UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF CALIFORNIA

The Consolidated Delta Smelt Cases	1:09-CV-00407 OWW DLB 1:09-cv-00480-OWW-GSA 1:09-cv-00422-OWW-GSA 1:09-cv-00631-OWW-DLB 1:09-cv-00892-OWW-DLB FINDINGS OF FACT AND CONCLUSIONS OF LAW RE PLAINTIFFS' REQUEST FOR INJUNCTIVE RELIEF AGAINST IMPLEMENTATION OF RPA COMPONENT 3 (Action 4)(Doc. 900)

I. INTRODUCTION

Plaintiffs State Water Contractors ("SWC"), Metropolitan Water District of Southern California ("MWD" or "Metropolitan"), Kern County Water Agency ("KCWA") and Coalition for a Sustainable Delta ("Coalition"), San Luis & Delta Mendota Water Authority (the "Authority") and Westlands Water District ("Westlands") (collectively herein "Plaintiffs"), seek an injunction prohibiting the implementation of Reasonable and Prudent Alternative ("RPA") Component 3, Action 4 (the "Fall X2 Action") set forth in the United States Fish and Wildlife Service's ("FWS") December 15, 2008, biological opinion ("BiOp"), which addresses the impacts of the coordinated operations of the federal Central Valley Project ("CVP") and State Water Project ("SWP") on the threatened delta smelt (*Hypomesus transpacificus*). Doc. 900. The California Department of

Water Resources ("DWR" or "Plaintiff Intervenors") joined in Plaintiffs' motion. Doc. 905. Federal Defendants and Defendant Intervenors opposed. Doc. 948. An evidentiary hearing on the motion was held on July 26, 27, 28, and 29, 2011. Docs. 998-1001. The parties were represented by counsel, as identified on the record.

Plaintiffs and Defendants submitted independent, lengthy proposed findings of fact and conclusions of law. Docs. 1004 & 1005. DWR and Plaintiffs also submitted notices of disapproval of Defendants' proposed findings of fact and conclusions of law. Docs. 1008 & 1009.

After consideration of the testimony of the witnesses, the exhibits received in evidence, the written briefs of the parties, oral arguments, and the parties' proposed findings of fact and conclusions of law, the following findings of fact and conclusions of law concerning the motion for injunctive relief are entered.

To the extent any of the findings of fact may be interpreted as a conclusion of law or any conclusion of law may be interpreted as a finding of fact, it is so intended.

II. BACKGROUND

A. The Challenged Action.

The 2008 Smelt BiOp, prepared pursuant to Section 7 of the Endangered Species Act ("ESA"), 16 U.S.C. § 1536(a)(2), concluded that "the coordinated operations of the CVP and SWP, as proposed, are likely to jeopardize the continued existence of the delta smelt" and

"adversely modify delta smelt critical habitat." Ex. 1[1] ("BiOp") at 276-78. As required by law, the BiOp includes the RPA designed to allow the projects to continue operating without causing jeopardy to the species or adverse modification to its critical habitat. *Id.* at 279-85. The RPA includes various operational components designed to reduce entrainment of smelt during critical times of the year by controlling exports out of and water flows into the Delta. *Id.*

At issue in this case is Component 3 (Action 4), which is designed to improve habitat for delta smelt growth and rearing, and requires sufficient Delta outflow to maintain a monthly average location of two parts per thousand salinity ("X2") no greater (more eastward) than 74 kilometers from the Golden Gate Bridge in "wet" water years and 81 kilometers from the Golden Gate Bridge in "above normal" water years. *Id.* at 282-83, 369. The average monthly location of X2 in the fall must be maintained in September and October (in November, the Fall X2 Action requires the Projects to adjust their upstream reservoir releases to prevent the storage of inflow) in accordance with an "adaptive management process" to be overseen by FWS. *Id.* at 282-83. The estimated cost to water users is 670,000 acre feet ("AF") of water if 2012 is a critically dry or dry year, or 300,000 AF if 2010 is a below normal or above normal year.

[1] All hearing exhibits, whether offered by Plaintiffs or Defendants, will be referenced generally as "Exhibit" ("Ex."). The exhibits were sequentially numbered so that no parties' exhibits overlap with those of any other party. The biological opinion, admitted as Exhibit 1, will be referenced as "BiOp."

B. Relevant Prior Rulings.

A December 14, 2010 Memorandum Decision Re Cross Motions for Summary Judgment ("12/14/10 MSJ Decision"), Doc. 757, *San Luis & Delta-Mendota Water Auth. v. Salazar*, 760 F. Supp. 2d 855 (E.D. Cal.), rejected some of Plaintiffs' challenges to the BiOp's rationale for the Fall X2 action, but found that the BiOp's X2 analysis was flawed in two critical respects. The rationale for the action rested in large part on a comparison of runs from two different computer models for Project operations, Calsim II and Dayflow. The Decision found that, in the absence of calibration of the two models, which was not performed, "the Calsim II to Dayflow comparison has the potential to introduce significant, if not overwhelming, bias to the analysis that the BiOp nowhere discussed or corrected." *Id*. at 922. The X2 action was remanded to the agency for further consideration of the implications of this error to the BiOp's findings. *Id*. at 913.

The Decision further held that the BiOp violated the Administrative Procedure Act's ("APA") requirement that FWS "examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made," *Motor Vehicle Mfrs. Ass'n v. State Farm Mutual Auto. Ins. Co.*, 463 U.S. 29, 43 (1983), as well as FWS's own Consultation Handbook implementing the ESA, which requires "a thorough explanation of how each component of the [RPA] is essential

to avoid jeopardy and/or adverse modification," ESA Handbook at 4-43, because the BiOp "fail[ed] to explain why it is essential to maintain X2 at 74 km and 81 km respectively, as opposed to any other specific location." *Id.* at 922-23. The practical result of the X2 Action is to allow large volumes of Project water to escape into the ocean.

A June 24, 2011 memorandum decision addressed Federal Defendants' and Defendant Intervenors' objection that this Court lacked jurisdiction to consider Plaintiffs' request for injunctive relief because an appeal was pending on related issues. Relying on *Natural Resources Defense Council v. Southwest Marine Inc.,* 242 F.3d 1163, 1164 (9th Cir. 2001), for the governing standard, the June 24, 2011 Decision found that *Southwest Marine* stands generally for the following propositions:

> (1) A district court may act to preserve the status quo while an appeal is pending.
>
> (2) The status quo is measured at the time the appeal is filed.
>
> (3) The district court may only act to effectuate the underlying purposes of the original judgment and may not materially alter the status of the appeal or change the core questions before the appellate panel.
>
> (4) It is impermissible to alter the status of the case on appeal by taking further action that cannot be undone by the appeal. In other words, the district court's post-appeal action must be grounded upon an issue that will receive a full and fair hearing before the appellate panel, leaving the burdened party's substantial rights unaffected if a reversal is issued.

Doc. 930 at 8. These principles apply to this case in the following way:

The first step is to determine the status quo. Federal Defendants point out that the BiOp and its RPA has been remanded but not vacated. Therefore, they argue that the status quo is operation of the projects pursuant to the RPA (including the Fall X2 Action) as described in the BiOp. This position is a material distortion of the record and cannot be adopted for two reasons. First, Plaintiffs indicated their intent to move for injunctive relief against the Fall X2 Action long before Final Judgment was entered or the appeal was filed. Defendants strenuously resisted immediate injunctive proceedings on the Fall X2 Action when a hearing was requested by Plaintiffs, on the ground that, at the time, it was not clear whether the Bureau would implement the Fall X2 Action during the 2010-2011 water year; i.e., it was premature for the district court to entertain an application for injunctive relief before it was certain the Fall X2 Action would be implemented based on this water year's hydrology.

Second, the 12/14/2010 Decision found the X2 Action was unlawful and unjustified on several grounds. This Fall X2 Action is unprecedented and had never before been implemented. Remand was ordered with the Court's understanding that any future unlawful action in Project operations would be the subject of provisional remedy proceedings. In remanding without vacature, the Court understood that, as has been the case throughout the over five years of active litigation over the Delta Smelt, as operational issues arise, the parties may seek and have sought provisional remedies during periods of remand of biological opinions to the Agency. The parties that sought remand without vacatur never disclosed they intended to argue that a remand without vacatur insulated CVP operations from judicial review during an appeal.

The disputed Fall X2 Action has never been triggered. The status quo as of the filing of the appeal on April 7, 2011 is that the implementation of the Fall X2 Action is an unprecedented possibility, which is projected to take one million acre feet of water from lawful users, and that Plaintiffs would have the opportunity to move to enjoin the Action if its implementation was reasonably certain.

The next inquiry is whether acting upon Plaintiffs' request for injunctive relief would effectuate the underlying purposes of the original judgment. The answer is unquestionably yes. The judgment found the Fall X2 Action was unlawful in a critical respect, namely that the

unprecedented specific water prescription imposed, which requires huge amounts of Project yield, was unjustified by the record. Permitting the Action to be implemented without even considering the totality of its on-the-ground consequences would undermine the purposes of the judgment and the obligation of a court sitting in equity to protect all competing human interests, health, and safety, not only the species.

The district court may not materially alter the status of the appeal, change the core questions before the appellate panel, and/or take further actions that cannot be undone by the appeal. Defendants argue that that Plaintiffs' merits brief rehashes issues already decided in the 12/14/2010 Decision. A preliminary review of the opening merits brief, Doc. 990, reveals that there is considerable overlap between the arguments there advanced and those addressed in the 12/14/10 Decision. *Southwest Marine* and related cases prohibit the district court from reconsidering issues already ruled upon, as this would impermissibly create a "moving target" for the appeal. *See Britton v. Co-op Banking Group*, 916 F.2d 1405, 1412 (9th Cir. 1990)(discussing the example of *McClatchy Newspapers*, in which the district court's modification of an order "reflected a change in the result of the very issue on appeal; if allowed to stand, the appeals court would be dealing with a moving target if it ruled on the revised order or, alternatively, its ruling would be obsolete if it ruled on the 'old' order").

However, the procedural posture of the cross-motions for summary judgment is distinct from a request for injunctive relief. The 12/14/2010 Decision ruled in favor of Plaintiffs and found the Fall X2 Action unlawful. Consideration of whether injunctive relief is required to prevent new, never imposed, operational prescriptions which may cause irreparable injury will not revisit or in any way modify the final judgment. Nor does the pending appeal preclude consideration of the strength of the scientific bases for the X2 Action in deciding a request for equitable relief. Considering whether the scientific rationale for an action is weak is legally distinct from finding that the agency violated the APA in advancing such a rationale.

Hoffman for and on Behalf of N.L.R.B. v. Beer Drivers and Salesmen's Local Union No. 888, 536 F.2d 1268 (9th Cir. 1976), explains that the general rule that an appeal to the circuit court deprives the district court of jurisdiction

> as to matters involved in the appeal "is not a creature of statute and is not absolute in character."
>
> > It is our opinion that the rule should not be applied in those cases where the district court, as here, has a continuing duty to maintain a status quo, and where, as the days pass, new facts are created by the parties and the maintenance of the status quo requires new action.
>
> *Id.* at 1276. This is such a case. New facts are constantly being created by environmental conditions and continuing operating requirements of the Projects. Such requirements may change hourly. Maintenance of the status quo may require changes to Project operations. The appeal does not remove the district court's jurisdiction over the BiOp's remand to the Agency and the ongoing operation of a federal Reclamation project.

Id. at 8-12.

The hearing on Plaintiffs' motion for injunctive relief was confirmed, four days of testimony was taken, and proposed findings have been submitted.

III. SUMMARY OF MOTION

Plaintiffs and DWR request injunctive relief on the following grounds:

- Federal Defendants intend to implement the Fall X2 Action beginning on September 1, despite the Court's determination that FWS acted arbitrarily and capriciously, and failed to use the best available science when it developed the Fall X2 Action. Plaintiffs assert that enjoining Federal Defendants' attempt to do so is an appropriate remedy to enforce this Court's Orders and Judgments and to maintain the status quo.

- **Plaintiffs have already succeeded on the merits of their ESA and National Environmental Policy Act ("NEPA") claims, and the balance of hardships and public interest support the requested injunction. Plaintiffs will suffer irreparable harm from the significant amount of water that will be lost if Federal Defendants impose the Fall X2 Action this year. By contrast, the best available scientific data do not show that the location of X2 bears a rational relationship to the subsequent abundance of delta smelt, or is necessary to avoid adverse modification to its critical habitat. To the contrary, the best available scientific data show that enjoining the Fall X2 Action will not jeopardize the species or adversely modify its critical habitat.**

IV. STANDARD OF DECISION

A. General Injunctive Relief Requirements.

Injunctive relief, whether temporary or permanent, is an "extraordinary remedy, never awarded as of right." *Winter v. Natural Resources Defense Council*, 555 U.S. 7, 24 (2008). The standard test for injunctive relief requires establishment of four factors by a preponderance of the evidence:

1. Likelihood of success on the merits;
2. Likelihood the moving party will suffer irreparable harm absent injunctive relief;

3. The balance of equities tips in the moving parties' favor; and

4. An injunction is in the public interest.

Winter, 555 U.S. at 20; *Am. Trucking Ass'n v. City of Los Angeles*, 559 F.3d 1046, 1052 (9th Cir. 2009).

Here, however, Plaintiffs seek post-judgment injunctive relief, after they prevailed in the lawsuit, which is governed by a modified standard that requires a plaintiff establish:

> (1) that it has suffered an irreparable injury;
>
> (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury;
>
> (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and
>
> (4) that the public interest would not be disserved by a permanent injunction.

Sierra Forest Legacy v. Sherman, --- F.3d ---, 2011 WL 2041149, *16 (9th Cir. 2001) (citing *eBay Inc. v. MercExchange*, L.L.C., 547 U.S. 388, 391 (2006)).

B. Scope of Review; Deference to Agency Action.

In an injunctive relief proceeding, even in an APA case, a court is not limited to a review of the record. *E.g., Nat'l Parks & Conservation Assn. v. Babbitt*, 241 F.3d 722, 738 (9th Cir. 2001) (Ninth Circuit considered evidence of species impacts not before the district court); *Ctr. for Biological Diversity v. Wagner*, 2009 WL 2176049, *6 (D. Or. 2009) ("[e]xtra-record evidence may also be

considered in relation to a request for injunctive relief"); *N. Plains Resource Council v. Bureau of Land Mgmt.*, 2005 U.S. Dist. LEXIS 25238, *3-*4 (D. Mont. 2005) (district court held an evidentiary hearing with witnesses and exhibits on the appropriate scope of injunctive relief pending completion of the remand), aff'd, *N. Cheyenne Tribe v. Norton*, 503 F.3d 836 (9th Cir. 2007); *Natural Res. Def. Council v. Norton*, 2007 WL 14283, *5 (E.D. Cal. Jan 3, 2007) ("post-decisional information might be relevant in the context of a motion for interim injunctive relief").

In reviewing a claim brought under the ESA and/or APA, a court must defer to a federal administrative agency's reasoned opinions within its field of expertise. This deferential standard has been articulated numerous times in these consolidated cases, *see, e.g.*, 12/14/2010 MSJ Decision, *San Luis v. Salazar*, 760 F. Supp. 2d at 869-70, and is incorporated by reference. However, in a post-judgment injunctive relief proceeding, a court is not bound by the same deferential standard. The Ninth Circuit reasoned in *Sierra Forest Legacy*:

> Although the federal government is undoubtedly permitted to follow its own experts when making a decision, federal experts are not always entitled to deference outside of administrative action....
>
> ... It is reasonable that courts would defer to particular experts when the government has unique expertise, in fields such as national security or the internal functioning of the military. However, *Winter* applied no such deference concerning the possibility that sonar testing would irreparably harm whales. *See id.* at 383-84. Ecology is not a field within the unique expertise of the federal

> government.
>
> If the federal government's experts were always entitled to deference concerning the equities of an injunction, relief against federal government policies would be nearly unattainable, as government experts will likely attest that the public interest favors the federal government's preferred policy, regardless of procedural failures.

--- F.3d ---, 2011 WL 2041149, *18-*19 (citations omitted). The government cannot hide behind and is not entitled to deference in this *de novo* injunctive relief proceeding.

V. FINDINGS OF FACT

A. The Agency Action.

1. The agency action is the coordinated operation of the CVP and SWP, pursuant to an Agreement for the Coordinated Operation of the two projects ("COA").

2. According to the Rivers and Harbors Act of 1937, the dams and reservoirs of the CVP "shall be used, first, for river regulation, improvement of navigation and flood control; second, for irrigation and domestic uses; and, third, for power." 50 Stat. 844, 850 (Aug. 26, 1937).

3. The CVP was reauthorized in 1992 through the Central Valley Improvement Act ("CVPIA"), which modified the 1937 Act and added mitigation, protection, and restoration of fish and wildlife as co-equal project purposes. Pub. L. 102-575 § 3402, 106 Stat. 4600, 4706 (1992). One of the stated purposes of the CVPIA is to address impacts of the CVP on fish and wildlife. *Id.* at § 3406(a). The CVPIA made environmental protection and water deliveries co-purposes.

B. Facts Relevant to NEPA Claim.

4. It is undisputed that neither FWS nor Reclamation engaged in any NEPA analysis in connection with preparation or implementation of the 2008 Smelt BiOp. This has been found unlawful.

5. It is also undisputed that on November 13, 2009, the Court entered an Order granting San Luis Plaintiffs' motion for summary judgment on their claim that Federal Defendants violated NEPA when they implemented the 2008 Smelt BiOp without conducting the required NEPA analysis. Doc. 399.

6. Federal Defendants did not engage in a systematic consideration of impacts to the human environment and/or consideration of alternatives that took into account those impacts, ordinarily performed as part of a NEPA review.

C. Wet Conditions in 2011 Will Trigger Implementation of Fall X2.

7. The 2011 water year is classified as a wet year. Ex. 301, Leahigh Decl. at ¶ 12. Wet and above normal water years trigger implementation of the Fall X2 Action, which requires that X2 be maintained at a monthly average position of not greater than 74 km (in wet years) or 81 km (in above normal years) eastward of the Golden Gate Bridge. BiOp at 282-83.

8. While the Fall X2 Action is not formally triggered until September 1, the Projects would need to alter their reservoir release patterns as early as the second week in August to ensure that the 74 km requirement could be met in September. Ex. 301, Leahigh Decl. at

¶ 21; 7/28/11 Tr. at 196:23-197:3 (Milligan).

9. FWS and the Bureau have announced that they will implement the Fall X2 action starting in September 2011.

D. Status of the Species.

(1) Abundance Trends.

10. The delta smelt was listed as a threatened species under the ESA on March 5, 1993. 58 Fed. Reg. 12,584 (March 5, 1993). Critical habitat was designated for the delta smelt on December 19, 1994. 59 Fed. Reg. 65,256 (Dec. 19, 1994). FWS recently determined that delta smelt warranted uplisting from threatened to endangered, but that the action was currently precluded by higher priority listing actions. 75 Fed. Reg. 17,667 (Apr. 7, 2010).

11. The most recent Fall Midwater Trawl ("FMWT") data available, from 2010, show an index value of 29. Ex. 503. Although this is an increase over the 2009 value of 17, it is still well below the lowest pre-2003 value of approximately 100, as are the other six of the past seven years. *Id.*

12. The 2011 Summer Townet Survey ("STS") indicated a slight improvement over the previous year's index value (up to 2.2 from 0.8). Ex. 507 at 2.[2]

[2] Plaintiffs argue the Fall X2 action is unnecessary because this slightly improved STS index followed a fall in which X2 was located at 83-84km. *See* 7-28-11 Tr. at 217:10-12 (Feyrer). This argument is misplaced for several reasons. First, it is not yet known whether the fall 2011 index value will show improved abundance realative to the fall index value from last year. Second, this year's STS index value of 2.2 is still near the historic low, and is the seventh year in a row with an index value at or near the historic low. Ex. 507 at 2. Third, the Bureau's Mr. Feyrer testified that an unusually wet winter and spring, which translated into a

13. Plaintiffs suggest that this index value is artificially low because it does not account for nearly 60% of the estimated Delta-wide population found at the Cache Slough, Sacramento Deepwater Fish Channel, and Liberty Island areas ("Cache Slough Complex"), which were not included in the annual survey used to calculate the index. However, even if the index accounted for this additional population, no party contends that the delta smelt should not be listed under the ESA.

14. Evidence presented at the hearing suggests that the estuary does not support as many delta smelt as it once did. 7-29-11 Tr. at 105:4-14 (Nobriga). This may be because the "compensatory density-dependence" that historically enabled juvenile abundance to rebound from low adult numbers no longer exists. Ex. 505, Nobriga Decl. at ¶ 20. Thus, now, if adult numbers or adult fecundity decline, juvenile production will also decline. *Id.* (citing Kimmerer (2011)). Because juvenile carrying capacity has declined, juvenile production hits a "ceiling" at a lower abundance than it once did. *Id.* This limits adult abundance and possibly fecundity, which cycles around and limits the abundance of the next generation of juveniles. *Id.*

15. Exhibit 504 demonstrates an abrupt change in population dynamics starting in the early 2000s:

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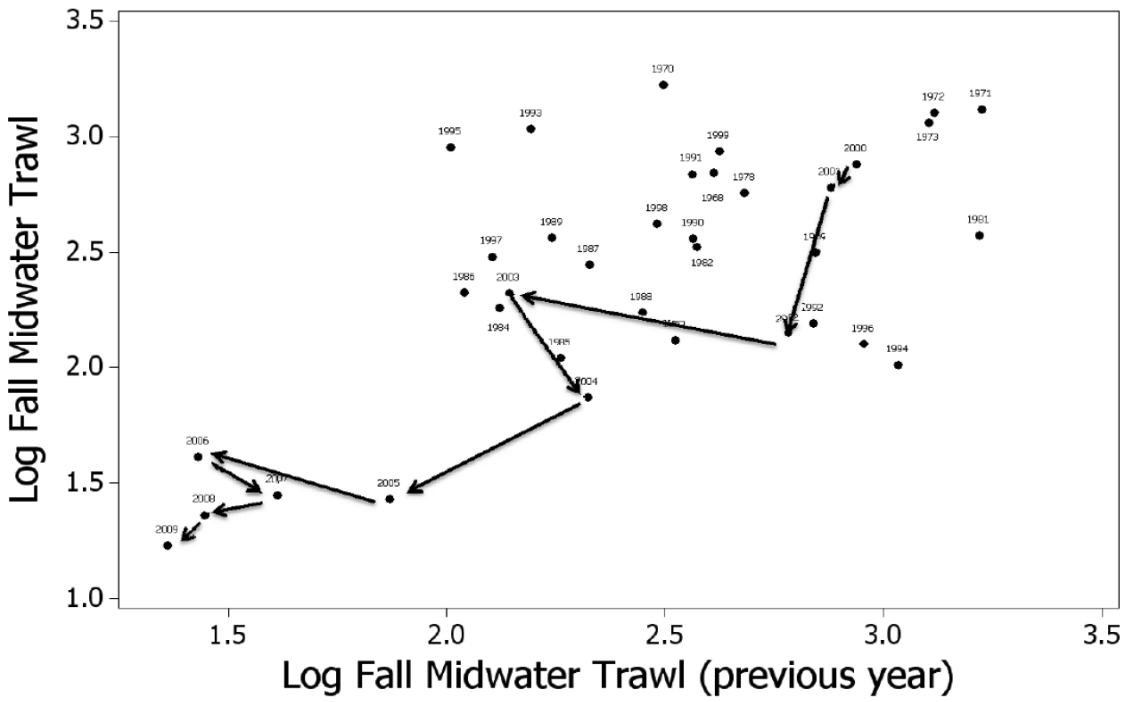
long spawning window, despite the easterly location of X2 last fall, combined with the fact that the Projects detected virtually no entrainment of delta smelt this Spring were likely responsible for this uptick in the STS index. 7-28-11 Tr. at 106:4-107:2.



Scatterplot of the log-transformed FMWT index versus the following year's log-transformed FMWT index. The abrupt change in population trend starting in the early 2000s, which moves toward the origin, indicates that the risk of extinction to delta smelt has increased.

16. The movement of the arrow toward the origin of the axes indicates that the risk of extinction to delta smelt has increased. Once the arrow reaches the origin, it indicates that no delta smelt are detected in any of the fish sampling trawls. 7-28-11 Tr. at 104:4-11 (Feyrer).

(2) Critical Habitat.

17. The delta smelt's designated critical habitat is composed of four primary constituent elements ("PCEs") that the BiOp found were significantly degraded by normal CVP and SWP project operations in the Fall. 7-29-11 Tr. at 178:12-179:13 (Norris); *see also BiOp* at

190-202, 239-244.

18. More specifically, the PCEs essential to the conservation of the delta smelt are physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration. Ex. 502, Norris Decl. at ¶ 22; *see also* BiOp at 190-202, 239-244.

19. The BiOp found that these PCEs are not located at all places within the delta smelt's designated critical habitat at all times. 7-29-11 Tr. at 177:16-20 (Norris). This is significant because features of delta smelt critical habitat may exist independently throughout the designation, but they only meet their intended conservation purpose when they coincide in space and during the life stage for which those features are required. *Id.* at 178:12-179:3 (Norris).

20. Under the ESA, the adverse modification threshold is exceeded when the proposed action will adversely affect the critical habitat's PCEs, or their management, in a manner likely to appreciably diminish or preclude the role of the designated critical habitat in the conservation of the species. Ex. 502, Norris Decl. at ¶ 20.

21. The BiOp found that the proposed continued operations of the CVP and SWP would adversely modify the delta smelt's critical habitat by preventing it from serving its intended conservation role

by degrading its PCEs and by limiting the co-occurrence of the PCEs at appropriate places and times. *Id*. at ¶ 23.

(3) Relationship of the Delta Smelt Population to X2.

22. Salinities in the Delta are typically measured as parts per thousand (ppt) or practical salinity units (psu), which are equivalent measures. 7/28/11 Tr. at 182:11-15 (Feyrer). The term "X2" refers to a salinity of 2 ppt or 2 psu. "Ocean salinity is usually around 33 psu." Ex. 578, Nobriga and Herbold (2009)), at 19.

23. Delta smelt are believed to typically reside in the low salinity zone[3]. Ex. 501, internal Exhibit B. Laboratory studies indicate that delta smelt are physiologically capable of tolerating salinities up to 19 psu, at which point, the salinity level becomes lethal. Tr. 7/28/11 at 182:24-183:8 (Feyrer). Nobriga and Herbold state: "In captivity, delta smelt can tolerate salinities as high as 10 psu for extended periods (Swanson et al 2000) but long-term monitoring shows that most juvenile delta smelt reside where specific conductance is about 1,000-10,000 microsiemens per centimeter, (about 0.6-6.0 psu)." Ex. 578, Nobriga and Herbold (2009)), at 19.

24. When X2 is at 79km or 80km, some individual delta smelt can

[3] The "low salinity zone" (LSZ) is the area of brackish water in the Delta where inflowing seawater mixes with outflowing freshwater. Some described the LSZ as being the area where salinity ranges from 0.5 to 10 practical salinity units ("psu" which is the same as parts pert thousand "ppt"). *See* Ex. 9, MacNally (2010), at 1419 ("[y]oung delta smelt move downstream in early summer and remain in the low-salinity zone (0.5-10 [on the practical salinity scale]) until they migrate for spawning."); *see also* Ex. 10, Thomson (2010), at 1433. Others define the LSZ as the area where salinities range between 0.5 to 6 ppt. Ex. 501, Feyrer Decl. at ¶ 23 ("low salinity zone is defined to include a range of salinities from approximately 0.5 to 6 ppt, [citing articles]."); 7/28/11 Tr at 107:3-9 (Feyrer). The LSZ moves up and down in the estuary both daily, with changing tidal conditions, and seasonally, with changes in rates of Delta outflow. *Id*. at 107:23-108:4 (Feyrer).

be found at higher salinity areas in Suisun Bay and Grizzly Bay. 7-28-11 Tr. at 213:14-19 (Feyrer). Mr. Feyrer also acknowledged that delta smelt can live their lives entirely in freshwater. Tr. 7/28/11 at 179:8-10.

25. Although delta smelt occupy a range of salinity and water clarity levels, the probability of observing a delta smelt is greatest at low salinities, centering on about 2 psu, and at relatively high levels of turbidity. Ex. 501, Feyrer Decl. ¶ 9; *see also* Ex. 586, Feyrer et al. (2007) ("Feyrer (2007)"), at 7 (AR 18272) (Figure 4(c)). According to Mr. Feyrer most delta smelt are typically caught in salinities between zero (freshwater) and 7 psu. 7/28/11 Tr. 186:17-187:9. Dr. Hanson testified that most delta smelt typically occupy areas between zero (freshwater) and "about 7 or 8 parts per thousand." 7/27/11 Tr. at 19:23-20:6. The probability of observing a delta smelt decreases as salinity increases above X2. 7-29-11 Tr. at 83:7-84:3 (Feyrer).

26. Several published studies, including Sommer *et al.* (2011) have demonstrated that the center of delta smelt distribution is at approximately the two parts per thousand isohaline, except during winter and spring for migration and spawning in freshwater. Ex. 501, internal Exhibit B.

27. This phenomenon is displayed graphically in the figure below, Figure 1 in Mr. Feyrer's declaration, which displays the empirically measured center of delta smelt distribution plotted

against the location of X2, in a tight-fitting relationship:

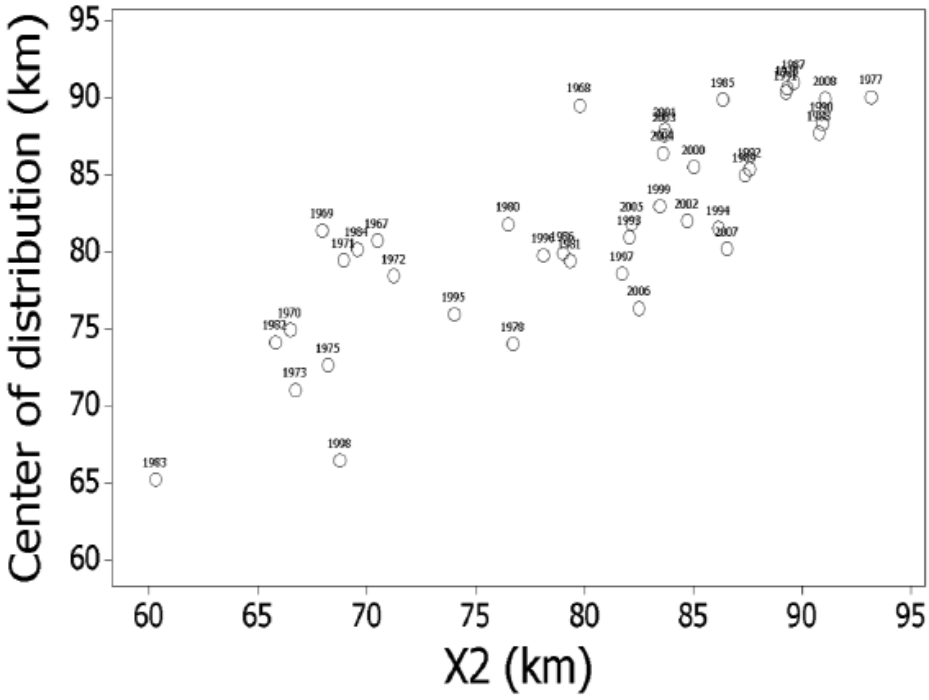


Figure 1. Center of delta smelt distribution plotted against X2.

Ex. 501, Feyrer Decl. at ¶ 9.

28. Dr. Hanson stated that he did not disagree with this figure or that delta smelt distribution centers on X2. 7-27-11 Tr. at 79:1-2. However, he noted that the "centroid" or "center of distribution" is not necessarily the area of greatest concentration, but rather is an index representing a weighted middle point based upon overall distribution. 7-27-11 Tr. at 29:13-17. For example, the "centroid" of the United States -- or the center of human distribution in the country -- might be Iowa, but that does not mean that the centroid is the area of greatest concentration. *See id.* at 29:18-21 (Hanson).

Dr. Hanson opined: "there are other facets of the distribution that need to be taken into account in order to interpret whether that's a meaningful metric." *Id.* at 29:24-30:1.

29. Dr. Hanson testified about a related issue: whether Fall X2 is related to the geographic distribution of delta smelt. He examined whether (1) when X2 is located between 70km and 75 km, the geographic distribution of smelt will expand; and (2) correspondingly, when X2 moves east into the narrower channels of the Sacramento River, the geographic distribution of smelt will contract. 7-27-11 Tr. at 10:11-25, 11:15-16 (Hanson); Ex. 103, figure depicting experimental inquiry. He also examined whether there was a relationship between the surface area of appropriate smelt abiotic habitat and smelt distribution. *Id.*

30. Dr. Hanson concluded the range of smelt distribution shifts further downstream when X2 is located further to the west and shifts further upstream when X2 is located to the east. 7-27-11 Tr. at 27:12-15 (Hanson). This range encompasses a broad geographic area spanning approximately 40 kilometers from Suisun Bay and Grizzly Bay in the west, to the Cache Slough Complex upstream to the north, regardless of the location of X2 in the fall or the extent of the "habitat area" depicted in Figure B-17 in the BiOp. 7-27-11 Tr. at 27:15-21 (Hanson); Ex. 102; 7-29-11 Tr. at 43:7-46:24 (Feyrer); Ex. 154, 155. Dr. Hanson concluded that moving the location of X2 westerly in fall months does not increase the area of habitat

utilized by delta smelt. 7-27-11 Tr. at 27:22-28:6 (Hanson).

31. Defendants criticize Dr. Hanson's analysis in a number of ways:

(a) According to Dr. Norris, one of the asserted purposes of the Fall X2 Action is to locate the centroid of the delta smelt population within the more productive areas of the estuary. Ex. 502, Norris Decl. at ¶ 24. Although Dr. Hanson's distribution maps did visually depict the relative number of smelt caught at each station, Ex. 100, Hanson Decl., Internal Exhibits 1a-e, Dr. Hanson's measurements of the breadth of smelt distribution looked only at the range of sites at which the mere presence of delta smelt was detected in survey data, and did not weight the catch in any way to account for the relative number of smelt caught at each station.

(b) Defendants also assert that Dr. Hanson's analysis is flawed because it is based on a comparison of disparate data sets. Specifically, Dr. Hanson compared FMWT data showing the location of smelt captures in the estuary to data showing a two-month average location of X2. 7-27-11 Tr. at 81:12-82:17. This comparison is of little utility in determining the relationship between smelt distribution and the location of X2 because using a two-month average location of X2 does not account for the location of X2 at the precise moment the smelt were captured. *Id.* at 82:15-17. Indeed, Dr. Hanson could not rule out the possibility that the smelt were located at X2

at the time they were captured. *Id.* at 81:25-83:18.[4]

(c) Defendants also maintain that Dr. Hanson formed a substantial portion of his opinion regarding the Fall X2 Action based on a small and unrepresentative subset of the available data. Ex. 501, Feyrer Decl. at ¶ 25. Specifically, Dr. Hanson states that he used data from 1990, 1996, 2002, 2003, 2005, 2006 and 2008. Ex. 100, Hanson Decl. at ¶ 20. This is only a handful of the 43 years of available data. Although Dr. Hanson states in a footnote that "[t]hese years were selected as examples of the geographic distribution of smelt under various hydrologic conditions," *id.* at 14 n.3, Defendants argue they do not represent relevant hydrological conditions. FWS only prescribed the Fall X2 Action to be implemented following springs classified as either wet or above normal. For unknown reasons, the seven years of data that Dr. Hanson chose "as examples of the geographic distribution of smelt under various hydrologic conditions," *id.*, included only a single example following a wet spring (1996) and a single example following an above normal spring (2006). Ex. 501, Feyrer Decl. at ¶ 25. In fact, of the 43 years of data available, 23 are years which follow a wet or above normal spring. *Id.* It is also unexplained why Dr. Hanson excluded 91% (21 of 23 years) of data points are appropriate.

(d) At best, Dr. Hanson's work on smelt distribution is

[4] Plaintiffs' notice of disapproval cites 7-27-11 Tr. at 82:2-83:3 as evidence that Dr. Hanson did consider the location of X2 on the day the smelt were captured. Those pages say no such thing and in fact reveal that Dr. Hanson admitted this could be done but that he did not do so.

valuable only to demonstrate that the breadth (in kilometers spanned) of smelt distribution does not shift dramatically as X2 shifts. It does not address how either the centroid or the majority of the smelt population moves with X2.

32. The 12/14/10 MSJ Decision found that X2 can rationally be used as a surrogate for delta smelt habitat. *San Luis v. Salazar*, 760 F. Supp. 2d at 918 (holding that "when all the disputed X2 studies are considered, X2 has a measurable effect on smelt abiotic habitat"); *id.* at 918 n.32 ("while X2 does not explain everything, it explains enough to consider X2 a proxy for critical habitat and to structure management prescriptions around X2").

33. The 2009 independent peer review conducted under the Information Quality Act ("IQA") determined that "hydrological events and actions that alter the [fall] X2 location directly *impact* suitable delta smelt abiotic habitat." Ex. 580 at 14. The IQA peer reviewers "strongly concur[red] with the USFWS's use of X2 as an index for identifying delta smelt abiotic habitat," finding that the "X2 index is extremely well supported and scientifically valid" and that "few ecological indices are as robust and well studied as X2." *Id.* In addition, DWR's own scientist, Dr. Ted Sommer, and others reiterated in a published and peer-reviewed journal article in 2011 that the "pre-migration distribution [of delta smelt] occurs in the low-salinity zone of the estuary as illustrated by the *strong association* between fish distribution and X2 during fall." Ex. 501,

Feyrer Delc., Internal Exhibit B, at 8 of 17.

E. Federal Defendants' Scientific Justification for the Fall X2 Action.

(1) Fall X2 Action and the Habitat Needs of the Smelt.

34. It is undisputed that during the fall, delta smelt are maturing pre-adults. They "live in the western portion of the estuary typically centered on the low salinity zone. That's the time of the year where they're growing and maturing into adulthood and preparing for their upstream migration for spawning." 7-28-11 Tr. at 110:17-21 (Feyrer). During this time, they "need enough food, enough calories to be able to grow, mature and start to produce eggs and to survive and make their way upstream and spawn again." *Id.* at 110:24-111:2 (Feyrer). If delta smelt do not eat enough prey and obtain sufficient caloric intake during this period, the species' overall reproduction could be impaired, and individual delta smelt "could produce less or fewer eggs or it might not even be able to reproduce at all." *Id.* at 111:3-12 (Feyrer). All else being equal, a female delta smelt that obtains more calories (prey) will grow larger and produce more eggs than a female delta smelt that obtains insufficient calories. *Id.* at 112:5-10 (Feyrer).

35. Mr. Feyrer opined that if delta smelt have access to more space, they will have more opportunity to encounter and consume prey than in an area where their habitat is more physically constricted. *Id.* at 112:11-17 (Feyrer). He further opined that delta smelt have increased opportunity to encounter and eat prey west of the

confluence of the Sacramento and San Joaquin rivers, and less opportunity to encounter and eat prey at or east of the confluence. *Id.* at 111:18-112:4 (Feyrer).[5]

36. The Fall X2 Action is designed to redistribute the current year's population of delta smelt into Suisun Bay, thereby increasing opportunities for feeding and rearing by increasing the ability of individuals to find food and avoid predation. Ex. 502, Norris Decl. at ¶ 17. Specifically, the Action, which requires increased Delta outflow, is designed to influence the spatial distribution of delta smelt so that it will overlap with biologically productive regions like Suisun Marsh, increasing opportunities for feeding and growth. *Id.* This repositioning is also designed to enhance the ability of pre-spawning delta smelt to escape predation because predation risk is lower in more turbid waters. *Id.*

37. FWS concluded that the ability of designated critical habitat to provide for the conservation of the delta smelt is compromised when the low salinity zone is disconnected from biologically productive areas that maximize the species' opportunity to find and consume prey, such as Grizzly Bay and Suisun Bay and Suisun Marsh areas, which are broader and shallower than the upstream

[5] Plaintiffs' object that these opinions are not based on data, but purely on the suppositions of Mr. Feyrer, whose work never considered food availability or analyzed whether altering the location of X2 would increase opportunities for delta smelt to encounter prey. Mr. Nobriga's work does provide limited support for Mr. Feyrer's conclusion by demonstrating the far western delta is the most biologically productive, with the Suisun area being slightly less productive but still more productive than areas east of the confluence. Nonetheless, Smelt abundance was highest in Suisun, where abiotic factors coincided with biological productivity. *See* Nobriga Decl. at ¶ 21.

confluence of the Sacramento and San Joaquin rivers. *Id.* at ¶ 24; *see also* 7-29-11 Tr. at 108:20-109:4 (Nobriga).

38. FWS also concluded that when the low salinity zone is upstream of the confluence, turbidity is lower than in the Grizzly Bay and Suisun Bay and Suisun Marsh areas, making it more difficult for delta smelt to avoid predation. Ex. 502, Norris Decl. at ¶ 24.

(2) The Delta Smelt Habitat Index.

39. To support the above-described conclusions regarding the Fall X2 ation, the BiOp relies almost exclusively on work by a Bureau of Reclamation scientist, Frederick Feyrer:.

40. The 12/14/10 MSJ Decision described the Feyrer's 2007 paper relied upon in the BiOp.

> [T]he BiOp's reli[ed] on a 2007 Canadian Journal of Fisheries and Aquatic Sciences paper by Feyrer, Nobriga, and Sommer, three scientists then working for Plaintiff DWR, entitled, "Multidecadal trends for three declining fish species: habitat patterns and mechanisms in the San Francisco Estuary, California, USA." AR 018266-77. That paper used a generalized additive model to assess the relationship between changes in environmental quality for delta smelt (particularly salinity and turbidity) and the abundance of delta smelt. *Id.*
>
> The paper demonstrated that a statistically significant relationship existed between salinity and turbidity in the fall months and the abundance of juvenile delta smelt the following summer for the period of 1987-2004. *Id.* This time period was chosen because it corresponded to the invasion of the *Corbula amurensis* clam which has resulted in significant ecological changes to the Delta. AR 018270. The results demonstrated that 63 percent of sampling stations showed statistically significant declines in environmental quality in the fall, with the western and southeastern regions of the Delta suffering the most substantial long term declines in habitat quality, while the area at the confluence of the Sacramento and San

> Joaquin Rivers least affected by the changes in fall habitat quality. *Id*.
>
> The Feyrer (2007) analysis uses the results of a 2005 study by William Bennett published in the Journal of San Francisco Estuary and Watershed Science, which concluded: "Factors defining the carrying capacity for juvenile delta smelt are unknown, but may include a shrinking volume of physically suitable habitat combined with a high density of competing planktivorous fishes during late summer and fall." AR 017004.
>
> The BA acknowledged the results of this 2007 study, including the conclusion that fall habitat conditions have population level effects:
>
> > Based on a 36-year record of concurrent midwater trawl and water quality sampling, there has been a long-term decline in fall habitat environmental quality for delta smelt (Feyrer et al. 2007). The long-term environmental quality declines for delta smelt are defined by a lowered probability of occurrence in samples based on changes in specific conductance arid Secchi depth. Notably, delta smelt environmental quality declined recently coinciding with the POD (Figure 7-8). The greatest changes in environmental quality occurred in Suisun Bay and the San Joaquin River upstream of Three Mile Slough and southern Delta (Figure 7-9). There is evidence that these habitat changes have had population-level consequences for delta smelt. The inclusion of specific conductance and Secchi depth in the delta smelt stock-recruit relationship described above improved the fit of the model, suggesting adult numbers and their habitat conditions exert important influences on recruitment.
>
> AR 010626; *see also* AR 10628-29 (reproducing maps and graphics showing habitat declines and geographic distribution of declines from Feyrer (2007)).
>
> The conclusions in Feyrer (2007) were also recognized in the January 2008 report on the Pelagic Organism Decline by the Interagency Ecological Program, which reached nearly identical conclusions about the effects of declining fall habitat quality on delta smelt abundance. *See* AR 016938, 016954, 016957.

San Luis v. Salazar, 760 F. Supp. 2d at 915-16.

A 2011 paper published in the Journal of Estuaries & Coasts, Feyrer et al. (2011) ("Feyrer (2011)"), built upon this and other

previous work by Feyrer. Using FMWT survey data, Feyrer (2011) developed an abiotic habitat index, which incorporates both quantity and quality of abiotic habitat. Ex. 501, Feyrer Decl. at ¶ 10; *see also* Ex. 7, Feyrer (2011). The index represents the surface area of the estuary standardized for salinity and water clarity conditions that are favored by delta smelt. Ex. 501, Feyrer Decl. at ¶ 10. The index represents the statistically-computed probability of observing a delta smelt at the observed salinity and water transparency conditions. *Id*. The habitat index is represented in the following figure:

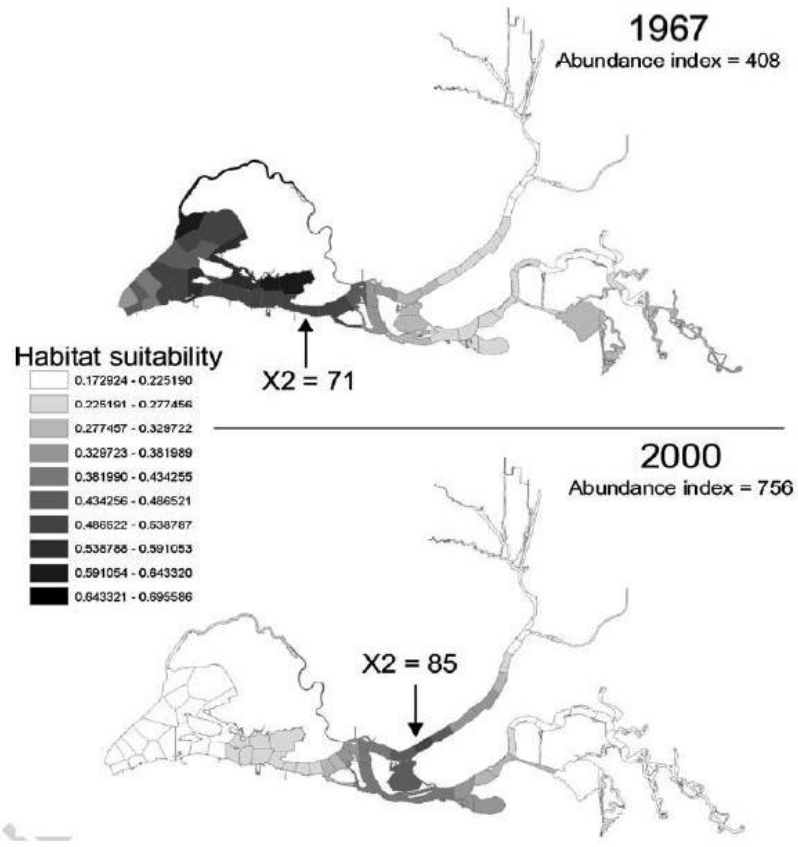


Figure 3. Spatial distribution of delta smelt habitat suitability for years in which X2 was either below (1967) or above (2000) the confluence of the Sacramento and San Joaquin Rivers. Abundance index is from the fall midwater trawl survey.

Ex. 501, Feyrer Decl. at ¶¶ 12-13.

41. In this image, "[t]he darker the shading means the higher suitability or the better it is for delta smelt." 7-28-11 Tr. at 122:2-3 (Feyrer). When the nominal location of X2 lies at 85 km, most of Suisun Bay and its turbid subsidiary bays, and biologically important parts of Suisun Marsh, are poorly suitable habitat according to the habitat index. Ex. 501, Feyrer Decl. at ¶¶ 12-13. The figure also shows that quality and quantity of delta smelt habitat increases as X2 moves westward toward Suisun Bay and Grizzly Bay. *Id*.

42. When explaining the image and the study's findings, Mr. Feyrer testified that "when X2 is located upstream of the confluence there, the habitat space for delta smelt and the habitat quality is much more restrictive compared to when X2 is to the west of the confluence. And when X2 is located west of the confluence, that opens up the low salinity zone and delta smelt habitat to those broad shoals in Suisun Bay and other areas, so there's just a lot more and a lot more suitable habitat for delta smelt." 7-28-11 Tr. at 122:9-16 (emphasis added).

43. The authors of Feyrer (2011) utilized fish catch data, salinity data, and turbidity data that were taken at the same place and time. *See* 7-28-11 Tr. at 115:12-18 (Feyrer). The study found "substantial decline in that habitat index over time." *Id*. at 120:10-11 (Feyrer); *see also* Ex. 7, Feyrer (2011), at 8

("deterioration of habitat represents a major issue for delta smelt because of its vulnerability to extinction").[6]

(3) Link Between Habitat Index and Delta Smelt Abundance Described in Feyrer Papers.

44. Feyrer (2007) concluded that incorporating abiotic habitat covariates into a basic stock-recruit model linking the abundance of sub adult delta smelt (as measured in the FMWT) to juvenile production (as measured in the STS) improved the fit of the model. Ex 586 at 6 (AR 18271) (Feyrer (2007)); *see also* Ex. 501, Feyrer Decl. at ¶ 17. Models that included the abiotic habitat variables accounted for approximately 20% more of the variance in the data set than those without the abiotic habitat variables (r-squared values improved from 0.39 to 0.59). *Id.*

45. Using FMWT fish catch and water quality data, Feyrer (2011) demonstrated a relationship between the abiotic habitat index and the delta smelt abundance index. Ex. 501, Feyrer Decl. at ¶ 18; 7-28-11 Tr. at 116:10-18. Feyrer (2011) concluded that "the habitat index was significantly positively correlated with the delta smelt abundance index..." 7-28-11 Tr. at 127:5-9. Mr. Feyrer presented the following figure, adapted from Feyrer (2011), to demonstrate the relationship between the abiotic habitat index and the FMWT abundance

[6] Plaintiffs dispute whether Feyrer (2011) considered all relevant smelt habitat, specifically whether Feyrer's habitat index analysis included habitat in the Cache Slough Sacramento Deepwater Ship Channel, and Liberty Island areas. Assuming, arguendo, that Feyrer (2001) did not take these areas into consideration, this would reduce the "denominator" of the habitat index. Ex. 4, Burnham Reply Decl. at ¶ 16. Including these areas would reduce the percent decline in the index observed over time. *Id.* Feyrer's testimony suggest that these areas may in fact have been included in his habitat index. 7-29-11 Tr. at 33:4-35:8 (Feyrer).

index.

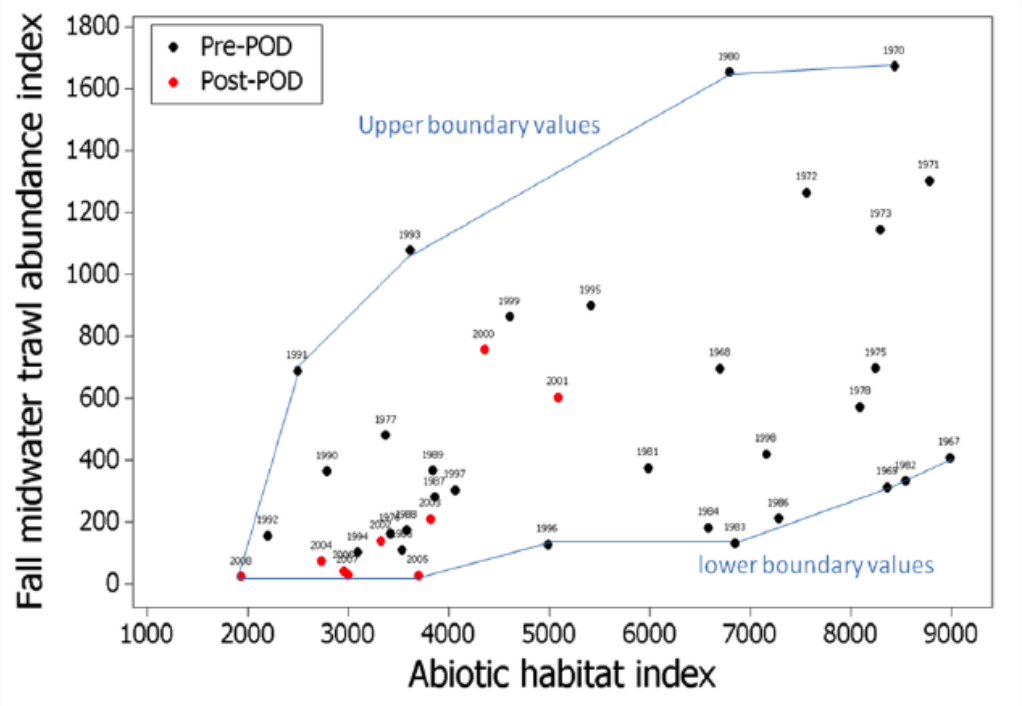


Figure 5. Delta smelt abiotic habitat index plotted against the Fall midwater trawl abundance index for the same year. Blue lines connecting the high and low boundary values were hand-drawn. Pre-POD period is 1967-1999. Post-POD period is 2000-2008. Figure is adapted from Feyrer et al. (2011).

Ex. 501, Feyrer Decl. at 11.

46. Mr. Feyrer opined: "the pattern of these data strongly suggests that although there is substantial variability in the relationship between the abiotic habitat index and the abundance index, there appears to be an upper limit to abundance that is an increasing function of abiotic habitat. A classic interpretation of these data is that delta smelt reach their population carrying capacity as a function of available habitat." *Id.* at ¶ 18.

47. However, both Dr. Deriso and Dr. Burnham opined that this correlation is meaningless, because the analysis in Feyrer (2011)

uses the same FMWT data on both axes, making some correlation inevitable. 7-29-11 Tr. at 207:8-208:9 (Burnham) ("There's the fall midwater trawl data underlying both axes ... And when you use the same data for things you then computed on both axes, it induces some degree of statistical correlation."). Mr. Nobriga agreed that any correlation between the habitat index and the FMWT would be "inherently circular because abundance and presence-absence are correlated," but further explained that Feyrer (2011) took this into account yet nevertheless reaffirmed the conclusion that the habitat index was significantly correlated with the FMWT. Ex. 505, Nobriga Decl. at ¶ 11. Mr. Nobriga does not explain how this correction was made.

48. These are legitimate criticisms and devalue the habitat index to an extent that cannot be determined with certainty.

(4) Other Criticisms of Feyrer's Work.

49. Plaintiffs argue that Feyrer's habitat index and the results of his research are flawed in several other ways.

a. Consideration of Statistical Uncertainty.

50. Plaintiffs argue that Feyrer's analysis fails to appropriately account for uncertainty. In its 2010 review of the available science supporting the Fall X2 Action, the NRC concluded:

> The controversy about the action arises from the poor and sometimes confounding relationship between indirect measures of delta smelt populations (indices) and X2. The weak statistical relationship between the location of X2 and the size of smelt populations makes the justification

> for this action difficult to understand. In addition, although the position of X2 is correlated with the distribution
> of salinity and turbidity regimes (Feyrer et al., 2007), the relationship of that distribution and smelt abundance indices is unclear. The X2 action is conceptually sound in that to the degree that habitat for smelt limits their abundance, the provision of more or better habitat would be helpful. The examination of uncertainty in the derivation of the details of this action lacks rigor. The action is based on a series of linked statistical analyses (e.g., the relationship of presence/absence data to environmental variables, the relationship of environmental variables to habitat, the relationship of habitat to X2, the relationship of X2 to smelt abundance), with each step being uncertain. The relationships are correlative with substantial variance being left unexplained at each step.

Ex. 12, NRC Report, at 53; 7-29-11 Tr. at 22:22-23:21 (Feyrer). Dr. Burnham agreed with the NRC and testified that it was "scientifically improper" for Mr. Feyrer to chain the results of multiple modeling efforts together without accounting statistically for the error introduced at each step. Ex. 2, Burnham Decl. at ¶ 22. According to Dr. Burnham, because Mr. Feyrer provided no analysis of the statistical uncertainty at each step of his habitat index, by the final step of his analysis it is impossible to assess the reliability of the correlations. 7-26-11 Tr. at 167:7-168:4 (Burnham). Defendants failed to adequately address this critique with countervailing competent scientific or mathematical analysis.

b. Feyrer Analyses Limited to Abiotic Factors Only.

51. Plaintiffs next argue that the Habitat Index is inherently flawed because the index considered only two abiotic habitat variables specific conductance (salinity) and Secchi depth

(turbidity). Ex. 7, Feyrer (2011) at 124; 7-29-11 Tr. at 7:8-13 (Feyrer).

52. Mr. Feyrer freely acknowledged that his work was limited to an examination of abiotic habitat factors, in part because of the absence of food supply data taken concurrently with the fish sampling trawls. *See* Hearing Ex. 7, Feyrer (2011) at 124; Ex. 586, Feyrer (2007), at 9-10 (AR 18274-75); Ex 505, Nobriga Decl. ¶ 12; 7-28-11 Tr. at 117:4-118:14, 120:22-121:5 (Feyrer). Where the habitat index is so heavily relied upon for management purposes, this is an unjustified exclusion.

53. In Feyrer (2007), which served as the basis for the "habitat index" analysis, the authors concede that "[b]iotic variables, most notably competition, predation and food availability, could have also played a major role in controlling the distribution of the [delta smelt, striped bass, and threadfin shad]." 7-28-11 Tr. at 246:3-14 (Feyrer). Mr. Feyrer further conceded that his analysis in Feyrer (2011) was "limited" because it only considered two abiotic variables in its analysis of "suitable" smelt habitat. 7-29-11 Tr. at 7:19-24. He agreed that a full and appropriate definition of "habitat" should take into consideration more than just abiotic conditions and that "[a]biotic habitat is a component of habitat." 7-28-11 Tr. at 244:17-21.[7]

[7] It was suggetsted by Mr. Feyrer that consideration of abiotic habitat alone was sufficient because "[a]biotic habitat factors are the underlying foundation that determines where an organism can live and reproduce." Ex. 501, Feyrer Decl. at ¶ 13. Likewise, Mr. Nobriga testified that a paper he published in 2005 demonstrates

54. The Feyrer (2007) and Feyrer (2011) studies provide some evidence of an association between delta smelt abundance and summer and fall abiotic habitat conditions. However, analyses utilizing the habitat index only explain a portion of the environmental influences on smelt abundance.

55. The Feyrer testimony revealed limitations of the habitat index, which are not satisfactorily explained. The extent to which this diminishes the efficacy of that index is significant, particularly in light of the magnitude of effect implementing the Fall X2 Action has on Plaintiffs. The disconnect between the weak scientific justification and the strong practical impact is corroborated by DWR's opposition to the X2 Action.

c. Failure to Separate Salinity from Turbidity.

56. Feyrer (2011) concluded that the habitat index variables of salinity and turbidity explain 25 percent of the variation in delta smelt abundance. 7-29-11 Tr. at 73: 5-16 (Feyrer). However, Mr. Feyrer acknowledged that the analysis in Feyrer (2011) does not provide a basis for calculating the proportion of the variation in the delta smelt abundance index attributable to salinity as a stand-alone variable. *Id.* at 74:16-75:2.

57. This adds an additional layer of uncertainty when using Feyrer's results to justify imposition of the Fall X2 Action. If

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that "physical aspects have to be appropriate for delta smelt in order for the biological productivity [of habitat] to matter." Ex. 505, Nobriga Decl. at ¶ 21. But, that abiotic factors are the "underlying foundation" for or are necessary to smelt survival and reproduction does not necessarily render them more important than biotic factors. Defendants presented no evidence to suggest such priority.

turbidity is the dominant factor, how will controlling X2 accomplish anything? This is not explored or explained.

d. Failure to Consider Smelt Populations Residing in the Cache Slough Complex.

58. The latest STS foudn that 60 percent of the total smelt catch came from areas upstream of the confluence of the Sacramento and San Joaquin Rivers, specifically in the Cache Slough Complex. Ex. 521, Hanson Decl., App. B at 1. This is an area of freshwater or low salinity that is unaffected by the location of X2. 7-27-11 Tr. at 39:5-11 (Hanson).

59. These findings call into question the current understanding of smelt biology. For example, the Interagency Ecological Program's December 6, 2010, Pelagic Organism Decline Work Plan and Synthesis of Results raised questions about the current conceptual model for delta smelt population dynamics:

> The delta smelt has been considered semi-anadromous, but in recent years investigations centered on its northern Delta spawning and early rearing areas have detected delta smelt year-round, leading to the idea that these putative "resident" individuals might represent alternative life history contingents (Sommer et al. 2009, Sommer et al in review). The southern end of the Yolo Bypass, including Liberty Island, Cache Slough, and the Sacramento deep water ship channel are known to support delta smelt spawning and rearing (see Bennett 2005). During 2003-2005 the USFWS collected delta smelt during monthly sampling activities throughout the year, not just during spring time, suggesting that delta smelt were using this relatively shallow, flooded island habitat throughout their entire life cycle (USFWS unpublished data). Similarly, extensions of the 20-mm Survey, TNS [Tow Net Survey] and FMWT surveys into the Sacramento deepwater ship channel caught delta smelt consistently from June through October, the warmest months of the year (CDFG unpublished data). Like the "core" rearing habitat of delta smelt near the Sacramento-San Joaquin River confluence, Liberty Island and adjacent

> deeper habitats in the Ship Channel and Cache Slough are very turbid and have very little SAV [submerged aquatic vegetation] (Nobriga et al. 2005, Lehman et al. 2010, CDFG unpublished data). However, Liberty Island is somewhat warmer during the summer than the river confluence (Nobriga et al 2005) and may prove to be a challenging habitat for rearing. The following conceptual model applies only to the traditional view of delta smelt as a semi-anadromous species. We are currently evaluating how to integrate these observations into our conceptual model (T. Sommer, DWR, unpublished data)."

Ex. 501, Feyrer Decl., Internal Exhibit C (Baxter, et al., *Interagency Ecological Program 2010 Pelagic Organism Decline Work Plan and Synthesis of Results* (Dec. 6, 2010)) at 55-56.

60. The Cache Slough Complex was not included in the STS until 2009 and 2011. 7-27-11 Tr. at 35:7-37:11 (Hanson); *See also* Ex. 106. Consequently, Feyrer's 2007 and 2008 analyses, which only utilized FMWT data up until 2004 and 2006 respectively, *see* Ex 586, Feyrer (2007), at 724 ; Ex. 6, Feyrer et al. (2008) ("Feyrer (2008)"), at 6 (AR 018283), and could not possibly have considered data of a substantial delta smelt population in the freshwater upstream areas in the Cache Slough Complex. Feyrer (2011) used only FMWT data up until 2008, Ex. 7, Feyrer (2011), at 141, so it too did not consider any evidence of a substantial population of delta smelt in Cache Slough that is unaffected by downstream shifts in the location of Fall X2.

61. Plaintiffs criticize Mr. Feyrer's work for excluding these areas from his habitat index analysis. Some evidence suggests Mr. Feyrer's calculation of the habitat index did include Cache slough and the Sacramento Deepwater Ship Channel. 7-28-11 Tr. at 124:15-20

(Feyrer) (testifying that the maps depicting the habitat index did encompass these areas).[8] However, on cross-examination, Mr. Feyrer admitted that the core stations he used to develop the habitat index were all downstream of Cache Slough, Liberty Island, and the Sacramento Deepwater Ship Channel. Tr. 7-29-11 at 36:6-37:15. This inconsistent testimony cannot support the absolute limits for X2 the current RPA establishes.

62. Even assuming the habitat index excluded these upstream areas, Mr. Feyrer opined that including them "would simply add a constant number of units to the habitat index, which would not affect the shape of the X2-habitat index relationship." Ex. 510, Feyrer Decl. at ¶ 16. He admitted, however, that additional units would shift the curve to the right. 7-29-11 Tr. at 33:24-34:1; Exs. 102(a), 153. This is highly relevant to the reliability of the justification provided for the specific 74 km X2 standard to be imposed this Fall.

e. Life Cycle Modeling.

63. Plaintiffs' also criticize Feyrer's work and the BiOp's reliance on it on the ground that Feyrer's results are contradicted by several recent papers evaluating smelt population dynamics through the use of life-cycle models. Life-cycle modeling is a special type of population dynamics modeling that considers the survival and

[8] At the time he prepared the relevant charts Liberty Island (which is actually no longer an island at all, but rather a recently flooded area) was not in existence. 12-28-11 Tr. at 124:14-17.

reproduction of species over time. 7-26-11 Tr. at 169:16-170:6 (Burnham).

64. It is undisputed that life-cycle modeling is the best method for determining the effect of an environmental variable on the population dynamics of a species. *See San Luis v. Salazar*, 760 F. Supp. 2d at 885 (finding it "undisputed that application of a quantitative life-cycle model is the preferred scientific methodology" for determining the effects of a stressor on the population of a species like the delta smelt); *id.* ("life-cycle modeling is standard practice in the field of fisheries biology").

65. Feyrer (2007) states that the development of life-cycle models for the delta smelt was "likely to better quantify the relative importance of water quality on their population dynamics." Ex. 586, Feyrer (2007), at 731 (AR 018274). Mr. Feyrer also admitted that the use of a quantitative life-cycle model "would definitely help us reduce the amount of uncertainty" in the RPA, 7-29-11 Tr. at 17:25-18:10 (Feyrer), and that "well constructed life-cycle models can definitely ... improve our understanding of the delta smelt population dynamics." 7-28-11 Tr. at 219:12-16 (Feyrer).

66. Despite the recognized need for a quantitative life-cycle model to analyze the effect of the location of X2 and other environmental variables on the population of the delta smelt, "it is undisputed that an appropriate life-cycle model had not been developed at the time the BiOp issued" in 2008. *See San Luis v.*

Salazar, 760 F. Supp. 2d at 885. The Court previously found that "FWS had the time and ability to prepare the necessary life-cycle model. FWS made a conscious choice not to use expertise available within the agency to develop one." *Id.* This is evidence of agency intransigence. The court has repeatedly found that the agency's "lack of data" apologetic is the premise for the agency to do what it chooses without addressing Plaintiffs' objections.

67. Dr. Norris, the ESA regulator charged with determining whether there is a likelihood of jeopardy or adverse modification of critical habitat, testified that a life cycle model is not *per se* the best available science under ESA Section 7(a)(2). 7-29-11 Tr. at 182:4-186:6. She opined that a life cycle model is not automatically considered to be a credible resource, but rather must be evaluated for credibility based on the assumptions that went into it, the questions that were being asked, the data that were used, how the results were derived and what conclusions were drawn from those results. *Id.* at 186:7-16. Dr. Norris further explained that it is unlikely that any one life cycle model ever would be considered definitive or conclusive evidence that forecloses other evidence. *Id.* at 186:17-22.

68. Dr. Norris observed that scientific understanding with regard to the delta smelt is never static, and new information frequently is developed after a BiOp has been prepared. *Id.* at 186:23-187:6. For instance, Dr. Norris testified that Dr. Ken

Newman, of FWS's Stockton, California office, currently is working on a delta smelt life cycle model that will have several unique features, including spatial variability throughout the Delta, as well as temporal variability. *Id.* at 182:18-183:13. Dr. Newman's model also will include the full data set for the Fall Midwater Trawl, which is fairly extensive and expanded over what has been done previously. *Id.*

(1) Feyrer (2008) Life Cycle Modeling Effort.

69. The BiOp relied in part on a 2008 manuscript, Feyrer (2008), which utilized a life-cycle model to evaluate the relationship between the location of X2 and delta smelt abundance. BiOp at 236. The December 14, 2010 MSJ Decision summarized the paper as follows:

> [Feyrer (2008)] expanded upon the 2007 research, used statistical analyses, including both Ricker and Beverton-Holt type models, to compare Fall X2, habitat area for and subsequent abundance of delta smelt. *Id.* Like Feyrer (2007), it concluded that fall habitat quality had a statistically significant effect on subsequent delta smelt abundance, determining that the model incorporating prior abundance and X2 accounted for 66 percent of the variability in subsequent abundance. *Id.* The authors identified a number of reasons why the location and extent of fall habitat affected subsequent abundance:
>
> > First, positioning X2 seaward during autumn provides a larger habitat area which presumably lessens the likelihood of density-dependent effects (e.g., food availability) on the delta smelt population. For example, food availability during autumn for adult haddock (*Melanogrammus aeglefinus*) likely improves juvenile recruitment the following year (Friedland et al. 2008). Second, a more confined distribution may increase the probability of stochastic events that increase mortality rates of adults. For delta smelt, this includes both predation, as well as anthropogenic

> effects such as contaminants or water diversion loss (Sommer et al. 2007).
>
> AR 018293. The study concluded: "Comparing the first ten years of the time series to the last ten years, the amount of suitable abiotic habitat for delta smelt during autumn has decreased anywhere from 28% to 78%, based upon the least and most restrictive habitat definitions, respectively." AR 018293-94.

San Luis v. Salazar, 760 F. Supp. 2d at 917.

70. Responding to Dr. Deriso's critique at that time that the Feyrer (2008) model inappropriately made use of a linear additive model, rather than a multiplicative model, the MSJ Decision concluded this critique "raise[d] a scientific dispute among experts," and noted that peer reviewers did not recommend exclusion of the model and broadly supported the Fall X2 action based in part upon the model. *Id.* at 922.

71. The Feyrer (2008) manuscript, which was cited in the BiOp, was ultimately published as Feyrer (2011), Ex. 7, but with a narrowed focus on the habitat index, and leaving the draft life cycle model contained in the 2008 manuscript for later, to be incorporated into a different effort where that could be the sole focus. 7-28-11 Tr. at 135:14-136:15 (Feyrer).[9]

72. Plaintiffs argue that the Feyrer (2008) model suffered from

[9] Plaintiffs suggest that the omission of the draft life cycle model from the final publication in 2011 undermines the value of the conclusions in Feyrer (2008). The fact that the authors of Feyrer (2008) removed the draft life cycle model from the manuscript prior to submitting it for publication in 2010, *see* Ex. 501, Feyrer Decl. at ¶ 19, does not mean that FWS's reliance on the manuscript (including its many other parts) in developing the 2008 BiOp was arbitrary and capricious. The draft life cycle model was removed so that it could be the focus of a separate effort, and because the Feyrer (2011) article ultimately took on a different focus, namely, the creation of the abiotic habitat index. 7-28-11 Tr. at 135:14-136:15 (Feyrer).

significant structural problems. Specifically, the model predicted negative smelt abundance as often as 54% of the time under certain scenarios. 7/28/11 Tr. at 251:15-252:23 (Feyrer); *see also* Ex. 6, Feyrer 2008, at 12 (AR 018289).

73. In his testimony, Mr. Feyrer stated that the negative abundance values might possibly represent an extinction scenario rather than a flaw in the model. 7-29-11 Tr. at 88:6-25 (Feyrer). However, contrary to this testimony, Feyrer (2008) considered this possibility and dismissed it. Ex. 6, Feyrer 2008, at 12 (AR 018289) ("[O]ne could make an argument that the frequency of times that such an event occurred was a prediction of the probability of extinction. ... However, the probability of negative abundances was largely a function of uncertainty in the parameter values as increasing the initial number of adult fish in the fall, even to 1,000, did not noticeably affect the probabilities."). This disassembling calls Mr. Feyrer's credibility into question. His scientific objectivity is compromised by inconsistency.

74. The Feyrer (2008) life cycle model concluded that fall habitat quality had a statistically significant effect on subsequent delta smelt abundance and determining that the model incorporating prior abundance and X2 accounted for 66 percent of the variability in subsequent abundance. The model and its application were imperfect. They represent relevant but scientifically compromised findings regarding the relationship of Fall X2 to smelt abundance.

(2) Overview of Other Life-Cycle Modeling Efforts.

75. Since the BiOp was published in December 2008, the body of scientific information on delta smelt has grown. Three additional life-cycle models have been developed by Maunder & Deriso (2011), Mac Nally et al. (2010) ("Mac Nally (2010)"), and Thomson et al. (2010) ("Thomson (2010)"). Each is the subject of an article published in a peer-reviewed scientific journal. Exs. 8, 9 & 10.

76. The Maunder & Deriso (2011) model is a state-space multistage life-cycle model that analyzes delta smelt populations at every life stage using data from multiple seasonal surveys of delta smelt abundance. 7-26-11 Tr. at 46:2-15 (Deriso). The state-space model approach is capable of utilizing an array of surveys, which allows for more closely tailored testing of environmental factors within a particular life stage. *Id.* at 46:23-47:1 (Deriso).

77. Thomson (2010) endorsed the statistical approach taken in the Maunder & Deriso (2011) model, stating "[a]nother area of future work that may clarify mechanisms is to fit process models that include multiple life history stages of the fish species using data available from surveys that complement data from autumn midwater trawl surveys used here ... A life history model that linked the abundances of each life stage would provide a more continuous picture of the delta smelt population and would capitalize more fully on available data." Ex. 10, Thomson (2010), at 1446.

78. Similarly, Mac Nally (2010) recommended the statistical

approach taken in the Maunder & Deriso (2011) model: "A broader life-history model with a more general state-space approach to modeling the pelagic species decline should be more informative." Exh. 9, Mac Nally (2010), at 1427.

79. The Maunder & Deriso (2011) model was structured so that it could perform hypothesis testing about candidate environmental factors to determine if they were important in accounting for changes to the population growth rate. 7-26-11 Tr. at 47:23-48:2 (Deriso).

80. The Maunder & Deriso (2011) model found that three kinds of environmental factors were important: food abundance in spring as measured by the zooplankton index, spring water temperature, and fall predation index. In addition, density dependence was significant. *Id.* at 48:11-17 (Deriso).

81. The Mac Nally (2010) model, which was co-authored by Mr. Feyrer, used a different statistical technique called multivariate autoregressive modeling to determine the effects of 54 different environmental covariates. 7/28/11 Tr. 220:18-20 (Feyrer); Ex. 9, Mac Nally (2010).

82. The Thomson (2010) model, which was also co-authored by Mr. Feyrer, used another statistical technique, Bayesian change point analysis, to determine the effect of a number of covariates on delta smelt abundance. 7-28-11 Tr. at 220:15-17 (Feyrer); Ex. 10, Thomson (2010).

83. Each of the published life-cycle models used different data

sets, different covariates, and different modeling approaches. 7-26-11 Tr. at 134:4-11 (Deriso); Ex. 501, Feyrer Decl. at ¶ 21.

84. Using different modeling approaches, data sets, and covariates, all three of the published life-cycle models came to the conclusion that the location of X2 in the fall does not have a statistically significant effect on delta smelt abundance. 7-26-11 Tr. at 134:4-11 (Deriso); 7/29/11, 18:14-21 (Feyrer); 7/29/11, 121:11-14 (Nobriga). Federal Defendants' expert Mr. Nobriga admitted, based on the three published models, that the 40 years of historical data do not support a correlation between the location of X2 in the fall and delta smelt abundance: "I think that in terms of the historical data, that the three models probably indicate there's – that you're not going to find a correlation out of the historical data." 7-29-11 Tr. at 141:5-15.

85. However, all three life-cycle models also came to <u>different</u> conclusions regarding which factors affect delta smelt abundance. Ex. 501, Feyrer Decl. at ¶ 21; *see also* Ex. 505, Nobriga Decl., Internal Exhibit B (chart comparing life cycle models). This suggests that there is no one single factor that affects delta smelt abundance, and there is no single paper, model, or analysis that is the final word on what factors affect the smelt. There is substantial disagreement among scientists about the relative importance of various factors. Additionally, the relative importance of factors differs both within and among years. *See* Ex. 501, Feyrer

Decl. at ¶ 21 (citing Bennett and Moyle (1996); Bennett (2005); Sommer *et al.* (2007); Baxter *et al.* (2010)).

86. Model results "depend very strongly on how the model is set up and what covariates are considered." Ex. 505, Nobriga Decl. at ¶ 23. Since covariates affect the result, it is therefore "extremely important that the covariates (i.e., the model inputs) accurately characterize what they purport to characterize – and that they reflect the best use of available scientific and monitoring information." *Id.* at ¶ 25. The scientific disagreement over which covariates should be considered does not justify ignoring the results of these life cycle models.

(3) Specific Critiques of the Maunder & Deriso Approach.

87. Dr. Deriso testified in detail about the results of the life cycle he developed with Dr. Maunder. Defendants offer numerous reasons why the Maunder & Deriso model should not be afforded definitive weight here.

88. Defendants first assert that both the Feyrer (2011) analysis and the Maunder & Deriso life-cycle model produced similarly powerful results, namely that they both "account for approximately the same percentage of variation in the FMWT." 7-28-11 Tr. at 127:13-129:11 (Feyrer)(basing his testimony on Dr. Deriso's previous testimony that the Maunder/Deriso model only explains 24% of the variation in adult delta smelt abundance, leaving unexplained 76% of the variation which must be caused by some other factor or factors.

7-26-11 Tr. at 119:13-120:2 (Deriso)); *see also* Ex. 3, Deriso Decl., Internal Attachment A, at 13 of 49.

89. Plaintiffs argue in their Disapproval that this is comparing apples to oranges. The 24% figure to which Dr. Deriso referred was taken from the "Adult" column of Table 7 of Deriso & Maunder (2011), which represents the period of the delta smelt life cycle from the FMWT to the spring 10mm survey. Doc. 1009 ¶ 63. This apparently does not represent the variation in the FMWT in the same way as Feyrer (2011) measured. Rather, Plaintiffs assert the more appropriate figure is 43%, taken from the "Juvenile" column of Table 7, which represents the period of the delta smelt life cycle from juveniles to adults in the STS to the FMWT, "in other words the changes in population level that result in the FMWT measurement." Id. But, Plaintiffs failed to present any evidence demonstrating that this is a better form of comparison. More importantly, this explanation highlights the fact that the two types of modeling compared by Mr. Feyrer are not necessarily equivalent. Dr. Burnham explained that comparison of two R-squared values is improper, because the underlying analyses are entirely different. Tr. 7-29-11 at 208:19-210:13. This further inconsistency raises additional questions about reliability of Feyrer's final opinion reflected by the Fall X2 RPA

90. Dr. Deriso generally acknowledged that the Maunder & Deriso model is merely "a start towards answering the complicated question

regarding the Delta." 7-26-11 Tr. at 123:11-13 (Deriso); Ex. 5, Deriso Reply Decl. at ¶ 27. Dr. Deriso admitted that his "model is not the final word on the delta smelt, it can undoubtedly be improved." 7-26-11 Tr. at 123:3-6; Ex. 5, Deriso Reply Decl. at ¶ 27.

91. Defendants further complain that Dr. Deriso's model is a generic life-cycle model that is merely illustrated in his manuscript by application to delta smelt. 7-26-11 Tr. at 86:25-87:5 (Deriso). His model does not reflect delta smelt biology other than being designed for an annual species with various abundance measurements during the year. 7-26-11 Tr. at 88 (Deriso). It was not developed with fish biologists or ecologists with extensive experience in the Delta. 7-26-11 Tr. at 124 (Deriso). However, Dr. Deriso explained that the Maunder & Deriso (2011) model was tailored to the specific life stages of the delta smelt. 7-26-11 Tr. at 88:6-20.

92. Defendants also criticize the Maunder & Deriso (2011) model for failing to analyze prey abundance or turbidity.

(a) Dr. Deriso admitted that prey abundance is a key factor affecting survival. 7-26-11 Tr. at 64:17-19; *see also* 7-26-11 Tr. at 133:24-34:3. Yet, his model specifically excluded consideration of prey density in the fall, 7-26-11 Tr. at 104:10-12 (Deriso), despite the fact that "[n]ative and non-native zooplankton abundances are known to be enhanced in the western portion of the Delta during the fall," Ex. 4, Burnham Decl., Internal Attachment A (Delta Science

Program Review Panel Summary Report Re: Draft Plan for Adaptive Management of Fall Outflow for Delta Smelt Protection and Water Supply Reliability), at 36 of 49. This is an unjustified rationalization that weakens applicability of the Maunder & Deriso life cycle model.

(b) Dr. Hanson concurs "that as habitat moves further down into the Suisun Bay area there would be zooplankton availability as a food resource. And under that circumstance, you would expect that the delta smelt would have greater opportunities for foraging when they were located further downstream in the Suisun Bay area." 7-27-11 Tr. at 9:-13.

(c) Similarly, Dr. Deriso did not test the effect of turbidity on delta smelt in the fall. As explained in Reclamation's 2011 Fall X2 draft adaptive management plan, "turbidity at X2 is higher when X2 overlaps Suisun Bay than when it's in the river channels east of the [Sacramento-San Joaquin] confluence" and that "higher turbidity is expected to reduce predation rates on delta smelt." Ex. 501, Internal Exhibit A, at 25 of 48. Dr. Hanson agreed: "as habitat area moves further down into the Suisun Bay area, ... it's an area that characteristically has higher turbidities. You might expect that those higher turbidities would result in a reduction in the vulnerability of delta smelt to visual predators such as striped bass. That would reduce predation mortality and increase delta smelt survival." 7-27-11 Tr. at 9:1-7.

(d) While Dr. Deriso did find that predation in the fall is a significant factor affecting smelt abundance, 7-26-11 Tr. at 107:14-20, he failed to include a turbidity variable in his fall X2 analysis that would measure whether increased turbidity would reduce the negative effect of fall predation, 7-26-11 Tr. at 108:12-17.

(e) Although prey abundance and turbidity were not directly tested in the Maunder & Deriso analysis, Plaintiffs point out that Defendants' theories are dependent upon the assumption that moving the location of X2 will redistribute smelt into areas where, in part because turbidity and prey abundance are favorable to the smelt, their abundance will increase. Dr. Deriso tested whether the location of X2 is correlated to changes in smelt abundance and found no correlation.[10]

93. There is also a dispute over whether the data inputs Dr. Deriso used were appropriate. To illustrate his model, Dr. Deriso chose to use covariates developed by Dr. Manly and Dr. B.J. Miller, rather than raw IEP data employed by the Thomson and Mac Nally models. *See* Ex. 5, Deriso Reply Delc., at ¶ 25. Dr. Deriso concluded that this data, which refined the raw data to represent actual smelt habitat locations and conditions, would produce more accurate and useful results than the raw data. *Id*. This was a

[10] Defendants also criticize Dr. Deriso's work because the data set used by Dr. Deriso in his published manuscript excluded salinity altogether as a factor affecting delta smelt. 7-26-11 Tr. at 102:18-20 (Deriso). But, Dr. Deriso performed a separate analysis of X2 using his life cycle model, from which he concluded that the location of X2 in the fall has no effect on delta smelt abundance. Ex. 3, Deriso Decl. at ¶¶ 23-31.

reasonable exercise of scientific judgment.

94. Additionally, Dr. Deriso's life cycle model uses a food supply variable based on zooplankton data that are collected at fewer and different stations from the fish sampling trawl, and at different times. Ex. 505, Nobriga Decl. ¶¶ 13, 32-33. This approach could "potentially bias the data" because both delta smelt and zooplankton can move quickly, either passively on currents, or under their own volition in response to local hydrodynamics. 7-29-11 Tr. at 119:19-120:5 (Nobriga); *see also* Ex. 303, Nobriga Decl. ¶ 13; *see also id.* ¶ 32 ("the key is to use concurrently collected data because the predator (delta smelt) and its prey (calanoid copepods) are always moving – both due to hydrodynamics and their own swimming behaviors"); 7-29-11 Tr. at 112:3-13 (Nobriga). Yet, on cross-examination, Mr. Nobriga admitted that there is no prey data collected concurrently with the FMWT. Tr. 7-29-11 at 133:14-134:9. This reduces the reliability of the data used.

95. Finally, Defendants assert that Dr. Deriso's model is flawed because it "does not reflect the current population status of the delta smelt." Doc. 1004, Defendant's Proposed Findings of Fact # 177. Specifically, Defendants point out that Dr. Deriso's model found strong evidence for density dependence for survival from juvenile delta smelt to adults. 7-26-11 Tr. at 110:3-5. Dr. Deriso acknowledges that this finding of a density dependent relationship is "heavily influenced" by three consecutive years of data from 1976-

1978, *id.* at 112:9-13, and that the juvenile-to-adult life stage of delta smelt is currently density independent, *id.* at 113. Defendants complain that, despite the current, density independent pattern, Dr. Deriso's model was specifically designed "to evaluate population impacts in the presence of density dependence." Ex. 3, Deriso Decl., Internal Attachment A, at 26 of 48.

96. Plaintiffs rejoin that this entire line of reasoning is misleading because the Ricker-type model that underlies the Maunder & Deriso (2011) model operates accurately to predict survival rates that are density independent at very low population levels, Doc. 1009, Disapprovals at 75, but Plaintiffs cite nothing in the record to support this assertion.

97. Overall, Defendants critiques of Dr. Deriso's work do not undermine its essential value as a peer-reviewed life cycle model that concludes there is no correlation between the position of X2 and delta smelt abundance.

f. Comparison of the Life Cycle Modeling Results.

98. Plaintiffs assert that the Mac Nally, Thomson, and Maunder & Deriso models should be given definitive weight because these three life-cycle models agree that the location of Fall X2 has no effect on delta smelt abundance. But, the evidence suggests that none of these models are universally accurate. Each approach asks different questions using different tools and inputs, and each result has its strengths and weaknesses. This is a classic scientific dispute.

99. These competing scientific results compared against one another do not produce a certain paradigm. They are all considered in the final balancing of the equities. The one clear conclusion that can be drawn from this dispute is that the Feyrer papers are neither definitive nor dispositive, and do not provide the level of confidence on which such unprecedented action should be based. They provide some evidence for the Fall X2 Action that is undermined and contradicted by the three most recent life cycle modeling efforts.[11]

F. Dr. Hanson's Testimony.

100. Plaintiffs' expert, Dr. Charles Hanson, a fish biologist, testified at length about his own independent investigation into the biological support for the Fall X2 Action. He first examined the purported relationship between the monthly average location of X2 in the Fall and the subsequent abundance of delta smelt. After examining the relevant scientific literature, Dr. Hanson identified four mechanisms by which movement of the location of X2 could possibly affect the population dynamics of delta smelt: (1) that X2 has an impact on the geographic distribution of delta smelt in the

[11] Federal Defendants assert generally that reliance on statistical applications and modeling computations are not a complete substitute for local biological and ecological knowledge. For example, recent work by Kimmerer indicates that losses of delta smelt to export pumping can be nearly undetectable with regression analysis yet have a very significant population-level effect. Feyrer Decl. ¶ 20 (7-1-11) (Hearing Exhibit 501) (citing Kimmerer (2011)) (Doc. 944). While Kimmerer may provide support for finding an effect despite statistical insignificance under the circumstances analyzed in his paper for losses of smelt to export pumping, no such analysis has been presented here regarding the impact of Fall X2 on smelt abundance. FWS cannot simply assume that the location of X2 affects smelt population dynamics. Record evidence is necessary. Here, such evidence is in the form of statistical analyses. The Fall X2 action must rise or fall on that information.

fall; (2) that X2 effects survival of pre-spawning delta smelt in the fall; (3) that X2 affects reproduction of delta smelt the following spring; and/or (4) that X2 affects delta smelt food availability. 7-27-11 Tr. at 8:13-9:16, 9:20-25 (Hanson); *see also* 7-26-11 Tr. at 234:18-235:1 (Hanson).

101. The results of Dr. Hanson's inquiry into the effect of Fall X2 on smelt geographic distribution were discussed above at Findings of Fact ## 28-31. Bvt5

(1) Relationship Between Fall X2 and Delta Smelt Survival.

102. Dr. Hanson examined whether there was a relationship between the position of Fall X2 and delta smelt survival. He did so by developing a survival index derived from FMWT survey data. 7-27-11 Tr. at 43:19-44:12, 44:20-21 (Hanson); Exhs. 108A, 109.[12] The survival index was mapped against the corresponding X2 location derived from Dr. Hutton's work. 7-27-11 Tr. at 46:9-10 (Hanson); Ex. 109.

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[12] Using DFG's estimates of delta smelt abundance for September, October, November, and December from the FMWT surveys, Dr. Hanson developed a survival index that plotted the change in abundance over the seasonal period, with the slope of the resulting regression serving as an index of the survival rate. 7-27-11 Tr. at 45:21-46:8 (Hanson).

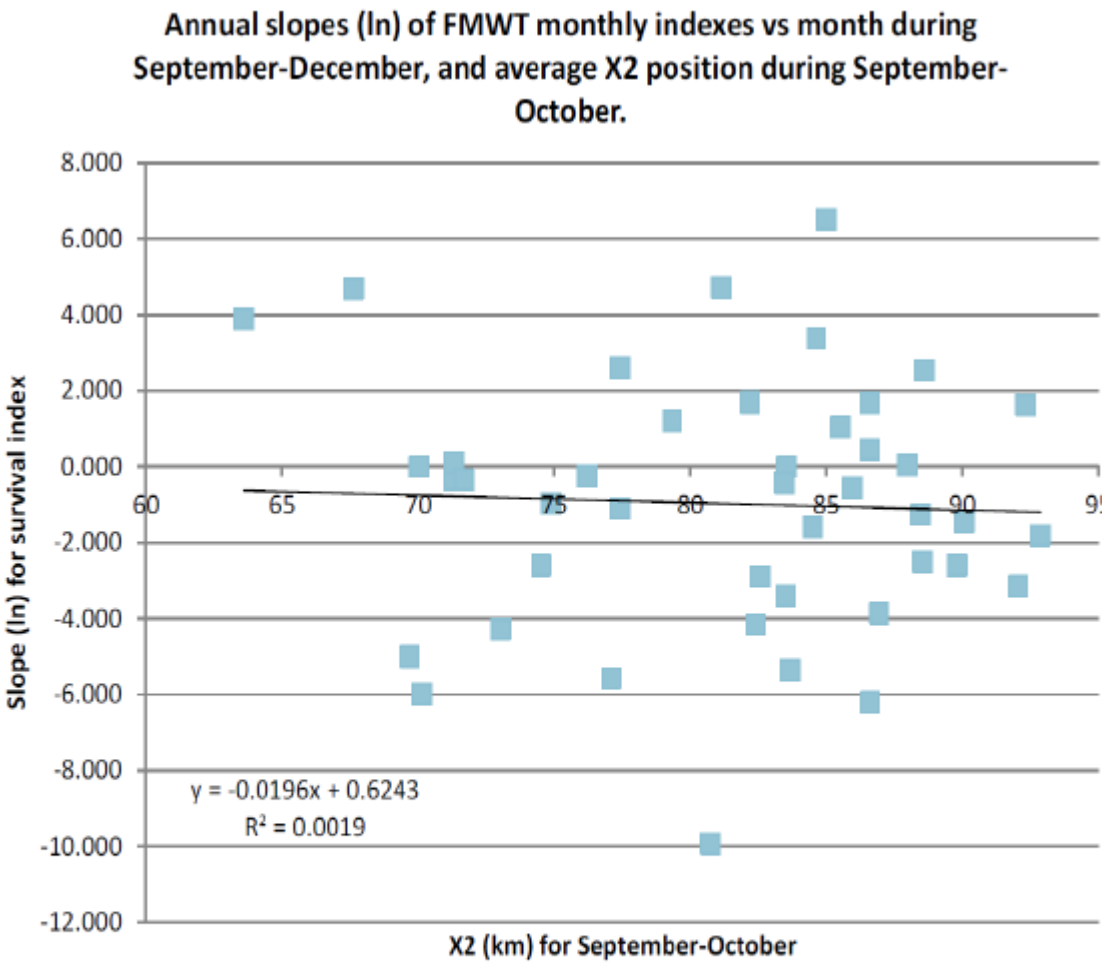

Figure 7. Estimated survival of delta smelt collected in the CDFG FMWT and September-October X2 location.

Ex. 100, Hanson Decl. at 19. When actual FMWT data were thus arrayed, they demonstrated that no relationship exists between the survival of delta smelt in the fall and the corresponding location of X2 in September and October. 7-27-11 Tr. at 46:13-47:14, 50:14-16, 52:5-19; Ex. 109.

103. Dr. Hanson also evaluated the location of X2 in the fall and delta smelt survival using data from a paper authored by Dr. Ken Newman of FWS that attempted to correct for sampling inefficiencies

in the FMWT data and reached exactly the same conclusion, namely that there is no evidence of a statistically significant relationship between delta smelt survival estimates using the "corrected" FMWT data and either the September or October location of X2 or the "habitat area," as estimated in Figure B-17 of the BiOp. 7-27-11 Tr. at 52:16-19, 52:20-53:3 (Hanson); Ex. 102.

104. Defendants assert Dr. Hanson's opinion with regard to the relationship between Fall X2 and delta smelt survival is subject to criticism because it is based on an analysis of data that included significant sampling bias. Specifically, Dr. Hanson used individual regression lines -- each of which were based on only four data points -- that included positive survival for delta smelt in the fall, something that is biologically impossible. 7-27-11 Tr. at 88:15-90:19; *see also* 7-26-11 Tr. at 182:23-184:17 (Dr. Burnham confirming his understanding that data points presented by Dr. Hanson in Figure 7 represented an increase in survival for delta smelt between the months of September and December, something that was "biologically impossible" if you "took [Figure 7] as truth," while explaining that uncertainty in the estimates may be responsible for the increase). Dr. Hanson admitted that he used this data for his analysis and made no effort to correct for the bias. 7-27-11 Tr. at 90:15-91:7. However, he also explained that such data points are caused by variability and uncertainty inherent in the fishery sampling process. 7-27-11 Tr. 48:14-50:3. The same data points were used by Mr. Feyrer

in his analyses. 7-27-11 Tr. 50:22-23 (Hanson). This admitted bias weakens Dr. Hanson's study.

(2) Relationship Between Fall X2 and Delta Smelt Reproductive Success.

105. Dr. Hanson then tested the BiOp's assertion that fall X2 location and the size of the zone characterized by FWS as "habitat area" might affect delta smelt reproduction -- i.e., when X2 is located further upstream and the delta smelt "habitat area" is supposedly smaller, delta smelt reproduction per adult should be reduced, and when the delta smelt "habitat area" is located downstream in Suisun Bay and the available "habitat area" is supposedly larger, food availability, fecundity, and other factors result in a higher rate of juvenile smelt production per adult. 7-27-11 Tr. at 53:21-54:6 (Hanson); Ex. 110A.

106. Using data from the California Department of Fish and Game ("CDFG") 20 Millimeter Survey for the larval stage and STS for the juvenile stage of delta smelt, Dr. Hanson created a normalized dataset by dividing juvenile abundance in the spring by the FMWT index of adult delta smelt abundance from the prior fall. 7-27-11 Tr. at 54:23-55:16, 4:7-12 (Hanson). The resulting reproduction ratio can be plotted as a function of either "habitat area" based on data from Figure B-17 in the BiOp, Ex. 111, or the location of X2 in the fall based on analyses performed by Dr. Hutton, Ex. 112A; *see also* 7-27-11 Tr. at 55:16-57:14 (Hanson). Doing so demonstrates that reproduction per adult in the spring is independent of the location

of X2 the prior fall. 7-27-11 Tr. at 4:12-13; 57:5-6, 57:10-13 (Hanson); Ex. 112A. Moreover, there is no significant relationship between the area referred to by FWS as the "habitat area" and the subsequent reproduction of per adult the following spring. 7-27-11 Tr. at 56:7-10, 57:10-13 (Hanson); Ex. 111.

(3) Relationship Between Fall X2 and Food Availability.

107. Dr. Hanson also analyzed the assumed relationship between the average monthly location of X2 in the fall and the availability of zooplankton, the principal food resource for delta smelt. To do so, he tested whether, when X2 is located downstream in Suisun Bay and, according to Federal Defendants, the "habitat area" is greater, more zooplankton are available, and when X2 moves further upstream, whether zooplankton availability is reduced. 7-27-11 Tr. at 59:10-21 (Hanson); Exh. 114A.

108. After examining DFG data collected since 1972 at various locations within the estuary, in combination with data from the FMWT surveys on *Eurytemora* and *Pseudodiaptomus* (zooplankton species that are substantive components of the delta smelt diet), Dr. Hanson found there is no relationship between zooplankton densities in the fall and the location of X2 in the fall. 7-27-11 Tr. at 4:14-16, 5:1-6, 60:7-9, 60:24-25, 61:13-16 (Hanson); Ex. 115. Instead, zooplankton densities were independent of the average monthly location of X2 in the fall, and the location of X2 provided little information about the variability inherent in zooplankton densities. 7-27-11 Tr. at

61:13-20, 63:12-13 (Hanson); Ex. 115.

109. Overall, Dr. Hanson's analyses lend support to the findings of the three most recent life-cycle models, Thomson, Mac Nally, and Maunder & Deriso, all of which concluded that Fall X2 had no relationship to delta smelt survival.

G. Effect of Project Operations on the Position of X2.

110. The BiOp concludes that "there has been a long-term shift upstream" in the location of X2 during the fall. *See, e.g.,* BiOp at 236. The BiOp reasons:

> The effects of project operations outlined above on X2 during the fall months have considerably altered the hydrodynamics of the estuary in two important ways other than which have already been described. First, the long-term upstream shift in fall X2 has created a situation where all fall seasons regardless of WY type now resemble dry or critical years (Figure E-27). In other words, all fall seasons have now been converted into uniform, low flow periods. Second, the effects have also manifested in a divergence between X2 during fall and X2 during the previous spring (April-July spring averaging period), and the modeling studies indicate this condition will persist in the future (Figure E-28).
>
> Combined, these effects of project operations on X2 will have significant adverse direct and indirect effects on delta smelt. Directly, these changes will substantially decrease the amount of suitable abiotic habitat for delta smelt, which in turn has the possibility of affecting delta smelt abundance through the depensatory density-dependant mechanisms outlined above. Because current abundance estimates are at such historic low levels, depensatory density-dependence can be a serious threat to delta smelt despite the fact that the population may not be perceived to be habitat limited. It is clear from published research that delta smelt has become increasingly habitat limited over time and that this has contributed to the population declining to record-low abundance levels (Bennett 2005; Baxter et al. 2008; Feyrer et al. 2007, 2008; Nobriga et al. 2008). Therefore, the continued loss and constriction of habitat proposed under future project operations significantly threatens the ability of a self-sustaining delta smelt population to recover and persist in the Estuary at abundance levels higher than the current record-

lows.

Id. at 237. This is part of the rationale for imposition of the Fall X2 Action.

111. The BiOp reached this conclusion after analyzing historic trends in the movement of X2 between 1967 and 2007. BiOp 271; 7-27-11 Tr. at 154:20-156:7. This analysis revealed an easterly shift of 17 km over that time period in the Fall. It also revealed a considerable reduction in the variability of X2 in the fall. *Id.* The accuracy of the BiOp's analysis of this data set is undisputed.

112. Plaintiffs, through the testimony of Dr. Paul Hutton, challenge the choice of time frame (1967 – 2007) analyzed in the BiOp, suggesting instead that a more appropriate analysis would consider all available historic data, which dates back to 1930. 7-27-11 Tr. at 153:3-13. Dr. Hutton organized his data into two time periods: pre-project (1930-1967) and post-project (1968-2010). He then compared pre- and post-project average position of X2 and the variability (as measured by standard deviation). Hutton's alternative reveals a far more modest rate of change in the average location of X2, on the order of about 0.01 kilometers per decade, over an eight- as opposed to a four-decade measuring period. 7-27-11 Tr. at 118:4-5, 14-18; 120:21-121:2; Ex. 119, Hutton Decl. at ¶¶ 2, 4; Ex. 121. In September, Hutton's analysis indicates X2 has actually moved 6.5 to the *west*. 7-27-11 Tr. at 121:6-12, 124:13-16; 125:17-19; Ex. 122. Dr. Hutton's analysis also demonstrated an

increase, rather than a decrease, in variability in the position of X2. 7-27-11 Tr. at 129:18-24; Ex. 123.

113. Dr. Hutton also specifically examined the movement of Fall X2 in wet and above normal years, as those are the years targeted for action under the Fall X2 action. In wet years, for example, the full DAYFLOW record shows that the average X2 position decreased (i.e., moved westerly) in the post-Project period (1968-2010) compared to the pre-Project period (1930-1967) in all of the post-Project fall months (September, October and November). In above normal years, the average X2 position decreased in September, but increased in post-Project October and November. Ex. 119, Hutton Decl. at ¶ 8.

114. Hutton opines that the difference between his results and those in the BiOp may be explained by the fact that the beginning point of the BiOp's Fall X2 analysis, 1967, occurred during a period of sustained below average Fall X2 resulting from an unusually wet period. But, Dr. Hutton's choice of 1930 as the starting point only creates a different kind of bias. His analysis begins with years from the Dust Bowl era, a period of severe drought that spanned the years 1928-1934. 7-27-11 Tr. at 162:4-16.

115. That there was data available for the period from 1930-1967 does not necessarily mean FWS acted arbitrarily by not including those years in its analysis. The year 1967 coincided with the first year CDFG collected smelt abundance survey information via the FMWT, making 1967 a non-arbitrary starting point for the BiOp's evaluation.

7-27-11 Tr. at 12:14-15 (Hanson).

116. The BiOp was not alone in its conclusion that X2 shifted upstream as a result of project operations. A peer reviewed, published journal article that was co-authored by a DWR engineer concluded that Fall X2 had shifted upstream in the past ten to twenty years as a result of increased pumping by the SWP and CVP. Ex. 1001; 7-27-11 Tr. at 178-183. The State Water Resources Control Board ("SWRCB") also concluded that fall outflow had declined since 1987, and had declined further since 2000, which they found was, "consistent with the observation of Feyrer et al 2007 that fall X2 has moved upstream and this has reduced the amount of available habitat for smelt in fall." 7-27-11 Tr. at 173:10-176:2.

117. Even if the data running back to 1930 is considered, Dr. Hutton's approach is not necessarily the only way to analyze that larger dataset. Mr. Feyrer opined that Dr. Hutton's analyses are "simply not appropriate to address the question of how project operations affect fall X2 as described in the BiOp. It was simply not possible for Dr. Hutton to have observed the effects in question with the way he organized the data." Ex. 501, Feyrer Decl. at ¶ 31. Feyrer advocates dividing the larger post-project period employed by Dr. Hutton (1968-2010) into two separate post-project periods (1968-1999 and 2000-2009). *Id.* at ¶ 32. This is necessary because of significant operational changes that occurred to the projects in the year 2000, most importantly, the completion of the 800,000 AF Diamond

Valley reservoir, which began filling in 1999 and completed filling in 2003. 7-27-11 Tr. at 164:6-19; 7-28-11 Tr. at 55:8-11. The action under examination in the BiOp is the current operation of the projects, which occur under parameters that most closely resemble this post-2000 period, rather than the entire period from 1968 on. *See* 7-28-11 Tr. at 149:10-12 (Feyrer).

118. Dividing the post-project period in two in this manner, Mr. Feyrer re-analyzed the entire 81-year data set in a series of charts. As illustrated in Figure 9 from Mr. Feyrer's Declaration, presented below, since 2000, exports have increased substantially compared to both pre-project and pre-2000 project levels, in both above normal and wet years. *See* Ex. 501, Feyrer Decl. at ¶ 36.

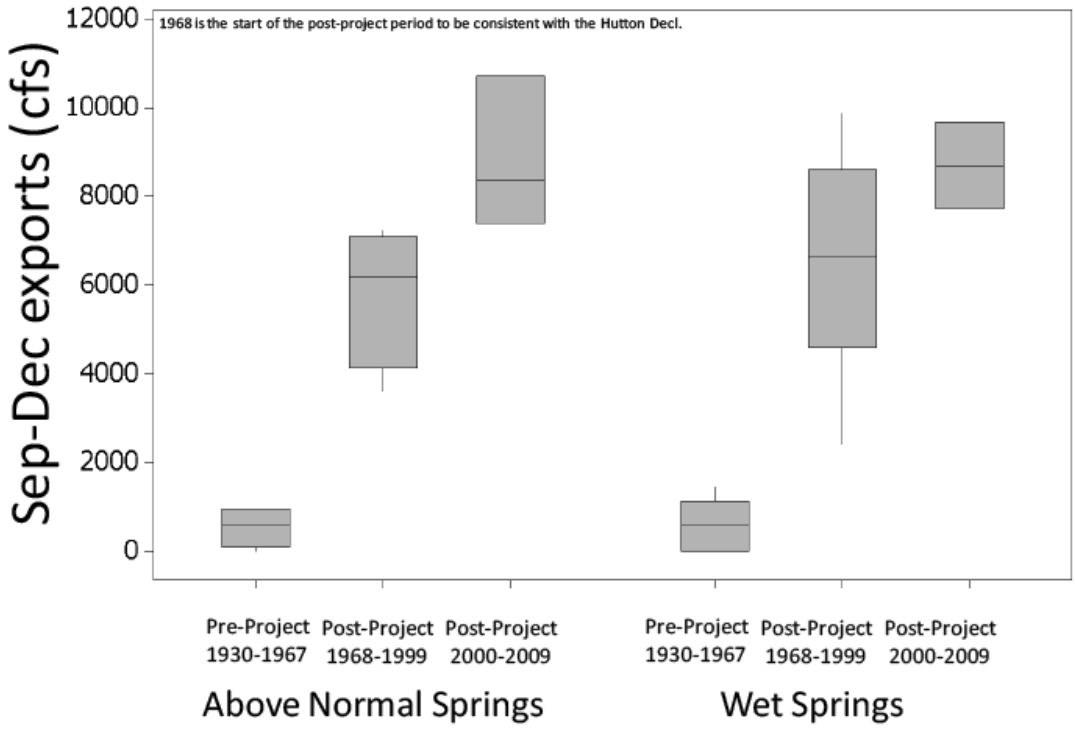

Figure 9. Box plots of exports for three time periods following above normal and wet springs.

119. According to Mr. Feyrer's analysis, outflow has likewise been reduced and rendered less variable post 2000, as compared to both pre-2000 and pre-project levels:

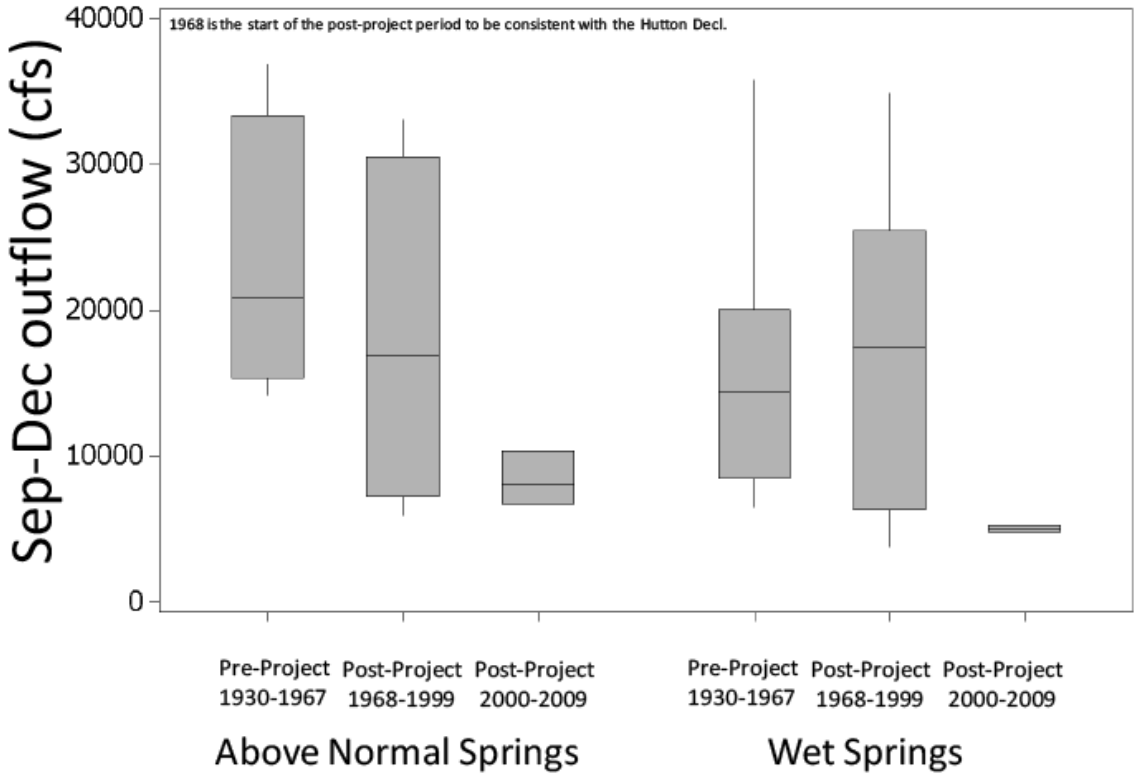

Figure 8. Box plots of Delta outflow for three time periods following above normal and wet springs.

Ex. 501, Feyrer Decl. at 21.

120. The post-2000 period reveals a shift in X2.

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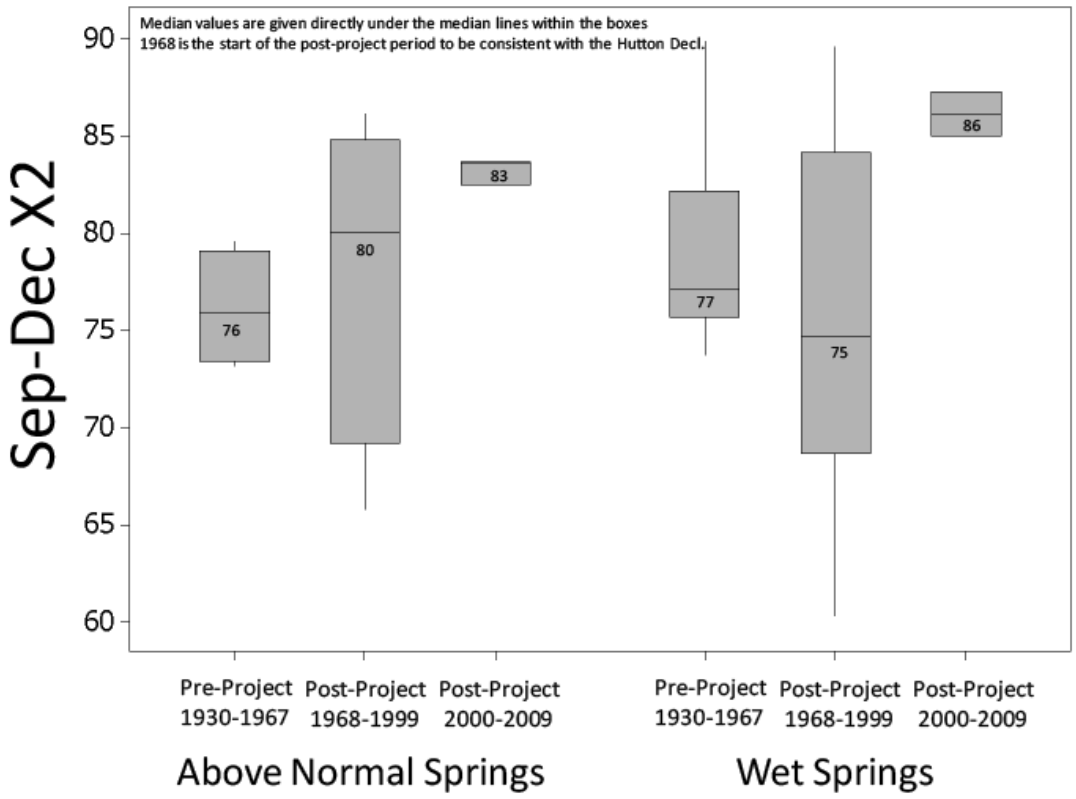

Figure 11. Box plots of X2 for three time periods following above normal and wet springs.

Id. at 24.

121. Mr. Feyrer's evaluation of the trends in the location of X2 from 1930 forward is also subject to criticism. Plaintiffs argue that his post-2000 period (2000-2009) is made up of only ten years, which is insufficient to identify factors that drive variations in Delta salinity and Delta outflow. 7-27-11 Tr. at 148:10-18; Ex. 120, Hutton Reply Decl. at ¶ 7. More specifically, this period contains only one wet year, making it difficult, if not impossible, to draw conclusions about trends in wet years. 7-27-11 Tr. at 148:5-9; 149:14-19; Ex. 120, Hutton Reply Decl. at ¶ 6. Enright and Culberson, respected researchers in the field of hydrology, recommend

evaluating variation in Delta outflow and salinity based on a minimum of 20 to 25 years, not 10 years, in order to ensure consideration of lower frequency changes in climatic conditions. 7-27-11 Tr. at 148:13-18; Ex. 120, Hutton Reply Decl. at ¶ 7.

122. In addition, rather than presenting DAYFLOW data on a month-by-month basis, Mr. Feyrer examined a four-month (September through December) average, even though there is no Fall X2 Action in December. 7-27-11 Tr. at 148:23-149:4; Ex. 120, Hutton Reply Decl. at ¶ 8b. The four-month average is also inappropriate because the Fall X2 Action itself is defined differently for the months of September and October than it is for the month of November. 7-27-11 Tr. at 149:5-13; BiOp 282-283.

123. Again, the record reveals that there is serious dispute over the appropriate way to evaluate the impact of project operations on the position of X2. There is no unequivocally "correct" answer, although there is partial merit to Mr. Feyrer's opinion that Dr. Hutton's breakdown of the analysis into two large time periods, pre-1967 and post-1967, fails to address the key question at issue in the biological opinion, what is the predicted current impact of the proposed action. It is undisputed that the proposed action describes project operations markedly different from operations in the 1960s, 1970s and 1980s.

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H. Federal Defendants' Rationale for the Specific 74 km and 81 km Markers for Action 4.[13]

124. FWS initially proposed tying the required fall X2 location to the location of the previous spring X2, with the fall X2 location allowed to be no more than 15 km upstream of the previous spring X2 location. *See, e.g.*, AR 006514 (peer review); *see also* AR 009455-57 (notes from initial meeting at which 10km-difference standard was proposed). An independent peer review criticized this approach as "not well supported by the analyses presented." AR 006526. It was also criticized by Plaintiff DWR, which instead "suggest[ed] that keeping fall X2 downstream of about 80 km may increase the area of habitat." AR 006994. DWR also argued that monitoring compliance with a variable fall X2 position would be impractical, especially when compared with using existing monitoring locations. *See* AR 007003 ("[I]t it would be difficult to measure an X2 at 85 km, whereas it would be much easier to measure at Collinsville (81 km) ....").

125. In response to these comments, FWS revised the proposed

[13] Ironically, Plaintiffs object to Defendants presenting a scientific justification for the 74 km and 81 km markers on the ground that, because the 12/14/11 MSJ Decision found that the BiOp contained no such justification, any contrary finding here amounts to a request to "alter or amend its final judgment," which is improper given that the MSJ ruling is on appeal. Plaintiffs' objection is baseless. At the summary judgment stage, the district court was required to evaluate whether, based on the administrative record, the agency had articulated a sufficient basis for the use of these markers. Here, the court is determining anew, based on a record not limited by the APA, whether it makes sense to impose the RPA utilizing these markers. The information presented by Defendants is necessary to this determination. Plaintiffs have also been permitted to significantly expand the evidence presented.

fall X2 location, setting it at fixed points of 75km (in wet years)[14] and 80km (in above-normal years). AR 006399 (December 4, 2008 draft RPA). These locations were later slightly refined to 74 km and 81 km. *See* BiOp at 282. These locations happen to correspond with existing salinity monitoring sites located at Chipps Island and Collinsville, respectively, and are thus familiar compliance points. AR 018798; *see also* AR 010295 (mapping in August 2008 Biological Assessment).

126. The 74 km and 81 km fall X2 locations are also correlated to the outflow water quality objectives for fish and wildlife beneficial uses required by SWRCB Decision 1641 ("D-1641"), which generally requires a minimum daily outflow of 7,100 cfs or that X2 should be located at or downstream of Collinsville (81 km), or Chipps Island (74 km) under certain higher inflow conditions, from February into June. *See* D-1641 at 184–86, 191.[15]

127. That the 74 km and 81 km points correspond to existing monitoring stations and/or D-1641 compliance points does nothing to establish that maintaining Fall X2 at those locations is necessary to the survival and recovery of the species.

128. Defendants maintain that selection of these specific

[14] Defendants cite AR 013820 for the proposition that the 75km location was "based on regression relationship," presumably to suggest that the 75km location was chosen for a scientific reason based on statistical analysis. But, another record citation offered by Defendants, AR 014227, as "explaining regressive analysis" in fact reveals that the "regression model" referenced is the formula used to estimate the X2 position based on hydrologic inputs and has nothing to do with the biology of the smelt or the impact of X2 on population dynamics.

[15] Available at http://www.waterrights.ca.gov/Decisions/D1641rev.pdf (last visited August 29, 2011).

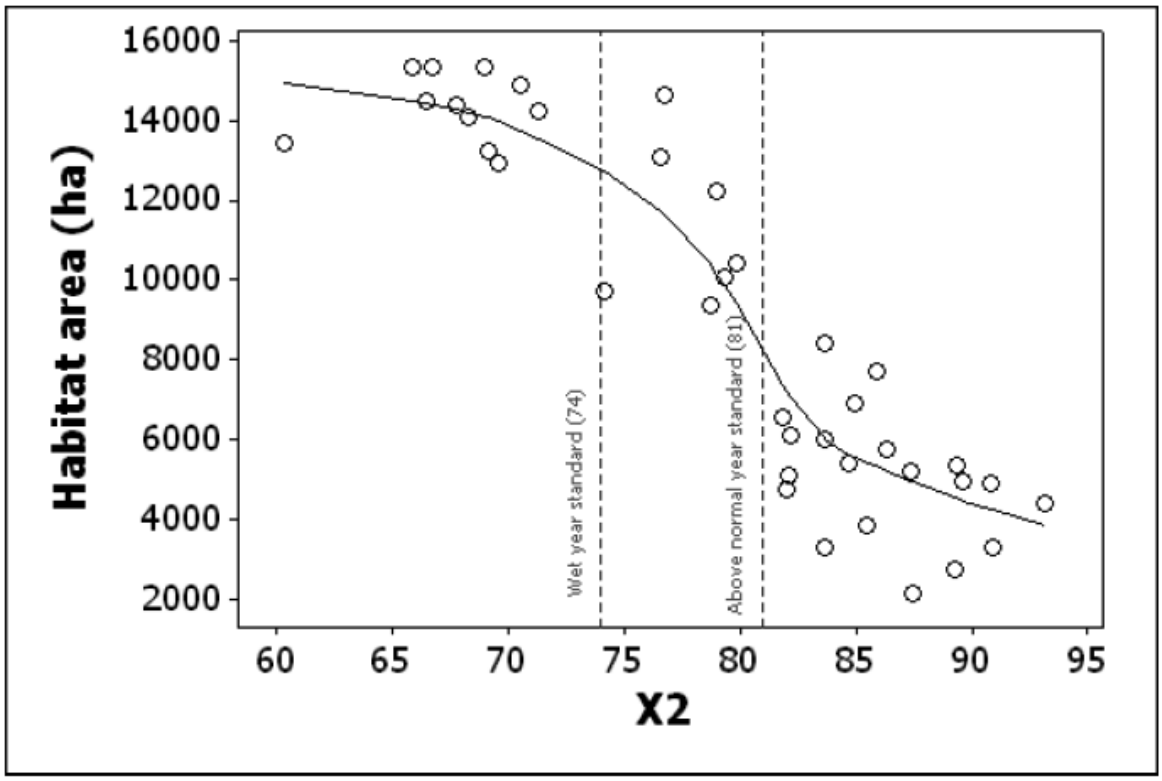
locations is independently supported by biological evidence presented in the BiOp. As discussed above, the BiOp relies heavily on studies that have "found a statistical association between fall X2 and the production of young delta smelt during the following year." BiOp 372. The BiOp also examined the impact of Project Operations on the position of X2, and concluded that the impact was most significant in wet and above-normal years. *Id.; see also* AR 006984 (excerpt from draft BiOp displaying historic differences between fall X2 and spring X2 by year type). Accordingly, the Fall X2 Action targeted only these water year types, reasoning "actions in these years are more likely to benefit delta smelt." AR 006615, 006732.

129. As a first step in determining the specific distance-based outflow requirements for the Fall X2 Action, FWS determined, using historical DAYFLOW data, that the median 1967–2007 fall X2 location was 79 km upstream of the Golden Gate Bridge. BiOp at 235. As discussed above, the BiOp concluded that the average fall X2 location has exhibited a long-term increasing (*i.e.*, moving upstream) trend, and this is especially so since the year 2000. BiOp at 236. In particular, the average fall X2 location during the years following the Delta's Pelagic Organism Decline (2000–2005) was several kilometers upstream when compared to the pre-Pelagic Organism Decline years (1995–1999). BiOp at 179.

130. The second step of FWS's evaluation of historical fall X2 data was to estimate the total surface area of suitable habitat

corresponding to a given year's fall X2 location. *See id.* at 235 (describing methodology). The results of that analysis are presented in the BiOp at page 374 in Figure B-17.

Figure B-17. Relationship between X2 and habitat area for delta smelt during fall, with standard shown for wet and above normal years.



In this figure, the plotted points represent the amount of abiotic habitat index available when X2 is placed at certain kilometer distances. The line among the points is a "LOESS smooth" fitted to the graph with statistical software. As Mr. Feyrer explained at the hearing in response to the Court's question, discussing this figure,

> ... some of the discussions we had internally at Reclamation while we were preparing the adaptive management plan and taking our own evaluation of whether or not 74 and 81 would be justified was, in fact, looking at the potential water cost in moving X2. And what we discussed in the plan is that, as you can see in this relationship here, there's really two tiers of habitat in this relationship.

> You have the lower tier, which is essentially 80 and above at X2, and then you have that steep portion of the relationship, and then essentially from about 74 or so up is that upper tier. And with respect to the 74 value, 74 is pretty much -- it's right about near the asymptote of that curve. It's pretty much as far to the right as you can get to get habitat area -- the habitat index up into that upper tier at the least amount of water cost with respect to moving X2.
>
> So in other words, you could provide a lot more X2 movement to the west all the way out to 60, but you're not going to get a whole lot more of the habitat index. So to get up into that upper habitat tier, 74 is pretty far to the right on that area. You could look at this in terms of -- you could argue that you could push 74 further out to the west, but you're not going to get really any more habitat benefit. And likewise, with the above normal year standard 81, 81 is pretty much near the bottom of the ascending limb of that curve. And that's about the minimum point where you get out of that lower tier of habitat conditions.

7-29-11 Tr. at 28:13-29:15.

131. In Figure B-17, the largest degree of change (steepest portion of the curve) in the habitat index occurs at X2 values approximately between 85km and 70km, with less change beyond those values. Ex. 501, Feyrer Decl. at ¶ 12. Feyrer opined that, across this 15-km range of X2, habitat suitability increases approximately two-fold. *Id.* The 74 km and 81 km markers approximate the ascending and descending asymptotes of the curve displayed in Figure B-17. Assuming this graph accurately represents habitat availability, the significance of this is that moving X2 further westward than 74 km in wet years is not likely to yield substantially greater benefits to delta smelt than keeping it at 74 km. Likewise, if you maintain X2 above 80 in the river channels, the center of the delta smelt population is aligned with severely degraded abiotic habitat conditions. This change in habitat is due largely to geography.

Id.; *see also* 7-28-11 Tr. at 125:19-126:9 (Feyrer).

132. The National Research Council's report reviewing the BiOp's RPA reported that the lowest smelt abundances all occurred when the habitat-area index was less than 6,000 hectares, which could mean that, while it is not the only cause of smelt population collapses, "reduced habitat area is a necessary condition for the worst population collapses." Ex. 12 at 53; AR 018153 (Reclamation observing that "delta smelt abundance is generally reduced when X2 is located upstream of Chipps Island [(74 km)]," that "when X2 is downstream of this point [abundance] increases in at least some of the years"); AR 010052 (OCAP BA noting that analyses of historical data indicate that habitat conditions are relatively poor and contribute to delta smelt producing fewer offspring in years when X2 is located above Collinsville (81 km) during Fall). Plaintiffs' witness Dr. Hanson testified that, according to Figure B-17, when X2 is at 74 km, the result is roughly 13,000 hectares, or 30,000 acres, of habitat in the salinity range preferred by delta smelt. 7-27-11 Tr. at 7:7-19.

133. Mr. Feyrer admitted that adding additional habitat units to represent the Cache Slough complex might shift this entire curve to the right, likewise shifting the location of the asymptotes up. Exs. 102a, 153. The exact impact of any such shift has not been calculated by any party. Nor is it clear whether any shift would change the reasoning described in the NRC Report, as a revised graph

would simply have revealed that the lowest smelt abundance occurred when the habitat index was less than some number above 6,000 hectares.

134. Mr. Feyrer suggested that the most significant gains in habitat area occur when X2 is located upstream of kilometer 80, above which the river channels become smaller with significantly less habitat area. He said:

> That gets back to some of what I explained earlier. And it's -- it's really nothing more than a function of the geography of the estuary. When the X2 is located downstream of approximately 80, downstream [of] the confluence of the Sacramento San Joaquin rivers, X2 and low salinity zones are in those vast large shallow base, those shoals of Suisun Bay, Grizzly Bay, Honker Bay, and so there's a lot of area there. That's why the habitat index is bigger. And then when you move upstream, above 80, approximately and up into the river channels, those river channels obviously are a lot smaller, lot less area there. And so the habitat index is therefore smaller.

7-29-11 Tr. at 125:23-126:9.

135. According to Federal Defendants' analyses of historical Fall X2 position, the 74 km and 81 km locations corresponded with actual fall X2 locations in wet and above-normal years prior to the POD, which began in 2000. *See id.* at 369 ("This will help return ecological conditions of the estuary to that which occurred in the late 1990s when smelt populations were much larger."); *id.* at 179 ("X2 ... during fall in the years following the POD (2000–2005) was several km upstream compared to that for the pre-pod years (1995–1999)").

136. As discussed above, Federal Defendants' method of evaluating the movement of X2 is subject to considerable criticism.

This location rationale is corroborated by Table 2 of Dr. Hutton's June 20, 2011 declaration, which shows that the 74 km marker for wet years corresponds with the average X2 location for all post-project wet years, from 1968 to 2010. Similarly, the 81 km marker for above normal years corresponds with the average X2 location for all post-project above normal years.

Table 2. X2 Average Position by Fall Month for Various Time Periods in Wet and Above Normal Years

	All Years	Pre vs. Post-Projects			Feyrer et al. (2007)		
Month	**1930-2010**	**1930-1967**	**1968-2010**	**Δ**	**1968-1986**	**1987-2004**	**Δ**
Wet Years (km)							
September	75.6	78.2	73.8	-4.4	71.6	76.9	5.3
October	75.4	76.1	74.9	-1.2	71.1	79.9	8.8
November	72.7	72.8	72.6	-0.2	68.5	77.5	9.0
Above Normal Years (km)							
September	81.5	82.7	80.8	-1.9	78.1	83.7	5.6
October	80.0	78.0	81.2	3.2	77.2	84.3	7.1
November	77.0	73.5	78.9	5.4	73.1	83.0	9.9

Ex. 119, Hutton Decl. at 6; Ex. 124 (reproducing Table 2); *see also* 7-28-11 Tr. at 154:11-155:25 (Feyrer) (post-project averages in Dr. Hutton's table correspond with 74 km and 81 km markers in Action 4 in the RPA).

137. This figure demonstrates that the average position of X2 from 1968-2010 in wet and above normal years corresponds to the 74 km and 81 km compliance points, respectively.

138. According to Federal Defendants' analyses of X2 variability, the 74 km and 81 km points also restore inter-annual variability in fall outflow to historical conditions. Historically, there was natural variability in the location of fall X2 to match the

type of water year experienced that year. This is depicted in the following plot:

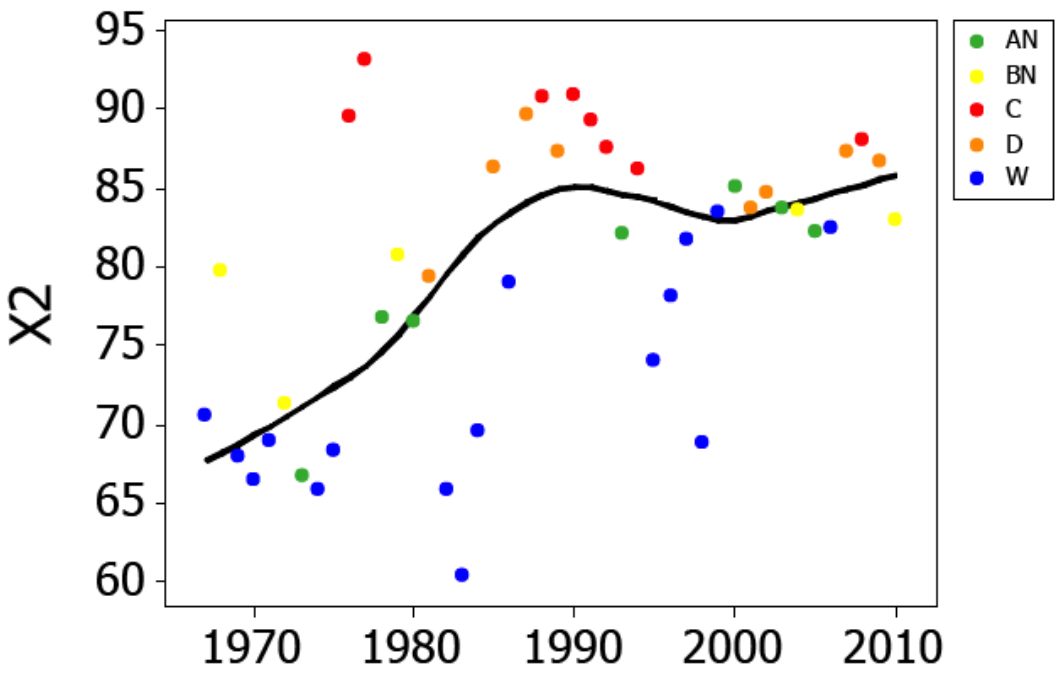


Figure 12. Time series of fall X2 since 1967. Water year types represent the preceding spring. A LOESS smooth is fitted to the data.

Ex. 501, Feyrer Decl. ¶ 40, Fig. 12 (displaying loss of X2 variability between dry (red/orange) and wet (green/blue) years); BiOp at 273 (similar plot); 7-28-11 Tr. at 152:8-154:10 (Feyrer).

139. In other words, according to Federal Defendants' analysis of X2 variability, a wet year would naturally result in fall X2 being located relatively further downstream than its location in a dry year. *See* Ex. 501, Feyrer Decl. ¶ 40, Fig. 12; Ex. 501, Internal Exhibit 1 (Reclamation Draft Plan) at 13-14.

140. The BiOp concludes that "[t]he persistence of this

significant hydrologic change to the estuary threatens the recovery and persistence of delta smelt." BiOp at 374; Ex. 501, Internal Exhibit 1 (Reclamation Draft Plan) at 16 (concluding that "[i]t seems clear that outflow affects the quality and extent of abiotic smelt habitat. It also seems clear that restoring lost abiotic habitat availability is likely to produce subsequent abundance benefits to delta smelt, probably by raising the carrying capacity.").

141. By setting the required fall X2 locations at 74 km and 81 km, FWS sought to reduce the intensity of this divergence and its consequent harms to both critical habitat and delta smelt persistence and recovery, by "restoring flow variability to the Delta environment so that smelt populations can recover through allowing these essential periods of population rebound." BiOp at 375.

142. That the 74 km and 81 km points are related to historical average positions of X2 and arguably restore inter-annual variability renders them non-arbitrary, but does not provide biological support for their imposition, particularly in light of the highly disputed evidence to support a link between X2 and smelt abundance and the high water costs required to maintain X2 at these positions.

I. Adaptive Management Plan.

143. The BiOp describes the Fall X2 Action as being "subject to adaptive management," whereby the Action may be modified as additional scientific information is gathered:

> The objective of this component is to improve fall habitat for delta smelt through increasing Delta outflow during

fall. Increase in fall habitat quality and quantity will both benefit delta smelt.

Subject to adaptive management as described below and in Action 4 in Attachment B, during September and October in years when the preceeding precipitation and runoff period was wet or above normal as defined by the Sacramento Basin 40-30-30 index, Reclamation and DWR shall provide sufficient Delta outflow to maintain monthly average X2 no greater (more eastward) than 74 km (from the Golden Gate) in Wet WYs and 81 km in Above Normal WYs. The monthly X2 target will be separately achieved for the months of September and October. During any November when the preceding water year was wet or above normal as defined by the Sacramento Basin 40-30-30 index, all inflow into CVP/SWP reservoirs in the Sacramento Basin shall be added to reservoir releases in November to provide an additional increment of outflow from the Delta to augment Delta outflow up to the fall X2 of 74 km for Wet WYs or 81 km for Above Normal WYs, respectively. In the event there is an increase in storage during any November this action applies, the increase in reservoir storage shall be released in December to augment the December outflow requirements in SWRCB D-1641.

Given the nature of this Action and to align its management more closely with the general plan described by the independent review team and developed by Walters (1997), the Service shall oversee and direct the implementation of a formal adaptive management process. The adaptive management process shall include the elements as described in Attachment B. This adaptive management program shall be reviewed and approved by the Service in addition to other studies that are required for delta smelt. In accordance with the adaptive management plan, the Service will review new scientific information when provided and may make changes to the action when the best available scientific information warrants. For example, there may be other ways to achieve the biological goals of this action, such as a Delta outflow target, that will be evaluated as part of the study. This action may be modified by the Service consistent with the intention of this action based on information provided by the adaptive management program in consideration of the needs of other listed species. Other CVP/SWP obligations may also be considered.

The adaptive management program shall have specific implementation deadlines. The creation of the delta smelt habitat study group, initial habitat conceptual model review, formulation of performance measures, implementation of performance evaluation, and peer review of the performance measures and evaluation that are described in steps (1) through (3) of Attachment B shall be completed before September 2009. Additional studies addressing elements of the habitat conceptual model shall be

> formulated as soon as possible, promptly implemented, and reported as soon as complete.
>
> The Service shall conduct a comprehensive review of the outcomes of the Action and the effectiveness of the adaptive management program ten years from the signing of the biological opinion, or sooner if circumstances warrant. This review shall entail an independent peer review of the Action. The purposes of the review shall be to evaluate the overall benefits of the Action and to evaluate the effectiveness of the adaptive management program. At the end of 10 years or sooner, this action, based on the peer review and Service determination as to its efficacy shall either be continued, modified or terminated.

BiOp at 282-83.

144. On June 6, 2011, Reclamation released a document entitled "Draft Plan: Adaptive Management of Fall Outflow for Delta Smelt Protection and Water Supply Reliability" (Hearing Exhibit 501 at 33-79) ("Reclamation Draft Plan"). The purpose of this document was for Reclamation to

> review[ ] the basic rationale provided in the BiOp, bringing to bear information that has become available since the BiOp was completed. New information includes the 2010 POD synthesis, some published studies bearing directly on outflow effects and other issues, commentaries from several review panels, complaints about the RPA that were raised by the State and Federal water contractors in letters and in litigation, and commentaries by DWR and NRDC that were provided to us in May 2011. The main questions Reclamation asks in this review are the following. What kind of action seems appropriate, given the present array of available information?

Ex. 501, Internal Exhibit 1 (Reclamation Draft Plan) at 6.

145. In conducting this review, Reclamation examined: "(1) delta smelt habitat; (2) X2 as a surrogate for delta smelt habitat; (3) evidence for associations between habitat and abundance; (4) project effects on Delta hydrology, X2 and delta smelt habitat; and (5) the

specific X2 action prescribed in the BiOp." *Id.* at 6-7.

146. Reclamation found that "[w]hile it is true that a complete description of habitat includes physical, chemical, and relevant biological characteristics, suitable physical and chemical characteristics are often necessary preconditions for suitability. The LSZ is not quite the rocky intertidal zone, but the power of salinity and turbidity to reliably predict where fish will be found during the fall months indicates that these variables are useful descriptors of habitat." *Id.* at 11. Reclamation thus concluded that "[b]iotic factors, including food supply, that characterize an area become an important issue only after abiotic conditions are such that smelt can reside in the area without incurring excessive physiological costs or other detrimental effects." *Id.*

147. In examining "Project effects on Delta hydrology, X2, and delta smelt habitat," Reclamation, as the operator of the CVP, concluded:

> Average X2 is largely determined by water project operations before winter storms begin in the fall. Since 1967, average fall X2 has moved upstream (Figure 7). In the last decade of the post-reservoir era there was substantial interannual variation in fall conditions. After wetter springs, there were often flood control releases in the fall months that moved X2 downstream for weeks. In the POD era very little interannual variation has been observed in the fall, and fall outflow conditions resemble what formerly occurred after drier springs regardless of actual spring hydrology.

Id. at 13.

148. Reclamation also concluded that "[s]ince 1967, the upstream

shift in X2 has resulted in a decline in the average delta smelt abiotic habitat index, with the effect most pronounced in wet or above normal years (Figure 8; Feyrer (2010) calculates 78%). This decline in delta smelt habitat has coincided with the long-term decline in delta smelt abundance (Feyrer 2010)." *Id.* at 14.

149. The BiOp requires Action 4 to "mitigate the effects of X2 encroachment upstream in current and proposed action operations, and provide suitable habitat area for delta smelt." BiOp at 373. In addressing the question "how to achieve [that] mitigation," Reclamation found that "[i]t has been demonstrated in both the BiOp and the discussion above that project operations have affected average X2 during the fall (September-December). A closer examination of the data using Kendall trend tests reveals that there are significant negative trends in X2 for September, October, and November but not December in both wet and above normal years." *Id.* at 15.

150. With respect to the specific 74 km and 81 km markers, Reclamation further found:

> Feyrer et al.'s habitat index (Figure 4) reveals two habitat tiers: a high habitat tier corresponding to X2 at approximately 74 km or downstream, and a low tier for X2 at approximately 86 km or upstream. The curve is empirical and these figures are approximate. That there are tiers is a consequence of geography (Feyrer et al. 2007). The high habitat tier corresponds to X2 opening into Suisun Bay, with the low tier corresponding to X2 in the more constrained river channels upstream. During most of the post-reservoir era, average X2 fell in the high habitat tier in falls after many wet and above-normal springs. This has not been the case in the Pelagic Organism Decline era.

> Feyrer *et al.*'s results suggest that reaching the high habitat tier (X2 at 74 km or less) approximately doubles the expected abiotic habitat index above POD-era values. Because the loss of high-tier habitat represents the biggest fall outflow change since the end of the post-reservoir era, an outflow action that restores it in the years that used to have it appears to us to be justified and very likely to produce habitat and subsequent abundance benefits. The use of an 81 km target for falls after above-normal years provides about 50% more of the abiotic habitat benefits than maintaining X2 at 86 km, and at present represents a reasonable intermediate action to restore late post-reservoir era conditions and variability.

Id. at 16.

151. Reclamation thus concluded that "[i]t seems clear that outflow affects the quality and extent of abiotic smelt habitat. It also seems clear that restoring lost abiotic habitat availability is likely to produce subsequent-abundance benefits to delta smelt, probably by raising the carrying capacity. Consequently, we conclude that the biological rationale for the 2008 RPA action is sound." *Id.* 152. The Reclamation Draft Plan also describes several monitoring and study efforts to be undertaken by Reclamation as part of the adaptive management requirements for Action 4 as set forth in the BiOp. *See, e.g.*, BiOp at 375 ("The Service will require that Action 4 be implemented with an adaptive management program to provide for learning and improvement of the action over time. The adaptive management program will include commissioning studies to clarify the mechanism underlying the effects of fall habitat on the delta smelt population"). The goal of these monitoring and study projects is that, "[b]y laying out a framework for rigorous, science-based

adaptive management, we hope the plan will enable us to learn what we need to know about the effects of Fall outflow, so that the most appropriate conservation action can be identified and implemented at lowest possible water cost." Ex. 501, Internal Exhibit 1 (Reclamation Draft Plan) at 2. .

153. Reclamation submitted the Draft Plan to an independent peer review panel for feedback. Ex. 210. The review panel criticized the draft adaptive management plan and made 17 primary recommendations regarding the plan. *Id.* at 3-5. The panel strongly urged Reclamation and other agencies to formulate an explicit work plan capable of evaluating changes in the health and condition of delta smelt in response to X2 manipulation. *Id.* at 4. The panel found that the draft plan was "woefully deficient on the details regarding the project's most important dependent variables," and that the question facing Reclamation is that "[i]n the absence of reliable abundance data, how will health and condition of the [delta smelt] population be evaluated?" *Id.* at 20; 7-28-11 Tr. at 237:4-11. The panel also had "serious reservations" about the successful implementation of the adaptive management plan because of concern regarding (1) explicit clarity of the hydrologic manipulation of the system to achieve the X2 criteria, and (2) explicit clarity of the key independent and dependent variables that will be evaluated to document success of the experimental manipulation. Ex. 210 at 23; 7-28-11 Tr. at 237:12-25.

154. The peer review panel did not criticize the need for, or the rationale behind, Action 4 itself, but rather, the studies that Reclamation is planning to undertake during and after Action 4 to measure its effectiveness. 7-29-11 Tr. at 85:7-86:25 (Feyrer). The peer review panel also found that the implementation of Action 4 "in a wet year represents a rare opportunity for a quantum leap in our fundamental understanding of Delta processes. This will help stake holders develop a common knowledge of key linkages between enhancing outflow, rate of export flows and the benefits to the biological resources and have profound implications to the future management of the Delta." Ex. 210 at 5.

155. On August 10, 2011, Reclamation completed its revised adaptive management plan for this year's Fall X2 Action. *See* Doc. 1002 ("Revised Plan"). The Revised Plan includes revisions from the draft plan in response to comments received from the independent peer reviewers of the draft plan and others, including agency scientists and policymakers, academics, stakeholders, and managers of the Interagency Ecological Program. *Id.*, Attachment 1 at 2 (transmittal letter from Reclamation to FWS).

156. The Revised Plan concludes:

> It seems clear that outflow affects the quality and extent of abiotic smelt habitat. It also seems clear that restoring lost abiotic habitat availability is likely to produce subsequent-abundance benefits to delta smelt, probably by raising the carrying capacity. We are also left with important unanswered questions that bear on the management of fall outflow. What are the key underlying ecological mechanisms that link outflow to delta smelt abundance, and how important and manageable is each link?

> How does fall outflow fit in with other drivers of delta smelt abundance? Are there more water-efficient ways to provide the necessary benefits?

Revised Plan at 16. "By adopting a more aggressive, active approach, Reclamation hopes to achieve more rapid learning – thereby finding the best and most efficient action faster – while alleviating adverse modification of delta smelt critical habitat and avoiding jeopardy." *Id.* at 1.

157. Specifically, Reclamation's Revised Plan focuses on monitoring and assessing a wide array of measurable variables to compare with projected outcomes. Table 1 in the Revised Plan describes these predictions and associated monitoring and studies with particularity. *Id.* at 55. The final plan includes a detailed discussion of how monitoring, studies, and analysis and modeling will occur. *Id.* at 57-74. The Revised Plan also includes quantitative models to assess the effects of the Fall X2 Action, including process equations for the growth, survival and movement of delta smelt in the Fall. *Id.* at 89-96. "[B]ecause of the broad agency interest in [the adaptive management plan] and its complexity," the multi-agency, multi-disciplinary Interagency Ecological Program will be in charge of conducting monitoring and analyses." *Id.*, Attachment 1 at 3. "The IEP has established expertise in long-term Delta ecosystem monitoring and investigation, including the Pelagic Organism Decline studies." *Id.*

158. The Revised Plan anticipates significantly better habitat conditions and delta smelt responses from locating Fall X2 at 74 km

as opposed to further upstream at 81 km or 85 km. Revised Plan at 55, Table 1. Among other things, Reclamation predicts higher delta smelt growth, survival and fecundity in the fall, and better health and conditions in the fall for delta smelt when Fall X2 is at 74 km as opposed to 81 km. Locating Fall X2 at 74 km this year will also provide much more vital scientific knowledge to guide recovery and restoration efforts in the future. As Reclamation explains:

> Because we have observed an almost unbroken string of low-outflow Falls since 2000, it is clear that the most informative Fall outflow action in 2011 would be a high-outflow action. With 2011 now officially designated as a "wet" year, we recommend that the Fall 2011 action should be the 74 km "wet"-year action described in the 2008 RPA.

Id. at 26.

159. The fact that Reclamation is following an adaptive management approach does not somehow render Action 4 speculative, uncertain, or arbitrary and capricious. Action 4 is not an impermissible "experiment," as Plaintiffs argue, simply because more favorable water conditions have triggered it this fall for the first time and the Defendant agencies are attempting to measure its effects and learn as much scientific knowledge from it as they can.

160. Plaintiffs emphasize that the Revised Plan admits that "many uncertainties regarding the mechanisms that link delta smelt responses to outflow conditions and the position of the LSZ remain." Doc. 1002, Attachment 2, part 2, p. 51. As Dr. Norris explained, while the underlying *mechanisms* that drive the relationship between fall outflow and smelt abundance are not well understood, that is

irrelevant for management purposes, because, in her opinion, "[t]he relationship itself is well established." 7-29-11 Tr. at 174:19-175:20. It is the underlying *mechanisms* that Reclamation's Draft Plan seeks to better understand.

161. Neither the Draft nor the Revised Adaptive Management Plans add anything to the dispute here. Reclamation says it will assure more intensive study and reiterates its position that there is support for the Fall X2 Action as it is currently drafted, ignoring and without specifically addressing any of the criticisms raised by Plaintiffs here. The Plans acknowledge, as they must, that substantial uncertainty remains regarding the mechanisms that link smelt abundance to X2. The issue presented is whether there is in fact a link between X2 and abundance, a question that must be answered based on the record now before the court.

J. Irreparable Harm.

(1) Water Supply Impacts.

a. No Impacts to the CVP.

162. No water supply impacts to CVP are anticipated as a result of implementation of the Fall X2 Action this year. Ex. 303; 7-28-11 Tr. at 199:23-200:9 (Milligan) ("So for September/October, we don't believe that implementing the action, as we currently understand it in those two months, would reduce CVP exports or supplies in any way."); *id.* at 202:2-5 (Milligan). Counsel for the federal contractor Plaintiffs conceded that "CVP exports will not be impacted

unless the Bureau of Reclamation forecast is wrong and the Delta inflows are lower than projected." 7-26-11 Tr. at 31 (Sims); *see also* Ex. 200, Snow Decl. at 2:16-17 (admitting that "there will not likely be an impact to CVP water supplies from implementation of RPA Component 3 this year."); *see also id.* at ¶ 15 ("I do not expect a reduction in CVP water supplies next year from implementation of RPA Component 3").

b. Impacts to SWP.

163. California recently emerged from a three-year drought (2007-2010), Erlewine Decl. (Doc. 983) at ¶ 13, leaving considerable deficits in storage, *see id.* at ¶ 14. Prudent water management calls for storing water in wet years as a buffer against inevitable dry years. 7-28-11 Tr. 18:7-17, 72:5-13; 81:14-20.

164. Water year 2011 was a "really good water year." 7-28-11 Tr. at 63:16 (Erlewine). The allocation for the SWP was 80 percent, the highest allocation since 2006. 7-27-11 Tr. at 206:23 (Leahigh); *id.* at 232:5-12. Undisputed evidence showed that the SWP is likely to export more water from the Delta in water year 2011 than ever before in the history of the projects. 7-28-11 Tr. at 211:20-212:5 (Milligan).

165. In 2011, in addition to the 80% Table A allocation for SWP contractors, 400,000 AF of surplus (also known as "interruptible") water supply under Article 21 was delivered to the SWP contractors. 7-27-11 Tr. at 232:20-233:2 (Leahigh).

166. MWD received at least 180,000 AF of Article 21 water. Ex. 567 at 3; 7-27-11 Tr. 233:17-21 (Leahigh). With this Article 21 water, Metropolitan received the equivalent of 90% of their Table A contract allocation amounts. 7-27-11 Tr. at 234:8-11 (Leahigh).

167. In addition to its Table A allocation of 80%, Plaintiff Kern County Water Agency ("KCWA") received Article 21 water, and as a result arguably received the equivalent of 100% of their Table A contract allocation amounts. *Id.* at 234:12-235:6 (Leahigh).

168. Much, but not all, of the storage depleted in drought years has been replenished. At the end of 2011, Metropolitan is likely to have more water in storage than ever before. *See* 7-28-11 Tr. at 75:18-20 (Erlewine); Ex. 567 at 5 (noting "all time high" storage levels). Metropolitan has been able to completely refill the approximately 1.5 million AF of its "in-region" storage reserves depleted during the 2007-2010 drought period. 7-28-11 Tr. at 47:13-16, 59:2-10 (Erlewine); Ex. 136, Erlewine Decl. at ¶ 10. Metropolitan has enough available reserve capacity in its out-of-region storage to put additional water to beneficial use. 7-28-11 at 47:17-49:4 (Erlewine). Metropolitan provided 800,000 AF of groundwater replenishment deliveries to its member agencies in 2011. *Id.* at 59:11-60:2 (Erlewine).

169. During the drought, Metropolitan used three-quarters, or one and a half million AF, of its storage reserves. *Id.* at 47:9-12 (Erlewine).

170. Kern County Water Agency is "maximizing" groundwater recharge this year. *Id.* at 84:10-15 (Erlewine). Groundwater levels in Kern County rebounded in 2010 and have continued to rebound. *Id.* at 83:18-21 (Erlewine). Recharge this year will be significant. *Id.* at 84:5-9 (Erlewine); *see also id.* at 31:18-21.

171. Metropolitan will not have to access its storage next year if its SWP allocation exceeds 50%. *Id.* at 77:22-78:1 (Erlewine). Based upon the 2009 Reliability Report, the average SWP allocation is 60%. *Id.* at 78:2-4 (Erlewine). Kern County needs an allocation of about 60 to 70 percent to meet its current water demands. *Id.* at 81:7-11 (Erlewine).

a. Likely Impact of Implementation of the Fall X2 Action in 2011 to the SWP.

172. The outflow requirement to maintain X2 at an average of 74 km can be met by increased upstream releases or decreased exports. 7-27-11 Tr. at 204:6-9 (Leahigh). The preferred method of meeting outflow requirements is increased upstream releases because there is an opportunity to recover these impacts during the winter. *Id.* at 204:10-205:1 (Leahigh).

173. Notwithstanding this preference, DWR is effectively constrained from relying exclusively on reservoir releases to meet the Fall X2 Action requirements for the October 15 to November 30, 2011 period by virtue of a 1983 agreement ("1983 Agreement") between DWR and the California Department of Fish and Game ("DFG") relating to DWR's Federal Energy Regulatory Commission license regarding the

operation of Oroville Dam. Ex. 301, Leahigh Decl. ¶ 17. The 1983 Agreement effectively restricts the volume of releases that can be made from Lake Oroville to the Feather River from October 15 to November 30. 7-27-11 Tr. at 205:6-13 (Leahigh); Ex. 301, Leahigh Decl. at ¶ 17. In order to manage the SWP to meet the Fall X2 Action requirements, the 1983 Agreement would compel the SWP to reduce exports during the October 15 to November 30 period, rather than making storage releases. 7-27-11 Tr. at 205:11-20 (Leahigh).

174. The final SWP allocation decision for 2011 has already been made, and therefore, an injunction will not change the 2011 Table A allocation. *Id.* at 207:5-8, 208:11-15 (Leahigh); 7-28-11 Tr. at 14:22-15-4 (Erlewine).

175. Mr. Leahigh testified at the hearing that the maximum potential water impact to SWP from the implementation of the Fall X2 Action is 850,000 AF, assuming 2012 is a dry year. 7-27-11 Tr. at 211:18-212:7 (Leahigh). Of this potential impact, 410,000 AF is attributable to a reduction in exports and 440,000 AF is attributable to increased releases from upstream storage. Ex. 301, Leahigh Decl. at ¶¶ 18-19.

176. This figure was calculated based upon DWR's May 1 Bulletin 120 Forecast and Water Supply Index. Since then, precipitation in the northern Sierra Nevada in June was 320% of the monthly average. 7-27-11 Tr. at 230:15-18 (Leahigh); Ex. 302, Leahigh Reply Decl. at ¶ 12. Additionally, the 850,000 AF impact figure was calculated based

upon assumptions of operations prior to the July 21, 2011 Reclamation Memorandum, which clarifies November operations. Mr. Erlewine stated that operations in accordance with the memorandum would lessen impacts. 7-28-11 Tr. at 57:2-7 (Erlewine).

177. After the hearing, at the behest of the Court, Mr. Leahigh filed a supplemental declaration, revising his estimates of impact to reflect up-to date hydrology, storage conditions, and the July 21, 2011 Reclamation Memorandum. Doc. 1006, Second Supplemental Leahigh Decl. at ¶¶ 6-8. His updated estimate indicates that implementation of the Fall X2 Action in 2011 will cause:

(a) 370,000 AF of storage impact, with a 75% probability of recovery in 2012. *Id.* at ¶ 7(a); *see also* 7-27-11 Tr. 211:9-11 (Leahigh) (In a median water year, no impacts to upstream storage are expected).

(b) 300,000 AF of export impact, with a probable elimination of these impacts in wet years. Doc. 1006, Second Suppl. Leahigh Decl. ¶ 7(b).

178. Reflecting the fact that storage impacts are unlikely unless drier conditions prevail, Mr. Leahigh summarizes his revised analysis as follows:

(a) 670,000 AF of impacts to SWP deliveries in 2012 if 2012 is a critically dry or dry year;

(b) 300,000 AF of impact to SWP deliveries in 2012 if 2012 is a below normal or above normal year;

(c) little to no impact to SWP deliveries in 2012 if 2012 is a wet year.

Id. at ¶8.[16]

179. It is more likely than not that all storage impacts caused by upstream releases north of the Delta will be recovered in 2012. 7-27-11 Tr. at 230:19-21 (Leahigh).

180. Likewise, it is more likely than not that at least a 300,000 AF impact to SWP deliveries in 2012 will occur, as only in a wet year will less impact occur.

b. Impact of Export Reductions on SWP Contractors.

181. If 2012 is a year with median hydrology, the export reductions resulting from imposition of the Fall X2 Action will adversely affect the ability of State Water Contractor member agencies to recharge depleted groundwater basins and, potentially, their ability to deliver water directly in 2012. 7-28-11 Tr. at 16:3-13 (Erlewine). At the hearing it was estimated that if the Fall X2 Action is imposed and 2012 is a median year, the resulting export reductions would equate to a 10% reduction in SWP Table A water deliveries. *Id.* at 19:4-10 (Erlewine). Subsequent estimates suggest

[16] Defendants emphasize that SWP contractors already received more surplus water this year than they could possibly lose as a result of export impacts from the Fall X2 Action. In 2011, in addition to the 80% Table A allocation, 400,000 AF of Article 21 water was delivered to SWP contractors, which is approximately equal to the total estimated export reductions that might result from the Fall X2 Action. 7-27-11 Tr. at 232:20-233:2 (Mr. Leahigh); 7-28-11 Tr. at 65:15-66:3 (Mr. Erlewine). Defendants maintain that this will offset any water supply impact from the Fall X2 Action. This ignores the fact that SWP Contractors are contractually entitled to surplus water when it is available for delivery. Ex. 137, Erlewine Reply. Decl. at ¶ 7.

the impact would be smaller than originally anticipated. *See generally* Doc. 1006, Second Suppl. Leahigh Decl.

182. KCWA receives roughly one quarter of total SWP Table A water deliveries. 7-28-11 Tr. at 19:12-14 (Erlewine). A 10% reduction in SWP deliveries in 2012 will equate to a loss of approximately 100,000 AF to KCWA. *Id.* at 19:12-14 (Erlewine). 100,000 AF of water is sufficient to irrigate 35,000 acres of permanent crops based on average water duties, or is sufficient to supply half a million urban water users for a year. *Id.* at 40:17-41:2 (Erlewine). KCWA's water supply impacts will increase to 200,000 acre feet if 2012 is a dry year. *Id.* at 42:8-11 (Erlewine). Mr, Leahigh's subsequent estimates suggest the impact will not be as significant as originally anticipated, but will nevertheless be substantial.

183. Because much of the agricultural acreage within Kern County is planted with permanent trees and vines which must always be watered, most of the water demand by users within KCWA remains at the same or similar levels regardless of the availability of SWP water. *Id.* at 21:13-16, 22:9-13, 24:2-16 (Erlewine); Ex. 136, Erlewine Decl. at ¶¶ 18, 19. As a result, a loss to KCWA of a certain volume of SWP deliveries in 2012 is likely to result in an equal volume of groundwater being pumped from the KCWA portion of the San Joaquin Valley Groundwater Basin that otherwise would not be extracted. 7-28-11 Tr. at 24:13-16. Some areas of KCWA, particularly areas on the

west side of its service area, do not have access to usable groundwater and thus rely heavily upon SWP water. *Id.* at 22:19-23:16.

184. An SWP water supply loss and the resultant additional groundwater pumping undertaken to make up for that loss, may also prevent KCWA from being able to recharge its groundwater reserves. *Id.* at 19:15-23; *see also* Exs. 138-141 (Kern Water Bank hydrographs); Exs. 142-144 (Kern County groundwater levels, 2007, 2010, 2011). Continued recharge of available storage space, and SWP deliveries, are needed to return groundwater to the levels necessary to survive future droughts. Ex. 136, Erlewine Decl. at ¶ 19. If 2012 is a dry year, KCWA would lose not only its recharge capability, but also the ability to deliver directly to its customers SWP supplies sufficient to prevent them from needing to extract further volumes of groundwater. *See* 7-28-11 Tr. at 42:1-7 (Erlewine).

185. At the end of 2006, the last wet year prior to the current year, the SWP had significant amounts of water in storage, including approximately 900,000 AF in San Luis Reservoir and more than 3 million AF in Lake Oroville. *Id.* at 16:14-24 (Erlewine). Individual contractors also had significant amounts of water in their own, separate storage facilities, with Metropolitan having approximately 2 million acre feet of water in storage available for its use and Kern County Water Agency's Kern Water Bank at high levels. *Id.* at 16:25-17:4 (Erlewine); Exs. 138-141 (Kern Water Bank hydrographs); Exs. 142

(Kern County groundwater levels 2007). During the 2007-2010 drought, a substantial volume of SWP storage was depleted and a number of extraordinary measures were imposed, including demand reduction measures, water transfers from other areas, and other water management activities. 7-28-11 Tr. at 17:5-8, 19-22 (Erlewine); *cf.* Exs. 142, 143 (Kern County groundwater levels 2007 and 2010).

186. Farmers in the San Joaquin Valley were aided in their ability to withstand the adverse effects of water shortages during 2007 through 2010 because they were able to receive and store surplus water during wet years. Ex. 271, Mettler Decl. at ¶ 3; Ex. 270, Stiefvater Decl. at ¶ 4. Specifically, when SWP water supplies were insufficient to meet their operational needs, farmers purchased supplemental water from local groundwater wells, groundwater storage banks, and other sources. *Id.* The availability of this stored water is the only reason farmers were able sustain their crops during recent drought periods. *Id.* During the 2006 to 2010 period, the disproportionate harm suffered by some CVP water users in the Central Valley, relative to many SWP water users, was largely due to insufficient local CVP water storage. Ex. 136, Erlewine Decl. at ¶ 23.

187. This is the nature of a conjunctively managed water supply. Groundwater is only available as supply in dry years if it is recharged in wet ones.

188. At least two other water contractors in the San Joaquin

Valley, Tulare Lake Basin Water Storage District and Dudley Ridge Water District, are also particularly dependent on SWP exports because they do not generally overlie usable groundwater basins in their service areas. 7-28-11 Tr. at 44:17-45:2; Ex. 136, Erlewine Decl. at ¶ 21. The impacts to these and other agricultural districts in the San Joaquin Valley that use SWP water would be similar to those of Kern County Water Agency. 7-28-11 Tr. at 44:4-16.

189. Metropolitan, the largest SWP contractor, holds approximately half of the entitlement to the SWP's total Table A water amount, equating to about 2 million AF of water. *Id.* at 18:22-19:14; Ex. 136, Erlewine Decl. at ¶ 6. If Metropolitan loses 10% of its SWP allocation in 2012 as a result of implementation of the Fall X2 Action, it will suffer SWP delivery reductions of approximately 200,000 acre feet. 7-28-11 Tr. at 47:25-48:22. This loss would reduce Metropolitan's ability to put additional water into its storage programs to prepare for future dry years. Ex. 136, Erlewine Decl. at ¶ 12.

c. Is There Sufficient Storage Capacity for SWP Contractors to Take Advantage of Increased Exports if Fall X2 Action is Enjoined or Modified?

190. Federal Defendants suggest that potential export impacts to the SWP as a result of the Fall X2 Action are likely to be lessened or eliminated, because the SWP may not have storage capacity available south of the Delta to store additional exports. Water storage in San Luis Reservoir is expected to be at least 1.2 million

AF at the end of the summer. Ex. 563. Storage in San Luis Reservoir this year is higher than the historic average. *Id.*; 7-27-11 Tr. at 237:22-24 (Leahigh). Given the "high storages that we see now" in San Luis Reservoir, there is a "fair probability" that the SWP will fill its share of San Luis Reservoir in the next six months, or by the end of January, 2012. *Id.* at 239:1-9 (Leahigh). Increased exports this fall would increase storage levels in San Luis Reservoir, which could increase the likelihood that the reservoir will fill. *Id.* at 240:23-25. If the state share of storage in San Luis Reservoir fills, that would reduce the impact of Action 4. 7-28-11 Tr. at 60:15-22 (Erlewine). Oroville storage is also nearly full. Ex. 584 at 6 of 6.

191. Metropolitan is already carrying over about 300,000 AF of its Table A allocation in San Luis Reservoir this year that could be risk of being lost if San Luis refills. 7-28-11 Tr. at 49:5-19 (Erlewine). Metropolitan concluded:

> Notably, storing water in SWP Carryover Storage is less desirable under current conditions than it has been in other years. This is because conditions on the SWP system should result in higher storage levels in San Luis Reservoir and Lake Oroville, which also leads to an increased chance of higher SWP Table A allocations next year. When this condition is combined with the fact that In-Region surface storage (Diamond Valley Lake and DWR Flexible Storage) is essentially full, it significantly increases the chances that any water stored in SWP Carryover Storage will be lost in early 2012 as San Luis Reservoir reaches its maximum capacity.

Ex. 567 at 4-5.

192. Nonetheless, SWP Member agencies attempt to manage

deliveries to avoid loss of carryover storage. 7-27-11 Tr. 239:10-17. While Metropolitan has been able to refill a portion of its reserves during 2011, it has remaining capacity to store or otherwise beneficially use the water it will lose if the Fall X2 Action is implemented. 7-28-11 Tr. at 47:13-49:4. Moreover, even in the highly unlikely event Metropolitan is unable to utilize further SWP water supplies, those supplies would be made available to other SWP contractors. If, for example, 100,000 AF is made available as Article 21 water as a result of Metropolitan's not taking its Table A entitlement, KCWA has sufficient capacity to take and beneficially use all of that water by placing it into groundwater storage. *Id.* at 50:21-52:4 (Erlewine). KCWA has sufficient recharge capacity and capability to place more than 100,000 acre feet of additional SWP supplies into storage in 2011-2012, if such further water supplies are made available as a result of not implementing the Fall X2 Action. *Id.* at 41:3-17 (Erlewine).

193. Defendants offer no alternative estimates of the likely loss of carryover storage and the impact such losses would have on the estimates of water loss caused by the Fall X2 action. Evidence presented by Plaintiffs suggests that except in the unlikely event that 2012 is a very wet year, the State Water Contractors have the ability to either beneficially use or store SWP water deliveries they will otherwise lose if the Fall X2 Action is implemented.

(2) Environmental Impacts to Plaintiffs.

194. In addition to the direct impact of reduced groundwater levels associated with implementation of the Fall X2 Action, if KCWA, its Member Units and individual farmers within their service areas are compelled to rely upon groundwater to make up any shortfall in SWP water deliveries, the additional pumping will result in increased energy usage due to the increased pumping lifts needed to access deeper groundwater. 7-28-11 Tr. at 24:13-16, 43:7-15 (Erlewine)

195. Implementation of the Fall X2 Action may also result in water quality impacts associated with declining groundwater levels. *Id.* at 8:22-9:7 (Erlewine); Ex. 136, Erlewine Decl. at ¶ 22. In Kern County, for example, large areas of saline, poor quality groundwater are adjacent to usable, higher quality groundwater. 7-28-11 Tr. at 9:2-4 (Erlewine). Drawing down groundwater levels in the areas with good-quality groundwater will potentially cause the poor-quality groundwater to be intermixed with good-quality water, leading to significant groundwater quality impacts. *Id.* at 8:22-9:7 (Erlewine). Shortage of water supplies could also lead to subsidence, Ex. 136, Erlewine Decl. at ¶ 24, but there is no evidence that subsidence is likely to occur as a result of the imposition of the Fall X2 action this year.

196. However, the likelihood of some of the alleged environmental impacts is unclear. Plaintiffs allege future environmental impacts based upon the dual assumptions of a current

loss of the ability to replenish groundwater or other storage reserves and below normal hydrology over the next several years. *See, e.g., id.* at ¶ 24 ("if next year or multiple subsequent years are below normal, dry, or critically dry, the loss now of the ability to replenish groundwater or store water for future dry years during times of water abundance will likely result in fallowed land, loss of permanent crops, worsened groundwater overdraft, and other serious environmental and economic impacts"). However, future hydrology is unknown. *Id.* at ¶¶ 12, 24; *see also* 7-27-11 Tr. at 226:19-23 (Leahigh) (acknowledging that the fact that this year's June hydrologic conditions were 320% of normal demonstrates that hydrologic conditions fluctuate).

(3) Lack of Access to Credit.

197. It is undisputed that water supply uncertainties interfere with farmers' abilities to secure financing. Ex. 270, Stiefvater Decl. at ¶ 9; Ex. 270, Mettler Decl. at ¶ 4. Lenders will not lend on the basis of SWP water alone, and demand additional and substantial sources of supplemental water. Ex. 270, Stiefvater Decl. at ¶ 9. Continued SWP shortages require depletion of supplemental water supplies such as local groundwater and water banking projects. Ex. 270, Mettler Decl. at ¶ 4. The depletion of these supplies adversely affects farmers' abilities to obtain adequate financing and continue their farming operations. *Id.* Water supply constraints and increased payments for supplemental water interfere with farmers'

cash flows, affect hiring decisions, strain liquidity, and create difficulties in meeting payroll obligations. Ex. 270, Stiefvater Decl. at ¶ 7; Ex. 270, Mettler Decl. at ¶ 3.

198. However, given that 2011 was such a good water year and that groundwater deficits have been able to substantially recharge, the evidence is insufficient to establish that credit access problems are likely to occur in the near future as a result of the implementation of the Fall X2 action.

199. This is also arguably a purely economic harm that may not be considered in the balance of the harms under the ESA.

(4) Employment other Sociological Impacts.

200. Previous testimony before this Court established that water supply losses can be linked to employment losses and related sociological impacts, including hunger and increased crime. *Consolidated Delta Smelt Cases*, 717 F. Supp. 2d 1021, 1055-56 (E.D. Cal. 2010) (May 27, 2010 ruling on Plaintiff's motion for emergency injunctive relief against imposition of Component 2 in that dry year).

201. In the context of the present motion for injunctive relief, Plaintiffs present the declarations of Dr. David Sunding to support a finding that such impacts will result from imposition of the Fall X2 Action this year. Exs. 204 & 205. Dr. Sunding, an economist with expertise in water resources, bases his opinions on employment trends from 2001 to 2009 and concludes that the 2009 delivery reduction

resulting from imposition of the BiOp's RPA resulted in the loss of 9,091 jobs in the San Joaquin Valley, relative to the year 2005. *Id.* at ¶ 3. He admits that his research did not isolate the mechanism by which the reduced deliveries caused job losses, but he surmises that reduced water deliveries resulted in less acreage under production, which in turn resulted in fewer jobs. *Id.* at ¶ 24. Dr. Sunding was able to demonstrate that the 2009 delivery reductions did in fact result in reduced acreage under production. *Id.* at ¶ 26.

202. Dr. Sunding did not attempt to opine as to the employment impact from imposing Fall X2 this year, an admittedly wet year in which exports are at historic levels and groundwater and surface storage is being replenished at historic rates. While it is safe to say that if reduced deliveries do occur in 2012 or subsequent years as a result of implementation of Fall X2 this year, some employment impact will occur, it is impossible to estimate the magnitude of any such impact with any certainty

(5) Modifying the Fall X2 Action will Substantially Decrease Water Supply Impacts.

203. Maintaining an X2 position in the Delta that is more easterly (upstream) than the 74 kilometer location required by the Fall X2 Action will result in less water cost to the Projects.

(a) In his Second Supplemental Declaration, Mr. Leahigh states that, if X2 were positioned at kilometer 79 during the months of September and October 2011, and up to kilometer 79 in November 2011, the estimated water supply impacts to the SWP in 2012 would be

reduced by 550,000 acre feet if 2012 is a critically dry year or by 210,000 acre feet in most other water year types, compared with the impacts of locating X2 at kilometer 74. Doc. 1006 at ¶ 14. That is, if X2 were positioned at kilometer 79, the SWP would experience water supply impacts in 2012 of 120,000 acre feet if 2012 is a critically dry year, or 90,000 acre feet in most other water year types, rather than the 670,000 acre feet (2012 critically dry or dry year) to 300,000 acre feet (most other water year types) of impacts, if X2 is located at kilometer 74. *Id.* at ¶ 11.

(b) Alternatively, if X2 were positioned at kilometer 80, the estimated water supply impacts to the SWP in 2012 would be reduced by 590,000 acre feet if 2012 is a critically dry or dry year, or by 220,000 acre feet in most other water year types, compared with the impacts of locating X2 at kilometer 74. *Id.* at ¶ 15. That is, if X2 were positioned at kilometer 80, the SWP would experience water supply impacts of 80,000 acre feet in 2012 in most water year types, rather than the 670,000 acre feet of impacts in critically dry and dry years, or 300,000 acre feet in most other water year types, if X2 is located at kilometer 74. *Id.* at ¶ 13.

K. Consistency Determination

204. The SWP has obtained a consistency determination from CDFG, pursuant to the California Endangered Species Act ("CESA"), which authorizes the take of delta smelt by the SWP, "provided DWR implements the Project as described in the BO, and complies with the

measures, RPAs and other conditions described in the BO." Ex. 1004, Doc. 474-2

2. The consistency determination further states the BiOp's RPA "must be implemented and adhered to." *Id.* The Fall X2 Action is one of the components of the RPA that is identified in the consistency determination. *Id.*

3. The incidental take permit that contains this consistency determination contains a clause that permits DWR to request a new consistency determination in the event the BiOp's RPA is modified. How the California Department of Fish & Game would respond to such a request is unknown. 7-29-11 Tr. at 268:1-10 (Mr. Lee).

VI. CONCLUSIONS OF LAW

A. Jurisdiction.

1. Jurisdiction exists under 28 U.S.C. § 1331 (Federal Question), as this case arises under the ESA, 16 U.S.C. § 1536 *et seq.*, NEPA, 42 U.S.C. § 4331 *et seq.*, and the APA, 5 U.S.C. § 702 *et seq.*

B. Evidentiary Disputes.

(1) Plaintiffs' Objection to Defendants' Request for Judicial Notice.

2. Plaintiffs object to certain documents relied upon by Defendants in their Proposed Findings, for which Defendants request judicial notice. These documents are:

- Doc. 945-15 (Letter from Director of CDFG);
- Doc. 945-16, Ex. 541 (CDFG Report);
- Doc. 945-17, Ex. 542 (Report of the Independent Workshop Panel on Salmonid Integrated Life Cycle Models);
- Doc. 945-18, Ex. 547 (CDFG Comments on BDCP EA).

As none of these documents have been relied upon in this decision, the objection is moot.

(2) Motion to Strike.

3. At the outset of the evidentiary hearing, the district court denied Defendants' motion to strike, Doc. 947: (1) materials that pertain to issues already litigated, which Defendants had challenged on law of the case grounds; (2) materials discussing economic harm, which Defendants had challenged as not properly before the Court under the ESA; (3) extra-record and post-decisional materials, which Defendants had moved to strike on the ground that such material may not be considered under the APA standard of review; and (4) materials presented by Plaintiffs for the first time in this motion that could have been raised during the summary judgment stage. 7-26-11 Tr. at 4:2-11:18. Specific rulings were made on the record. *Id.* Those rulings are incorporated by this reference.

4. The Court also permitted all parties to raise further objections on a question-by-question basis during the hearing, and noted Defendants' standing objections to the testimony of witnesses who would testify by declaration only pursuant to the parties'

stipulation. *Id.* at 11:6-12:17. Defendants now request rulings on specific objections, presumably on the ground that they were not previously addressed.

a. Declaration of Terry Erlewine.

5. Defendants propose to strike paragraphs 11-13, 24-25, and lines 5-8 of Paragraph 20 of the initial Erlewine Declaration (Ex. 136), on the ground that these paragraphs concern environmental impacts that result from groundwater overdraft as well as impacts to air quality, from subsidence, and related matters about which Mr. Erlewine has no expertise or credentials. However, Mr. Erlewine has personal knowledge of the operations, Table A contract amounts, and storage facilities of MWD, as well as groundwater levels, energy use, water quality and other environmental impacts experienced in the SWP service area as a result of reduced SWP deliveries, particularly in Kern County. 7-28-11 Tr. at 7:7-9:13, 20:3-25, 42:23-43:15. This objection is OVERRULED.

6. Defendants propose that Paragraphs 3 to 5 of Mr. Erlewine's initial declaration (Ex. 136) be stricken. Defendants do not offer a separate justification for striking these paragraphs, which relate exclusively to SWP water supply impacts associated with implementation of the Fall X2 Action. Defendants concede that Mr. Erlewine has been qualified as an expert witness regarding SWP operations. Doc. 1004, Defendants' Proposed Findings, ¶ 256. This objection is OVERRULED.

b. Declarations of Jeffrey Mettler and Rod Stiefvater.

7. Plaintiffs have offered the testimony of two farmers, both of whom provide evidence of economic harms associated with potential water supply reductions from the implementation of the Fall X2 Action. *See* Declaration of Rod Stiefvater (Ex. 270); Declaration of Jeffrey R. Mettler (Ex. 271). Neither Mr. Stiefvater nor Mr. Mettler has been qualified as an expert in CVP or SWP operations or economics. Defendants argue that both offer opinion testimony based on scientific, technical, or other specialized knowledge that is not permitted under Federal Rule of Evidence 701. *See United States v. Durham*, 464 F.3d 976, 982 (9th Cir. 2006) (finding that "opinion testimony of lay witnesses must be predicated upon concrete facts within their own observation and recollection – that is facts perceived from their own senses, as distinguished from their opinions or conclusions drawn from such facts") (internal quotations and citation omitted).

8. As an example, Defendants argue that Mr. Stiefvater's opinion that his existing 80% SWP allocation is in danger of being reduced by 10% is a speculative harm that no party is alleging in this case. *See* Ex. 270 at ¶ 6. Mr. Mettler states that "[i]n 2010, the SWP allocation was sufficient for my crop needs, but the cost of this supply was substantially higher than if a higher SWP allocation was available." Ex. 271 at ¶ 3. Defendants maintain Mr. Mettler and Mr. Stiefvater offer no basis for these opinions, and therefore the

opinions are barred by Federal Rule of Evidence 701.

9. Similar arguments have been rejected numerous times in these consolidated cases. *See, e.g., San Luis & Delta-Mendota Water Auth. v. Salazar*, 2009 WL 1516798, *3-*6 (E.D. Cal. May 29, 2009). Here, Mrs. Mettler and Stiefvater are farmers personally familiar with the water allocations their farms receive and the cost increases that will likely occur if water supplies are decreased. Personal knowledge acquired through management and operation of one's business, as well as experience in the industry, provides a foundation for lay testimony and opinion about the economic aspects of one's own business, general practices in the industry, and how one's business actions might change under different circumstances. *United States v. Hill*, 643 F.3d 807, 840-42 (11th Cir. 2011) (permitting officer or employee of a corporation to offer lay opinion testimony about industry standards and pricing); *Eckelkamp v. Beste*, 315 F.3d 863, 872 (8th Cir. 2002) (perceptions based on industry experience provide foundation for lay testimony); *National Hispanic Circus v. Rex Trucking*, 414 F.3d 546, 551-52 (5th Cir. 2005) (corporate manager permitted to testify about matters related to business expertise).

10. Mr. Mettler's and Mr. Stiefvater's observations regarding past and prospective reduced water allocations, and the effects of such reductions, are lay opinions; they are opinions or inferences "predicated upon concrete facts within their own observation and

recollection." Defendants' objections are OVERRULED. The nature of their experience goes to the weight their lay testimony will be afforded vis-à-vis other, expert witness testimony.

c. Declaration Dr. David L. Sunding.

11. Defendants' reiterate a previously-articulated objection to the Declarations of Dr. David L. Sunding, which was offered facially "to respond to" the Declaration of Cameron Speir filed in the *Consolidated Salmonid Cases*, 1:09-cv-1053 OWW (Doc. 563), regarding "employment trends in the San Joaquin Valley from 2001 to 2009." Ex. 204, Sunding Decl. at ¶ 2. Defendants object that, because the Speir declaration was not introduced by Defendants in any injunctive relief proceeding in this case and is not properly before the Court on this motion, Dr. Sunding's declaration is not relevant here. This elevates form over substance. While Dr. Sunding may have been "responding to" this earlier Declaration in an intellectual sense, he offers independent evidence that stands alone.

12. Defendants also object that, because Dr. Sunding's declaration addresses employment trends in the San Joaquin Valley from 2001 through 2009, his opinions are not relevant to the question of Plaintiffs' allegations regarding the likelihood of irreparable harm from implementation of Action 4 in 2011. This goes to weight not admissibility. "'Relevant evidence' means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than

it would be without the evidence." Fed. R. Evid. 401. Dr. Sunding's opinions has some tendency to confirm a relationship between reduced water deliveries and unemployment, as well as serving to explain the costs of groundwater depletion and the fact that groundwater pumping is not a sustainable solution to long-term reductions in water availability. That his opinions focus on data from 2001-2009 and examine the impacts of reduced deliveries during a time of water shortage, rather than plenty, go to weight, not admissibility. This objection is OVERRULED.

C. Threshold Issue: Does the CDFG Consistency Determination Render Redressability (A Standing Requirement) Speculative?

13. Defendants argue that Plaintiffs lack standing to bring this motion for injunctive relief because Plaintiffs cannot establish redressability, one of the elements of standing. Plaintiffs bear the burden of proving that it is "likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." *Friends of the Earth, Inc. v. Laidlaw Envt'l Servs. (TOC), Inc.*, 528 U.S. 167, 181 (2000).

14. Specifically, Defendants point to the CDFG Consistency Determination, which authorizes the take of delta smelt by the SWP under CESA, so long as "the Project as described in the BO, and complies with the measures, RPAs and other conditions described in the BO." Ex. 1004, Doc. 474-2. Defendants argue that Plaintiffs have provided no evidence that CDFG is likely to issue a revised consistency determination if this Court were to grant Plaintiffs'

requested injunction. The CESA incidental take permit that contains this consistency determination contains a clause that permits DWR to request a new consistency determination in the event the BiOp's RPA is modified, but it is not known how CDFG would respond to such a request. The State Water Contractors filed a separate challenge to CDFG's incorporation of the RPA provisions into the state incidental take permit. 7-28-11 Tr. at 87:25-88:11 (Erlewine). The parties to that lawsuit stipulated to stay further proceedings pending the outcome of this case. *See* 7-29-11 Tr. at 198:21-196:3.

15. Where redress of a plaintiff's harms depends on independent decisions of governmental entities not a party to the pending lawsuit, standing does not exist. *See Lujan v. Defenders of Wildlife*, 504 U.S. 555, 568-71 (1992) (plaintiffs had no standing to challenge regulation interpreting ESA § 7(a)(2) as being limited in geographic scope to projects undertaken in the United States and the high seas; redressability was speculative because agencies funding projects overseas were not parties to the case and maintained the challenged regulation was not binding upon them, therefore requested relief (termination of funding until consultation) was not likely to result from successful lawsuit). "There is no redressability, and thus no standing, where ... any prospective benefits depend on an independent actor who retains 'broad and legitimate discretion the courts cannot presume either to control or to predict.' " *Glanton ex rel. ALCOA Prescription Drug Plan v. AdvancePCS Inc.*, 465 F.3d 1123,

1125 (9th Cir. 2006) (quoting *ASARCO, Inc. v. Kadish*, 490 U.S. 605, 615 (1989)). In *Glanton*, for example, the "[p]laintiffs claim[ed] that, if their suit [was] successful" in proving that the defendant, a pharmacy benefit manager, charged their health plans too much for prescription drugs, "the plans' drug costs [would] decrease, and that the plans might then reduce contributions or co-payments." *Id.* But the Ninth Circuit found no standing, explaining that "nothing would force [the health plans] to" pass any savings down to the plaintiffs and that the plans "would be free" to keep the savings for themselves. *Id.*

16. This is arguably a procedural injury case in which certain aspects of the redressability requirements are relaxed.

> A showing of procedural injury lessens a plaintiff's burden on the last two prongs of the Article III standing inquiry, causation and redressibility. Plaintiffs alleging procedural injury must show only that they have a procedural right that, if exercised, could protect their concrete interests.

Salmon Spawning & Recovery Alliance v. Gutierrez, 545 F.3d 1220, 1226 (9th Cir. 2008) (emphasis in original) (internal citations and quotations omitted).

17. However, nothing in the procedural injury standing jurisprudence relaxes the rule that redress cannot depend on independent decisions of governmental entities not a party to the pending lawsuit. *See Nuclear Info. Res. Serv. v. Nuclear Regulatory Comm'n*, 457 F.3d 941, 955 (9th Cir. 2006) ("*NIRS*"). In NIRS, the plaintiffs challenged the NRC's decision to revise regulations

governing exemption standards for the transportation of radioactive material. Plaintiffs alleged that NRC failed to comply with its procedural obligations under NEPA. NRC objected that the plaintiffs' procedural injuries were not redressable because the Department of Transportation ("DOT") had promulgated identical exemption standards that would be unaffected by the lawsuit. The Ninth Circuit agreed with NRC and held that plaintiffs lacked standing:

> The parties agreed at oral argument that NRC licensees are required to follow DOT's regulations for the transportation of nuclear material.... Thus, even if we were to set aside the current NRC rule and remand to NRC with instructions that it prepare an EIS, nothing requires DOT to revisit its identical exemption standards, which govern the universe of NRC licensees.... [T]he DOT rule would control even if the NRC rule was wiped off the books. And the DOT regulation is not before us. We cannot see how an order remanding to NRC would remedy the asserted injury from the ... exemption standards because DOT would be under no obligation to reconsider its own, identical rule.

NIRS, 457 F.3d at 955.

18. Redressability may be shown if "a causal relation [ship] is 'probable' ..., even if the chain cannot be definitively established." *Envtl. Def. Ctr. v. EPA*, 344 F.3d 832, 867 (9th Cir. 2003); *see also Coalition v. Koch*, 2009 WL 2151842, at *13 n. 6 (E.D. Cal. Jul. 16, 2009) ("So long as there is evidence that the third party, whether possessing a four-chambered heart or not, will behave in a predictable manner, the causal chain is not necessarily rendered 'tenuous' for the purposes of the standing analysis."); *see also Loggerhead Turtle v. County Council*, 148 F.3d 1231, 1247 (11th Cir.1998) ("standing is not defeated merely because the alleged

injury can be fairly traced to the actions of both parties and non-parties" (citing *Lujan*, 504 U.S. at 560)).

19. A related redressability issue was addressed in connection with a challenge to CDFG's sportfishing regulations designed to protect the Delta's striped bass population. Plaintiffs in that case claimed that protecting striped bass, known predators of delta smelt, constituted unlawful "take" of delta smelt, which in turn impacted smelt abundance and caused Plaintiffs harm from water supply impacts resulting from same 2008 Smelt BiOp RPA's challenged in this lawsuit. *Coalition for a Sustainable Delta v. Carlson*, 2008 WL 2899725 (E.D. Cal. July 24, 2008). Redress of that harm was found to be speculative:

> [E]ven if [plaintiff] were to prevail in this case, its injury would not necessarily be redressed. If the regulations were invalidated, even if the striped bass population were reduced to a level that measurably protected salmonid species on which they prey, there are other predators (the pikeminnow) and other causes: operation of the Projects, toxics, in-Delta diverters, alien invasive species, all of which contribute to the species' jeopardy. The present Delta smelt and salmonids jeopardy findings are based on drought conditions and Project operations, as primary causes. The extent to which all other cooperative causes will continue to operate is unknown. There remains total uncertainty whether reduction in the threat of some predators will have more than minimal effect on the protected species.

Id. at *10.

20. The present situation is distinguishable. Here, Plaintiffs directly challenge imposition of one of the RPA Actions on the ground that it is scientifically unjustified. They have partially prevailed

on the merits of this challenge. CDFG has issued a consistency determination that incorporates the reasoning of the BiOp and its RPA:

> The Central Valley and California Delta system ... supports populations of delta smelt, which is distinguished as a threatened species under both the federal ESA and the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.). Flow disruption, loss of habitat, and entrainment caused by Project related water export and management activities result in incidental take of delta smelt.
>
> Because the Project has the potential to take a species listed under ESA, the USBR, on behalf of DWR, consulted with the USFWS under Section 7 of the ESA. On December 15, 2008, USFWS issued a Biological Opinion (Ref. No. 81420-2008-F-1481-5), which includes an incidental take statement (hereafter, the BO). The BO describes the Project, including conservation measures developed to minimize impacts to delta smelt, and sets forth measures to mitigate any remaining impacts to delta smelt and its habitat. The measures in the BO include one "Reasonable and Prudent Alternative" with five components (RPAs) which must be implemented and adhered to. The RPA actions are to be implemented using an adaptive approach with specific defined constraints. The BO includes a detailed description of the adaptive process, its framework, and the rationale for each of the RPA components. On June 17, 2009, the Director of the Department of Fish and Game (DFG) received correspondence from Lester A. Snow, Director of DWR, requesting a determination from DFG that the BO and its incidental take statement are consistent with CESA pursuant to Fish and Game Code Section 2080.1.
>
> **DETERMINATION**
>
> DFG has determined that the BO, including all RPA requirements and the related incidental take statement, is consistent with CESA because the mitigation measures therein meet the conditions set forth in Fish and Game Code section 2081, subdivisions (b) and (c), for DFG to authorize incidental take of CESA listed species. This determination is limited to only those actions specifically identified and analyzed in the December 15, 2008 BO. Specifically, DFG finds that take of delta smelt will be

incidental to an otherwise lawful activity (i.e., SWP operations); the measures and RPAs identified in the BO to modify flow requirements and restore habitat will minimize and fully mitigate the impacts of the taking of delta smelt; and the Project, with the pre- scribed measures and RPAs in place, will not jeopardize the continued existence of the species. The avoidance, minimization, and mitigation measures in the BO include, but are not limited to, the following:

Minimization and Mitigation Measures

Avoidance and Minimization Actions: The BO requires SWP operational actions which are expected to provide flow conditions that reduce entrainment of delta smelt and retain necessary outflow and habitat to support all its life stages. Specific flow modification requirements are presented in RPA Components 1 and 2, including the information necessary to determine delta smelt risk. The requirements include a defined real time scientific evaluation process to develop timely flow augmentations to avoid situations that increase delta smelt risk.

Mitigation Measures: The BO includes two actions to increase the area of suitable delta smelt habitat in the estuary: 1) *Delta outflow augmentation in the fall following wet and above normal water years and*, 2) restoration of at least 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh.

Reporting and Monitoring Actions: Conditions of the BO and respective RPAs require DWR to develop and follow specific monitoring programs to adaptively evaluate specific flow requirements and action triggers to achieve the RPA objectives. Participation in (including DFG among others), review of, and reporting requirements for these processes are all a condition of and detailed within the BO and RPAs. The BO outlines a monitoring and reporting process to determine specific operational actions set forth in RPA Components 1 and 2. RPA Components 3 and 4 include similar requirements for the design, monitoring, and adaptive management of fall flow actions to improve delta smelt habitat, as well as the implementation of required habitat restoration actions. RPA Component 5 ensures that information is gathered and reported appropriately.

****

> Based on this consistency determination, DWR does not need to obtain authorization from DFG under CESA for incidental take of delta smelt that occurs in connection with the Project, provided DWR implements the Project as described in the BO, and complies with the measures, RPAs and other conditions described in the BO. However, if the Project as described in the BO, including the mitigation measures therein, changes after the date of the BO, or if the USFWS amends or replaces the BO, including any of the RPAs, DWR will need to obtain from DFG a new consistency determination (in accordance with Fish and Game Code section 2080.1) or a separate incidental take permit (in accordance with Fish and Game Code section 2081).

Ex. 1004 at 1300-301. This Consistency Determination is made under the authority of California Fish and Game Code § 2081, which sets forth the requirements for obtaining a take permit under CESA. Although these requirements are not identical to those of the ESA, *e.g.*, § 2081 requires that take be "minimized and fully mitigated," a federal judicial finding that an RPA is scientifically unjustified significantly undermines the basis for the Consistency Determination. This is sufficient for purposes of standing. The principles of judicial economy would not be served if Plaintiffs were required to prosecute both cases simultaneously in parallel cases in order to obtain evidence from the state court that a parallel injunction would likely result from a federal injunction against the Fall X2 action. Adopting Defendants' rule would effectively bar standing in many cases involving species dually listed under the ESA and parallel state statutes, contrary to Congressional intent that ESA challenges be subject to broad judicial review. *See* 16 U.S.C. § 1540(g).

D. Success on the Merits.

(1) Success on NEPA Claims.

21. Plaintiffs have already succeeded on their NEPA claim. *See* Doc. 399.

22. NEPA insures that federal agencies "make informed decisions and 'contemplate the environmental impacts of [their] actions.'" *Ocean Mammal Inst. v. Gates*, 546 F. Supp. 2d 960, 971 (D. Hi. 2008) (quoting *Idaho Sporting Cong. v. Thomas*, 137 F.3d 1146, 1149 (9th Cir. 1998)).

23. "NEPA emphasizes the importance of coherent and comprehensive up-front environmental analysis to insure informed decision-making to the end that the agency will not act on incomplete information, only to regret its decision after it is too late to correct." *Ctr. for Biological Diversity v. U.S. Forest Serv.*, 349 F.3d 1157, 1166 (9th Cir. 2003).

24. Federal Defendants' violations of NEPA prevented the required reasonable evaluation, analysis, "hard look at," and disclosure of the harms of implementing the 2008 Smelt BiOp RPA Actions to human health and safety, the human environment, and other environmental values.

(2) Success on the ESA Claim Regarding the Fall X2 Action.

25. The 12/14/10 MSJ Decision rejected some of Plaintiffs' challenges to the BiOp's rationale for the Fall X2 action, but found that the BiOp's X2 analysis was flawed in two critical respects. *San*

Luis v. Salazar, 760 F. Supp. 2d at 922. The MSJ Decision marginally upheld the BiOp's reliance on the Feyrer (2007) and Feyrer (2008) studies as justification for imposing some controls on Fall X2, but found that the BiOp "fail[ed] to explain why it is essential to maintain X2 at 74 km and 81 km respectively, as opposed to any other specific location." *Id.* at 922-23.

E. Requirements for Injunctive Relief.

26. In order to establish entitlement to injunctive relief, Plaintiffs must establish:

> (1) that [they will] suffer[] an irreparable injury;
>
> (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury;
>
> (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and
>
> (4) that the public interest would not be disserved by a permanent injunction.

Sierra Forest Legacy, --- F.3d ---, 2011 WL 2041149 at *16.

(1) Irreparable Harm.

a. General Requirements for Proving Irreparable Harm.

27. Plaintiffs bear the burden of showing that "irreparable injury is likely in the absence of an injunction." *Winter*, 555 U.S. at 22. Attenuated, conjectural, or speculative injuries will not suffice. *Caribbean Marine Servs. Co. v. Baldrige*, 844 F.2d 668, 674-75 (9th Cir. 1988) (finding that declarations which merely speculate about imminent threat of harm are insufficient for purposes of

injunctive relief).

28. The Court of Appeals recently confirmed that the likelihood of irreparable harm -- as opposed to the mere possibility of it -- remains an unyielding threshold requirement prior to the issuance of injunctive relief. ***Alliance for the Wild Rockies v. Cottrell***, 632 F.3d 1127, 1131 (9th Cir. 2011). Although the ***Alliance for the Wild Rockies*** panel affirmed other parts of the "sliding scale" approach not reached in Winter and not at issue here, the panel also confirmed the irreducible requirement that "under ***Winter***, plaintiffs must establish that irreparable harm is likely, not just possible." ***Id***. Under controlling Supreme Court and Ninth Circuit precedent, a district court need not reach the remaining factors of the injunctive relief test if a moving party has not shown that irreparable harm is likely.

29. In general, "the test for determining if equitable relief is appropriate is whether an injunction is necessary to effectuate the congressional purpose behind the statute." ***Biodiversity Legal Found. v. Badgley***, 309 F.3d 1166, 1177 (9th Cir. 2002).

30. In addition, before any injunctive relief can issue, Plaintiffs must also show that the relief they seek is "narrowly tailored" to remedy the specific violations at issue and is not likely to result in irreparable harm to an ESA-listed species. ***Nat'l Wildlife Fed'n v. NMFS***, 422 F.3d 782, 796, 800 (9th Cir. 2005); ***see also Pac. Coast Fed'n of Fisherman's Ass'ns v. Gutierrez***, 606 F.

Supp. 2d 1195, 1203 (E.D. Cal. 2008) (noting that during periods of interim relief in ESA context "only 'non jeopardizing' actions may continue"); *Natural Res. Def. Council v. Kempthorne*, 2007 WL 4462395, at *21 (E.D. Cal. Dec. 14, 2007) (holding that "[a]ny interim remedial prescriptions must (1) not cause jeopardy ... [or]; (2) adversely modify its critical habitat").

b. Injunctive Relief in ESA Cases.

31. Previous rulings in this case have discussed the balancing of the equities in ESA and NEPA cases:

> The Supreme Court held in *TVA v. Hill*, 437 U.S. 153, 194 (1978), that Congress struck the balance in favor of affording endangered species the highest of priorities. In adopting the ESA, Congress intended to "halt and reverse the trend toward species' extinction, whatever the cost." *Id*. at 184 (emphasis added). *TVA v. Hill* continues to be viable. *See Home Builders*, 551 U.S. at 669-71; *see also Oakland Cannabis Buyers' Co-op.*, 532 U.S. 496-97; *Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 543 n.9 (1987).
>
> *Winter* does not modify or discuss the *TVA v. Hill* standard. Although *Winter* altered the Ninth Circuit's general preliminary injunctive relief standard by making that standard more rigorous, *Winter* did not address, nor change, the approach to the balancing of economic hardships where endangered species and their critical habitat are jeopardized. *See Biodiversity Legal Found. v. Badgley*, 309 F.3d 1166, 1169 (9th Cir. 2002) (Congress removed the courts' traditional equitable discretion to balance parties' competing interests in ESA injunction proceedings); *Nat'l Wildlife Fed'n v. Burlington N. R.R., Inc.*, 23 F.3d 1508, 1510-11 (9th Cir. 1994)(same).
>
> Prior decisions involving the coordinated projects' operations found that *TVA v. Hill* and related Ninth Circuit authorities foreclose the district court's traditional discretion to balance economic equities under the ESA. There is no such bar in NEPA injunction proceedings.

> Plaintiffs have advanced a human welfare exception and contend that unlike any of the prior cases, this case juxtaposes species' survival against human welfare, requiring a balancing of the BiOp's threats of harm to humans, health, safety, and protection of affected communities. No case, including TVA v. Hill, which concerned the competing economic interest in the operation of a hydro-electric project and prohibited federal courts from balancing the loss of funds spent on that project against the loss of an endangered species, expressly addresses whether the ESA precludes balancing of harms to humans and the human environment under the circumstances presented here.
>
> This case involves both harm to threatened species and to humans and their environment. Congress has not nor does *TVA v. Hill* elevate species protection over the health and safety of humans.

Consolidated Delta Smelt Cases, 717 F. Supp. 2d at 1068-69.

32. *TVA v. Hill* itself involved more than just pure economic interests. The Supreme Court's description of the project at issue in that case includes non-economic human interests on both sides of the equation:

> In this area of the Little Tennessee River the Tennessee Valley Authority, a wholly owned public corporation of the United States, began constructing the Tellico Dam and Reservoir Project in 1967, shortly after Congress appropriated initial funds for its development. Tellico is a multipurpose regional development project designed principally to stimulate shoreline development, generate sufficient electric current to heat 20,000 homes, and provide flatwater recreation and flood control, as well as improve economic conditions in "an area characterized by underutilization of human resources and outmigration of young people." Hearings on Public Works for Power and Energy Research Appropriation Bill, 1977, before a Subcommittee of the House Committee on Appropriations, 94th Cong., 2d Sess., pt. 5, p. 261 (1976). Of particular relevance to this case is one aspect of the project, a dam which TVA determined to place on the Little Tennessee, a short distance from where the river's waters meet with the Big Tennessee. When fully operational, the dam would

> impound water covering some 16,500 acres-much of which represents valuable and productive farmland-thereby converting the river's shallow, fast-flowing waters into a deep reservoir over 30 miles in length.

TVA v. Hill, 437 U.S. at 157. But, the Supreme Court never discussed how these non-economic impacts factored into the balance of the equities, perhaps because the impact of enjoining Tellico's construction was to prevent benefits that would flow from the construction of the dam. Here, by contrast, it is alleged that imposition of the Fall X2 Action will affirmatively harm human communities through the reduction of water supplies and by reducing water supply security in future years. If such harms cannot be considered in the balance in an ESA case, it is difficult to envision how a resource-dependent plaintiff would ever obtain injunctive relief in an ESA case.

33. Even if an injunction may not issue under the ESA based on economic harm, there is no such restriction in a NEPA case. A court may not issue an injunction under NEPA that would cause a violation of other statutory requirements, such as those found in section 7 of the ESA. *See United States v. Oakland Cannabis Buyers' Coop.*, 532 U.S. 483, 497 (2001) ("A district court cannot, for example, override Congress' policy choice, articulated in a statute, as to what behavior should be prohibited."). Nor should an injunction issue under NEPA when enjoining government action would result in more harm to the environment than denying injunctive relief. *Save Our Ecosystems v. Clarke*, 747 F.2d 1240, 1250 (9th Cir. 1984); *Am.*

Motorcyclist Ass'n v. Watt, 714 F.2d 962, 966 (9th Cir. 1983) (holding public interest does not favor granting an injunction where "government action allegedly in violation of NEPA might actually jeopardize natural resources"); ***Alpine Lakes Prot. Soc'y v. Schlapfer***, 518 F.2d 1089, 1090 (9th Cir. 1975) (denying injunctive relief in NEPA case where more harm could occur to forest from disease if injunction was granted). However, where the evidence indicates that the ESA will not be violated by injunctive relief issued under NEPA, the presence of a NEPA claim permits consideration of economic harm evidence.

c. Showing of Irreparable Harm.

34. Although the showing of irreparable harm made here is subject to uncertainty, it is not "speculative."

35. The CVP will likely not experience any water supply impact as a result of the Fall X2 Action. However, it is more likely than not that SWP Contractors will suffer some water supply impact in 2012 if the Fall X2 Action is implemented starting in September 2011.

36. Mr. Leahigh's most up-to-date estimates, which incorporate recent conditions, indicate that any storage losses due to implementation of the Fall X2 Action in 2011 will likely be recovered. However, it is more likely than not that the SWP will suffer a 300,000 AF export impact, as only in a wet year would this impact be reduced or eliminated.

37. Even though 2011 has been a "really good water year," in

which much of the storage deficits caused by the 2007-2010 drought have been made up, prudent water management calls for the storage of water in good years to guard against future dry periods. SWP Contractors fared relatively well, as compared to CVP Contractors, during the last drought period, largely due to local surface and groundwater storage reserves.

38. A 300,000 AF export impact would reduce SWP Contractors' ability to put additional water into storage programs to prepare for future dry years. SWP Contractors have sufficient storage available to take advantage of any additional water that may be delivered if the Fall X2 Action is modified or enjoined. Although the impact of reduced deliveries resulting from the Fall X2 Action may be delayed, this does not render them "speculative."

39. Although it is likely that San Luis Reservoir will fill this year, which has the potential to cause SWP Contractors to lose SWP Carryover storage held there, the record suggests that the SWP Contractors will modify delivery schedules to minimize or eliminate any such losses.

40. Metropolitan, the largest SWP Contractor, which serves primarily domestic users in Southern California, holds approximately half of the total SWP Table A entitlement. Because Metropolitan's current storage levels are at historic levels, it is unlikely that Metropolitan will be required to reduce deliveries to its member agencies in 2012 as a result of any reduced exports in 2011 due to

the Fall X2 Action. However, it is undisputed that any reductions in deliveries to Metropolitan will reduce its overall ability to store water to prepare for future dry years. Reduced water supply reliability for domestic uses in the service area of the largest SWP Contractor is not a purely economic harm.

41. KCWA will likewise be impacted in its ability to store water for future years. Due to cropping patterns (predominantly permanent trees and vines) in KCWA service areas, a loss of a given volume of water to KCWA is likely to result in an equal volume of water being pumped from the KCWA portion of the San Joaquin Valley Groundwater basin that otherwise would not be extracted.

42. In addition to affecting the SWP Contractors' ability to store water for future dry periods, reduced exports resulting from the Fall X2 Action will directly impact the environment by making it more difficult for Contractors to recharge historically depleted groundwater basins. This can have resulting impacts to groundwater quality. As users draw down groundwater levels, this increases the likelihood that they will have to rely on poor quality groundwater. Increased groundwater pumping will also likely result in increased energy use.

43. Evidence gathered during the recent drought period, ending in 2010, suggests that water supply reductions have resulting economic impacts to the agricultural industry, by reducing the ability of farmers to access credit and provide employment. Reduced

employment has the potential to adversely impact agricultural communities. However, the evidence does not clearly demonstrate the extent to which implementation of the Fall X2 Action in 2011 will cause such economic and sociological impacts in the foreseeable future.

44. Modifying the Fall X2 Action will substantially decrease the water supply impact of the action.

(a) Positioning X2 at kilometer 79, as opposed to kilometer 74, would have a likely water supply impact of 90,000 AF, reducing the impact by 210,000 AF in most water year types.

(b) Positioning X2 at kilometer 80, as compared to kilometer 74, would have a likely water supply impact of 80,000 AF, reducing the impact by 220,000 AF in most water year types.

(2) Monetary Compensation Inadequate.

45. No party has addressed the issue of whether monetary compensation could adequately compensate Plaintiffs for the harm they may suffer as a result of the Fall X2 Action. It has never been suggested that Federal Defendants could be subject to money damages for any harm imposed by implementation of an action required by an ESA biological opinion. *See, e.g., O'Neill v. United States*, 50 F.3d 677, 682-87 (9th Cir. 1995) (finding language in CVP water service contracts absolves federal government of liability for reduced water deliveries). There are no claims in this lawsuit that could even arguably subject the State of California to monetary damages.

(3) Balancing of the Equities.

46. According to the recently-decided *Sierra Forest Legacy*, in a post-judgment injunctive relief proceeding, a court is not bound by the deferential standard applicable in APA cases:

> **Although the federal government is undoubtedly permitted to follow its own experts when making a decision, federal experts are not always entitled to deference outside of administrative action....**
>
> **... It is reasonable that courts would defer to particular experts when the government has unique expertise, in fields such as national security or the internal functioning of the military. However, *Winter* applied no such deference concerning the possibility that sonar testing would irreparably harm whales. *See id.* at 383–84. Ecology is not a field within the unique expertise of the federal government.**
>
> **If the federal government's experts were always entitled to deference concerning the equities of an injunction, relief against federal government policies would be nearly unattainable, as government experts will likely attest that the public interest favors the federal government's preferred policy, regardless of procedural failures.**

--- F.3d ---, 2011 WL 2041149, *18-*19 (citations omitted).

47. Therefore, the Court must independently weigh the evidence to determine whether, on balance, the record justifies imposing the Fall X2 Action.

48. The smelt has been listed as a threatened species under the ESA, and FWS has determined that uplisting to endangered status is "warranted but precluded" by other, higher-priority listing activities.

49. Although abundance indices have shown slight improvements since 2009, the species is still imperiled. Abundance indices are

still at or near historic lows. The species' overall situation is not altered by the discovery in recent years of "new" populations of delta smelt in the Cache Slough Complex.

50. Although smelt occupy a wide range of salinities, the movement of the "centroid" (i.e., the center of the distribution) of the delta smelt population is correlated with the movement of X2. While the breadth (i.e., overall spread of the population from east to west) of the distribution does not appear to change as X2 shifts, X2 is a reliable proxy for the center of the smelt population.

51. The Fall X2 Action is designed to address a purported shift to the east of the average location of X2, as well as a decrease in the variability of the average position of X2. The BiOp concludes, based on a review of data from 1967 forward, that these changes were caused by project operations. Plaintiffs' argue that an analysis of a broader set of data, starting in 1930, demonstrates that no easterly shift has occurred and variability has in fact increased over time. However, Defendants' alternative analyses of the longer data set indicate that Plaintiffs' results are not dispositive.

52. The Fall X2 Action is also designed to redistribute the centroid of the smelt population into Suisun Bay, a more biologically productive and turbid area of the Delta in which smelt are likely to have increased opportunities to feed, rear, and shelter.

53. To support moving X2 (and therefore the centroid of the smelt population) to Suisun Bay, the BiOp, as well as subsequent

analyses issued by Federal Defendants, relies almost exclusively on Mr. Feyrer's work to develop an abiotic habitat index, which evaluates the availability of suitable abiotic habitat in various locations of the Delta according to the position of X2. Based on this work, the BiOp concluded that, as X2 shifts to the west, greater areas of suitable habitat become available to the smelt.

54. This trend is depicted in Figure B-17, which shows an "s" shaped curve, with two asymptotes at approximately 74 kilometers and 81 kilometers. These asymptotes represent the outer boundaries of the part of the curve that changes most rapidly, suggesting that gains and losses in habitat area occur less rapidly outside these bounds. These bounds correspond to the Fall X2 Action's 74 km and 81 km requirements in wet and above normal years.

55. Mr. Feyrer and his co-authors found a statistically significant correlation between the habitat index in the Fall and the subsequent year's FMWT. Specifically, Feyrer (2011) found that the habitat index variables of salinity and turbidity explain 25% of the variation in delta smelt abundance.

56. These results are the subject of considerable, legitimate criticism, on the following grounds: (1) the analysis used data from the FMWT in both axes, thereby guaranteeing some form of statistical significance; (2) the authors' failed to account for statistical uncertainty throughout their analyses; and (3) the admitted limitation of the analysis to abiotic factors only.

57. In addition, the recent discovery of relatively large smelt populations outside the areas that were the primary focus of Feyrer's work suggest that additional units of habitat may need to be added to the "s" shaped curve depicted in Figure B-17. This may shift the asymptotes of the curve slightly to the right, which could justify different kilometer requirements for the Fall X2 Action.

58. The Feyrer (2011) analysis of the relationship between the habitat index and abundance, as well as its precursor Feyrer (2007), did not utilize life cycle modeling, a methodologically superior way to quantitatively measure the impact of one environmental variable on a species population growth. The Feyrer (2008) manuscript employed a life cycle model to evaluate whether the habitat index was correlated with abundance, and concluded that the fall habitat index had a statistically significant impact on subsequent smelt abundance. This life cycle model was omitted from the published version of that manuscript, which became Feyrer (2011).

59. Plaintiffs presented the results of three subsequent life cycle modeling efforts. Although all three life cycle models employed different methods and data sets, all concluded that the position of X2 in the fall was not related to subsequent delta smelt abundance. All found different combinations of other factors drove abundance the following year. For example, the Maunder & Deriso model concluded that food abundance in spring, spring water temperature, and fall predation are important factors.

60. While each model, and in particular the Maunder & Deriso model that was the focus of Plaintiffs' presentation, have weaknesses, the overall trend in this research cannot be ignored. These three recent statistical approaches do not demonstrate a link between the position of X2 and delta smelt population growth.

61. The results of the three recent life cycle models find some corroboration in the work of Dr. Hanson, who found no relationship between Fall X2 and delta smelt survival in the fall, reproductive success the following year, or food availability.

62. Overall, the record reveals no support for a direct link between X2 and smelt abundance. There is some support for the BiOp's conclusion that the habitat index is correlated with smelt abundance, but the overall value of this finding is undermined by, among other things, the fact that it considers only abiotic habitat factors.

63. The record also reveals almost no biological support for the use of the 74 km and 81 km markers for the Fall X2 Action. While those locations correspond with existing monitoring stations, this is not biological support for requiring X2 to be positioned at these locations.

64. The locations also correspond with the asymptotes of the curve depicted in Figure B-17, suggesting that 74 km is the western edge beyond which the increase in habitat surface area begins to slow. This is not a reasonable biological justification for positioning X2 at 74 km either.

(a) First, while this curve generally reflects the geography of the delta and the fact that more habitat (measured by surface area) is available to the smelt as X2 moves westward, the exact position of the curve may need to be revised to account for additional habitat that appears to exist in the Cache Slough Complex. Moving the curve will change the location of the asymptotes.

(b) Second, Defendants do not explain why it is important to push X2 to the asymptote. Pushing it beyond 74 km may not achieve much, but this does not justify 74 km per se, as opposed to 75 km or 76 km. These are not just academic debates. The record indicates that every kilometer that X2 must be pushed to the west requires substantial amounts of water.

65. Finally, Defendants' suggestion that a 74 km requirement is justified because that represents the average of where X2 was located historically in wet years is not persuasive. The lack of a correlation between the position of X2 and the species' abundance suggests that other factors, besides the location of X2 are controlling the species' abundance today. Particularly in the absence of NEPA compliance, the costs of returning habitat to pre-Project conditions must be considered.[17]

[17] The ESA contains independent requirements that FWS evaluate whether Project operations are likely to (1) jeopardize the continued existence and recovery of the species and/or (2) adversely modify the species critical habitat. The adverse modification threshold is exceeded when the proposed action adversely affects the critical habitat's PCEs, or their management, in a manner likely to appreciably diminish or preclude the role of the designated critical habitat in the conservation of the species. Defendants argue that the Fall X2 Action should be upheld because it independently addresses adverse modification of critical habitat.

66. There is some record support, however, for not permitting X2 to shift east of the confluence of the Sacramento San Joaquin Rivers. It is undisputed that because of the geography of the estuary, if X2 is located upstream of the confluence, the habitat index decreases dramatically. The National Research Council's report reviewing the BiOp's RPA reported that the lowest smelt abundances all occurred when the habitat-area index was less than 6,000 hectares, which could mean that, while it is not the only cause of smelt population collapses, "reduced habitat area is a necessary condition for the worst population collapses." Ex. 12 at 53. Mr. Feyrer suggests that 80 km is a reasonable demarcation line above which the habitat is "a lot smaller." 7-29-11 Tr. at 125:23-126:9.

67. While the evidence for imposing any form of X2 control this fall is not strong, the imperiled status of the species cautions against entirely abandoning the Fall X2 Action.

68. In addition, the balance of the harms shifts dramatically if the Fall X2 Action is modified. As discussed above:

(a) Positioning X2 at kilometer 79, as opposed to kilometer 74, would have a likely water supply impact of 90,000 AF, reducing the impact by 210,000 AF in most water year types.

(b) Positioning X2 at kilometer 80, as compared to kilometer 74, would have a likely water supply impact of 80,000 AF, reducing the impact by 220,000 AF in most water year types.

But, the BiOp provides no independent critical habitat justification for requiring X2 to be maintained at 74 km in wet years.

(4) Public Interest.

69. It is undeniable that "that CVP water not pumped for diversion to the San Luis Unit flows through the Delta and out to the ocean." *San Luis & Delta-Mendota Water Auth. v. Locke*, 2010 W.L. 500455, *8 (E.D. Cal. Feb. 5, 2010). Preservation of such water for beneficial use "is in the public interest, and protection of human health, safety and the affected communities also serves the public interest." *Id*.

70. The public interest is also implicated in this case because the actions sought to be enjoined are ones that are taken by the United States government in its responsibility to implement and to enforce the ESA and NEPA, both of which are public interest statutes

VII. CONCLUSION

1. Plaintiffs have succeeded on the merits of their NEPA claim.

(a) NEPA requires that the responsible agency take a hard look at the environmental consequences of its actions, *Robertson v. Methow Valley Citizen's Counsel*, 490 U.S. 332, 350 (1989), obligating federal agencies to prepare an environmental impact statement ("EIS") for all "major federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C). This has not been done.

(b) Federal Defendants are required to evaluate the impact of the coordinated operations of the CVP and SWP, which constitutes

major federal action. The evidence establishes significant detrimental effects visited on the quality of the human environment by implementation of the BiOp's RPA Actions, which impose substantial restrictions on the water supply to California, solely to protect the delta smelt.

(c) Where required, an EIS is intended to disclose environmental effects of a proposed action and consider alternative courses of action. *Id.* Here, by erroneously by-passing NEPA, Federal Defendants completely abdicated their responsibility to consider reasonable alternatives to the Fall X2 Action that would not only protect the species, but would also minimize the adverse impact on humans and the human environment. The result is the issuance and implementation of a one-sided, single purpose RPA that inflicts drastic consequences on California water users, a situation NEPA prohibits.

2. Plaintiffs have also succeeded in part on the merits of their ESA challenge to the Fall X2 Action. This required de novo review of the available evidence to determine if equity permits injunctive relief:

(a) Plaintiffs have established the likelihood of irreparable harm. Imposition of the Fall X2 Action as it is currently planned will likely cause a negative 300,000 AF water supply impact to SWP contractors. This will impact long-term water supply reliability for both domestic and agricultural users. There

will be further impacts to groundwater recharge programs, with resulting direct environmental impacts to groundwater levels, groundwater quality, and energy use. Water supply reductions will cause economic impacts to farmers and may have socioeconomic impacts on agricultural communities, although the magnitude of any such economic and/or socioeconomic impacts given the "very good" water year in 2011 is unclear.

(b) The scientific evidence in support of imposing any Fall X2 action is manifestly equivocal. There is essentially no biological evidence to support the necessity of the specific 74 km requirement set to be triggered in this "wet" water year. The agencies still "don't get it." They continue to believe their "right to be mistaken" excuses precise and competent scientific analysis for actions they know will wreak havoc on California's water supply.

(c) In balancing hardships, the record arguably supports a requirement that X2 not be allowed to shift east of the confluence of the Sacramento San Joaquin Rivers. Positioning X2 at 80 km or 79 km accomplishes this goal. It also serves the population data collection objective of the Action's adaptive management plan. The competing balance is the continuing imperiled status of the protected species, which counsels against doing nothing at all.

(d) Limiting the Fall X2 Action will significantly reduce the water supply impact. Positioning X2 at kilometer 79 will have a probable water supply impact of 90,000 AF, reducing the impact by

210,000 AF. Positioning X2 at kilometer 80 would equate to a probable water supply impact of 80,000 AF, reducing the impact by 220,000 AF in most water year types.

(e) Balancing the imperiled status of the species, the equivocal and highly disputed support for the X2 action, and the even weaker and unjustified support for positioning X2 at 74 km, against the substantial and damaging water supply impact of doing so, limiting the X2 position to 80 km or 79 km achieves equity. Between these two targets, assuming the truth of Federal Defendants' scientific theories, positioning X2 at 79 km will provide substantial additional protection above and beyond an 80 km X2 for a relatively insignificant additional water cost of 10,000 AF. This is only 5 km further upstream than the BiOp's wet year requirements, yet imposes a far less draconian water supply cost.

The BiOp's Fall X2 Action shall be enjoined to prevent implementation of the 74 km X2 target. No Fall X2 action setting the X2 target west of 79 km shall be implemented. All other requirements of the Action, including the timing of the Action and the mechanisms for its measurement, shall remain unchanged.

Plaintiffs shall submit a form of injunction consistent with these findings of fact and conclusions of law within five days following electronic service.

SO ORDERED
Dated: August 31, 2011

/s/ Oliver W. Wanger
United States District Judge