USFWS Delta survival release and recapture experiments to try to determine effects of the Delta Cross Channel operations, SWP and CVP Delta export operations, and environmental variables on Chinook survival in the Delta. The model and sensitivity analyses were used in the State Water Quality Control Board Water Quality Plan proceedings.

- Participated in the 5 – Agency Salmon Management Workgroup 1998-1990 – The purpose of this workgroup was to develop multi-agency consensus water project operations recommendations for Chinook for the Water Resources Control Board Water Quality Plan.

- Co-authored the 1993 OCAP Biological Assessment for Winter-Run Chinook (1992-1993) – I co-authored the effects of Central Valley Project and State Water Project Delta Operations on Winter-Run Chinook Salmon. I transformed the historical salvage facilities database from an antiquated tape drive system to a desk top computer system, and quality controlled the data. I refined the DFG length at date criteria and applied them to at the Delta export facilities to identify winter-run loss. I was responsible for "near real-time" data synthesis and reporting required by the OCAP BO for winter-run Chinook.

- Participated in Interagency Ecological Program (IEP) Winter Run Salvage and Loss Workgroup (1994 – 2004) – The purpose of this group was to evaluate the efficiency of the salvage procedures at the SWP and CVP Delta Export facilities as they apply to the requirements of the endangered species listing of winter-run Chinook. I evaluated the salvage procedures and made recommendations on sampling frequency and duration, additional biological data recording. I wrote a computer model of the salvage facilitates to simulate potential alternative operations to benefit fish, and demonstrate the mechanics of the salvage facilities to biologists. The group ultimately evolved into the IEP Winter-Run Chinook Project Workgroup.

- Participated in the IEP Delta Salmon Workgroup 1997-2001 – The purpose of this interagency group was to analyze and review the Chinook salmon Delta monitoring data and experiments. The group assisted USFWS in designing Delta release and recapture experiments that ultimately evolved into the Vernalis Adaptive Management Plan experiments on the San Joaquin River side of the Delta, and the Delta Action 8 experiments on the Sacramento River side of the Delta.

- Participated in CALFED OPs meetings (1994 - 2006) – Participated in CALFED OPs meetings and provided information and data regarding the status of Chinook at the SWP and CVP export facilities and analyses regarding effects of the water project on Chinook.

- Contract manager for the Central Valley Chinook genetics research project (1995 – present) – The purpose of this research was to apply cutting-edge research in population genetics to Central Valley Chinook. My responsibilities in this research effort are to guide the researchers in applying their results to Central Valley Chinook management priorities. I am also responsible for integrating the genetics results with the Chinook monitoring programs upon which the research is based, e.g., SWP and CVP Delta export facilities and the USFWS Delta monitoring program. An important outcome of this research has been to identify juvenile winter-run Chinook using genetics. This was an improvement over the length at date criteria which did not have the accuracy to distinguish winter-run Chinook from the other non-listed runs at the juvenile lifestage.

- Co-authored a paper on the effectiveness of fish salvage operations at the intake to the California Aqueduct, 1979-1993 (1996) - It was published in “San Francisco Bay: The Ecosystem”, pages 497-518, J.T. Hollibaugh (ed.) AAAS, San Francisco.

- Chaired the Interagency Ecological Program Genetics Workgroup (1997 – present) – The purpose of this group is to evaluate genetic research progress and provide guidance to managers on how genetic research could improve out ability to manage Central Valley Chinook.

- Chaired the CALFED OPs Data Assessment Team (1997 - 2005) – The Data Assessment Team (DAT) is a multi-agency and stakeholder forum for discussing “near-real-time” monitoring of fish and water project operations data to develop consensus potential water project operations alternatives to benefit fish when appropriate. “Real-time” operations developed as the agencies determined static, prescriptive actions to protect fish were realistic for dynamic biological populations. I synthesized the “real-time” biological and environmental data and disseminated it in "real-time" for weekly DAT conference calls. As the chair of DAT, I guided the group discussion in order to develop a consensus decision regarding fish needs and water project operations. The results of the DAT calls are disseminated to agency management as information or for management discussion.

- Participated in the DFG spring-run Chinook listing process (1997) – Under State law, the spring-run Chinook received protective status during the candidacy period. During this period, I participated in an interagency group convened to determine what monitoring was needed for spring-run, and develop monitoring criteria to implement protective actions for spring-run. I coordinated "real-time" data acquisition, synthesis and dissemination from our up-stream of Delta monitoring locations. I participated in the development of the "Spring-Run Protection Plan", a document that defined the biological science used for the developing spring-run protective actions. This document was later expanded into the "Salmon Decision Process".

- Participate in the CALFED Diversion Effects on Fisheries Team (DEFT) 1998 – The purpose of this group was to evaluate the three CALFED alternatives for through-Delta conveyance for their effects of salmon.

- Participated in CALFED Environmental Water Account (EWA) gaming effort (1999) - The purpose of gaming was to attempt to determine the size of the upcoming EWA program. Gaming consisted of simulating fish management agencies' "real-time" decisions. The result was an estimated 300,000 acre feet of water per year.

- Participated in the (b)2 Implementation Team (B2IT) (2001-2005) – The B2IT was a group of State and federal fish and operations experts that was responsible for assisting USFWS and USBR in implementing the federal CVPIA b(2) environmental water. The fish biologists analyzed data to develop an annual allocation schedule to guide the application of (b)2 water to benefit fish.

- Participated in the EWA Program (2000-2006) – I participated in the EWA Salmon Biologists group, comprised of management and project agencies and stakeholders. The group analyzed data to develop an annual allocation schedule to guide the application of the EWA.

- Participated in an interagency group developing the "Salmon Decision Process" (2000-present) – This group was an ad-hoc group of agency and stakeholder technical experts that participated in the Spring-Run Protection Plan and/or CALFED OPs. Our goal was to expand the Spring-Run Protection Plan into a "Salmon Decision Process" that would provide public transparency regarding agency salmon management. The "Salmon Decision Process" was presented at CALFED OPs as a "living document", i.e., the data and information supporting the "Salmon Decision Process" are continually evaluated and the "Salmon Decision Process" is revised as appropriate. I developed the "real-time" data acquisition and synthesis for the for implementation of the "Salmon Decision Process". Since the original "Salmon Decision Process" in 2000, I have participated in four revisions.

- Participated in Water Operations Management Team (WOMT) meetings (2002-2008) - Participated in WOMT meetings and continued to provide information and data regarding the status of Chinook at the SWP and CVP export facilities and analyses regarding effects of the water project on Chinook on a weekly basis.

- Participated in the IEP Central Valley Salmonid Project Workgroup (2001-present) – The workgroup coordinates Chinook salmon and steelhead research, monitoring and management activities in the Central Valley system. The team facilitates communication and information exchange among the agencies and stakeholders through the organization of meetings, workshops, and seminars. The team also provides technical advice, informal peer review, and recommendations for management of Central Valley salmonids.

- Participated in the NMFS Technical Recovery Team for Central Valley listed salmonids NEED DATES – This team was comprised of multi-agency and stakeholder technical experts in local salmonid biology and ecology. The purpose of the team was to assist NMFS in developing criteria to determine the viability of the listed salmonid from our existing data, and guidelines for establishing recovery goals, and ultimately a recovery plan.

Technical Reports and Publications

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- Brown, R.L. and S. Greene. 1994. An evaluation of the Feather River Hatchery as mitigation for the construction of the State Water Project’s Oroville Dam. Pp 111-113 in Environmental Enhancement of Water Project. USCID, Denver.

- Brown, R.L., S. Greene, P. Coulston, and S Barrow. 1996. An evaluation of the effectiveness of fish salvage operations at the intake to the California Aqueduct, 1979-1993. Pp 497-518 in San Francisco Bay: The Ecosystem. J.T. Hollibaugh (ed.) AAAS, San Francisco.

- Greene, S.L. 1997. Central Valley Chinook Genetics Project Update. Interagency Ecological Program Newsletter for the Sacramento-San Joaquin Estuary, 38-42.

- California Department of Water Resources and U. S. Bureau of Reclamation. 1999. Effects of the Central Valley Project and State Water Project on Steelhead and Spring-run Chinook Salmon. California Department of Water Resources and U. S. Bureau of Reclamation, Biological Assessment.

EXHIBIT 2

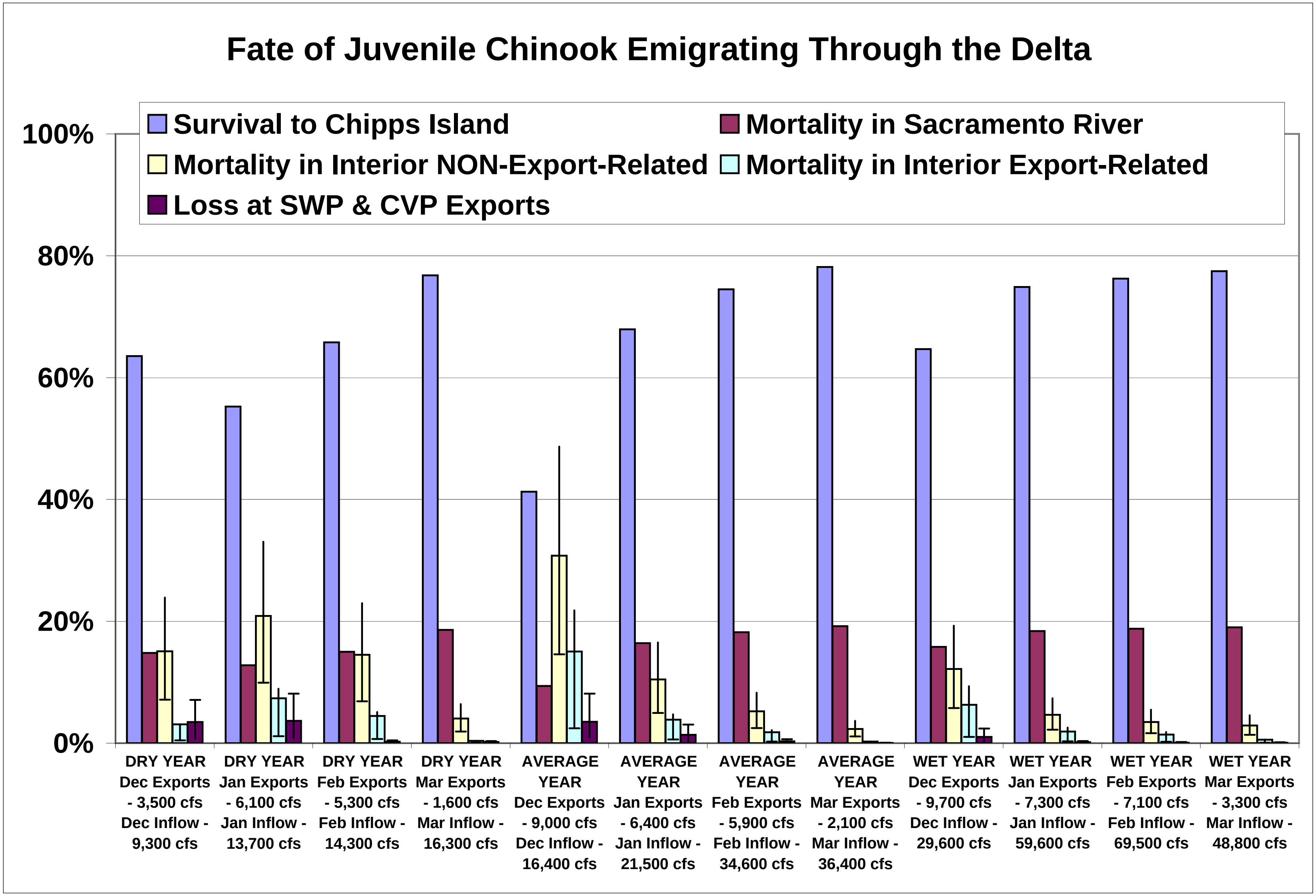
DWR PROJECTED DELTA INFLOW AND EXPORTS ASSUMING THE SMELT REMEDY

STATUS OF JUVENILE CHINOOK EMIGRATING THROUGH THE DELTA	DRY YEAR Dec Exports - 3,500 cfs Dec Inflow - 9,300 cfs			DRY YEAR Jan Exports - 6,100 cfs Jan Inflow - 13,700 cfs			DRY YEAR Feb Exports - 5,300 cfs Feb Inflow - 14,300 cfs			DRY YEAR Mar Exports - 1,600 cfs Mar Inflow - 16,300 cfs		
	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%
% Population Mortality in Sacramento Mainstem/ western sloughs		15%			13%			15%			19%	
% Population Mortality in the Interior Delta NON-Export-Related	7.16%	**15.09%**	23.89%	9.91%	**20.89%**	33.08%	6.88%	**14.51%**	22.97%	1.93%	**4.06%**	6.43%
% Population Mortality in the Interior Delta Export-Related	2.89%	**3.09%**	0.47%	8.94%	**7.37%**	1.14%	5.12%	**4.49%**	0.70%	0.28%	**0.37%**	0.06%
% Population Lost at the SWP & CVP Exports	7.10%	**3.48%**	0.73%	8.15%	**3.68%**	0.85%	0.45%	**0.21%**	0.05%	0.34%	**0.18%**	0.04%
% Population Exiting to Chipps Island	68.05%	**63.54%**	60.11%	60.20%	**55.26%**	52.14%	72.54%	**65.80%**	61.28%	78.86%	**76.79%**	74.87%

STATUS OF JUVENILE CHINOOK EMIGRATING THROUGH THE DELTA	AVERAGE YEAR Dec Exports - 9,000 cfs Dec Inflow - 16,400 cfs			AVERAGE YEAR Jan Exports - 6,400 cfs Jan Inflow - 21,500 cfs			AVERAGE YEAR Feb Exports - 5,900 cfs Feb Inflow - 34,600 cfs			AVERAGE YEAR Mar Exports - 2,100 cfs Mar Inflow - 36,400 cfs		
	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%
% Population Mortality in Sacramento Mainstem/ western sloughs		9%			16%			18%			19%	
% Population Mortality in the Interior Delta NON-Export-Related	14.59%	**30.76%**	48.70%	4.96%	**10.45%**	16.54%	2.48%	**5.22%**	8.27%	1.10%	**2.32%**	3.68%
% Population Mortality in the Interior Delta Export-Related	21.81%	**15.04%**	2.43%	4.74%	**3.84%**	0.61%	2.15%	**1.79%**	0.29%	0.23%	**0.28%**	0.04%
% Population Lost at the SWP & CVP Exports	8.13%	**3.53%**	0.92%	3.07%	**1.37%**	0.32%	0.66%	**0.30%**	0.07%	0.09%	**0.05%**	0.01%
% Population Exiting to Chipps Island	46.06%	**41.27%**	38.56%	70.83%	**67.94%**	66.14%	76.52%	**74.49%**	73.18%	79.37%	**78.15%**	77.08%

STATUS OF JUVENILE CHINOOK EMIGRATING THROUGH THE DELTA	WET YEAR Dec Exports - 9,700 cfs Dec Inflow - 29,600 cfs			WET YEAR Jan Exports - 7,300 cfs Jan Inflow - 59,600 cfs			WET YEAR Feb Exports - 7,100 cfs Feb Inflow - 69,500 cfs			WET YEAR Mar Exports - 3,300 cfs Mar Inflow - 48,800 cfs		
	Upper 95%	WET	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	Average	Lower 95%
% Population Mortality in Sacramento Mainstem/ western sloughs		16%			18%			19%			19%	
% Population Mortality in the Interior Delta NON-Export-Related	5.78%	**12.19%**	19.29%	2.20%	**4.64%**	7.35%	1.65%	**3.48%**	5.51%	1.38%	**2.90%**	4.59%
% Population Mortality in the Interior Delta Export-Related	9.36%	**6.28%**	1.03%	2.58%	**1.93%**	0.30%	1.84%	**1.41%**	0.22%	0.53%	**0.56%**	0.09%
% Population Lost at the SWP & CVP Exports	2.40%	**1.04%**	0.28%	0.34%	**0.15%**	0.04%	0.18%	**0.08%**	0.02%	0.15%	**0.08%**	0.02%
% Population Exiting to Chipps Island	66.66%	**64.69%**	63.60%	76.48%	**74.88%**	73.91%	77.54%	**76.23%**	75.45%	78.93%	**77.46%**	76.30%

EXHIBIT 3


Fate of Juvenile Chinook Emigrating Through the Delta
Survival to Chipps Island
Mortality in Sacramento River
Mortality in Interior NON-Export-Related
Mortality in Interior Export-Related
Loss at SWP & CVP Exports
100%
80%
60%
40%
20%
0%
DRY YEAR Dec Exports - 3,500 cfs Dec Inflow - 9,300 cfs
DRY YEAR Jan Exports - 6,100 cfs Jan Inflow - 13,700 cfs
DRY YEAR Feb Exports - 5,300 cfs Feb Inflow - 14,300 cfs
DRY YEAR Mar Exports - 1,600 cfs Mar Inflow - 16,300 cfs
AVERAGE YEAR Dec Exports - 9,000 cfs Dec Inflow - 16,400 cfs
AVERAGE YEAR Jan Exports - 6,400 cfs Jan Inflow - 21,500 cfs
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