UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF CALIFORNIA

HON. OLIVER W. WANGER, JUDGE

NATURAL RESOURCES DEFENSE COUNCIL, et al.,	)	
Plaintiffs,	)	No. 05-CV-1207-OWW
vs.	)	HEARING RE INTERIM REMEDIES
	)	DAY 5
DIRK KEMPTHORNE, Secretary, U.S. Department of the Interior, et al.	)	
Defendants.	)	

Fresno, California Wednesday, August 29, 2007

REPORTER'S TRANSCRIPT OF PROCEEDINGS

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Reported by: KAREN LOPEZ, Official Court Reporter

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Wednesday, August 29, 2007 Fresno, California
9:00 a.m.

THE COURT: We're going back on the record in NRDC versus Kempthorne.

Has the government completed its evidence?

MR. MAYSONETT: Your Honor, just a couple of housekeeping things.

Your Honor, we presented Ms. Goude last week, of course. We have submitted some declarations by Mr. Milligan, who is from the Bureau of Reclamation and our expert on what I'll call the water costs issues.

My understanding of the process we're following is that Mr. Milligan's declarations have been admitted into evidence subject to the provision that the plaintiffs or the parties have an opportunity to cross-examine Mr. Milligan.

We introduced two of Mr. Milligan's declarations into evidence last week. And at this time, I want to proffer a third which was submitted before the TRO proceedings and addresses the minimum pumping levels and the windings of the pumps and those issues, just for the completeness of the record.

THE COURT: Okay. So we can all be consistent, give us the numbers of the declarations that he has submitted that you've offered in evidence and then this third one.

MR. MAYSONETT: Just a moment, Your Honor.

Your Honor, Federal Defendants' Exhibit 1 is the July 9th declaration of Ronald Milligan. Federal Defendants' Exhibit 2 is the August 3rd declaration of Ronald Milligan. Federal Defendants' Exhibit 3 was one of Ms. Goude's declarations.

And the declaration we're proffering now, which will be Federal Defendants' 4, is docket number 335 and it is the May 31st, 2007 declaration of Ronald Milligan.

THE COURT: All right. Any objection to that declaration subject to the conditions we've previously established?

MS. POOLE: Good morning, Your Honor, Kate Poole for the plaintiff. Will be joining these proceedings after a short absence.

THE COURT: Good morning.

MS. POOLE: Your Honor, we do have some objections both to this new declaration as well as the previous two declarations that federal defendants have marked. We prepared those in written form and I can file those this morning with the Court.

THE COURT: All right.

MS. POOLE: And we have informed the federal defendants that in the interest of time and moving these proceedings along as expeditiously as possible, we have agreed to waive cross-examination of Mr. Milligan.

THE COURT: All right. Thank you very much. As soon as I receive the objections, I will rule on them. But I haven't received them yet. So I'll reserve my rulings. Mr. Wall.

MR. WALL: Yes, Your Honor. Thank you. That does raise an issue with respect to timing, which we'd like to discuss with the Court if we have an opportunity to do that.

THE COURT: Yes, we can do that. Let's see if Mr. Maysonett has anything else on his case and then we'll take up the issues of timing.

MR. WALL: Thank you, Your Honor.

MR. MAYSONETT: Your Honor, obviously I haven't seen the plaintiffs' objections either so I can't respond to them.

We do submit that it will be appropriate to take direct testimony from Mr. Milligan at some point if time allows given the expedited nature of the proceedings and the Court's previous rulings. So to the extent that's possible, we think it would be appropriate for Mr. Milligan to testify after Mr. Leahigh, who will address many of the similar issues.

THE COURT: All right. I will permit you to reserve calling Mr. Milligan. I understand you want the State to go first with Mr. Leahigh.

MR. MAYSONETT: Yes, Your Honor.

THE COURT: All right. Anything further at this

time?

MR. MAYSONETT: No, Your Honor.

THE COURT: All right. Mr. Wall.

MR. WALL: Thank you, Your Honor. We understood the Court to intend to conclude these proceedings this week. And --

THE COURT: That is my hope.

MR. WALL: We're acutely aware of the timing in this case. As the Court will recall, our expert's proposals for remedies to address the ESA violations would begin in September, at the beginning of September. And we hope to avoid a situation where the passage of time renders that proposal moot rather than a ruling of the Court.

We're also aware that counsel for the defendants or defendant intervenors have indicated that they have scheduling conflicts throughout almost the entire month of September.

And with that in mind, we're trying to figure out if there's a way that we can come up with an orderly plan to conclude these proceedings this week rather than having to resume them perhaps a month from now, which would significantly prejudice our client's interests.

THE COURT: I'm not inclined to continue these proceedings. And so we're not going to wait a month. My intent is to go through with the taking of evidence. And tell me what you think that requires, and I'll hear from the other

parties to determine whether it's feasible for us to expect we can finish this week.

MR. WALL: Your Honor, at this point we have presented our case in chief. And our principle involvement at this point would be through cross-examination of any witnesses that the defendants or defendant intervenors called. It's obviously a little difficult to predict exactly how long that cross-examination will take because we don't know how responsive the witnesses will be. But we certainly intend to focus our cross-examination on the issues that would be of most importance to the Court and move through it as expeditiously as we can.

Should time permit, we would also appreciate the opportunity to put on a very, very short, at least at this point, rebuttal case on some of the issues that the defendants might raise. And we have previously reserved --

THE COURT: You reserved that right. And time permitting, we're going to do the best we can to get all the evidence in in the time that has been prescribed.

MR. WALL: Your Honor, there's one other matter related to schedule, which is my understanding that there's a fisheries conference next week at which I expect all the biologists in this case are going to be attending. And that would make them unavailable next week.

THE COURT: Understood.

MR. WALL: Thank you, Your Honor.

MS. POOLE: Your Honor, may I clarify one issue?

THE COURT: Yes.

MS. POOLE: It was plaintiffs' understanding that federal defendants were simply going to submit Mr. Milligan's declarations into evidence and that they were not planning to present direct testimony. If he is given the opportunity for direct testimony, then we will need to rethink our decision about cross-examination.

THE COURT: All right.

MS. POOLE: Thank you.

THE COURT: That certainly is something we can revisit. I think that your description is accurate of what my understanding has been. My sense of this is that the Court has questions that relate to testimony that we've heard so far from experts that I don't know if there's anybody besides Mr. Milligan who can answer these questions.

And so depending upon what happens, the court may ask for him to testify relative to some questions that have arisen. But obviously, you will -- if that happens, everybody will be able to respond to that, to request either another witness or we need to do something else by way of cross-examination or responding to it, you'd be given that opportunity.

MS. POOLE: Thank you, Your Honor.

THE COURT: All right. Mr. Lee, anything changed on your part?

MR. LEE: Your Honor, I'd like to ask the United States a question because it might determine where we proceed from our standpoint.

THE COURT: Yes.

MR. LEE: And that is, as I understand, they have submitted their case in chief. That they may or may not do cross-examination and that they may submit a rebuttal witness at the end. I did not hear from them that they were planning to proffer any of their declarations that they have not otherwise introduced. I would just like confirmation from the plaintiff that that's the case.

THE COURT: The plaintiff or the government?

MR. LEE: The plaintiffs.

MS. POOLE: Your Honor, we have just received, right before this proceeding opened today, an additional set of declarations that some of the defendant intervenors intend to submit. And I'm not sure yet whether we have the full set. I've only spoken to counsel for the State Water Contractors and for Westlands. I have not yet had a chance to go through these and see what's in there. And I need to -- I would like to ask the Court for 24 hours to do that before we respond to Mr. Lee's question.

MR. LEE: The question I had was whether any of their

existing current declarants that they have not offered up as witnesses, whether they intend to proffer their declarations.

THE COURT: And I think, if I'm interpreting Ms. Poole's answer correctly, she has said that they're going to complete their review of the designations that intervenors have made in this case and that the government has made and by tomorrow we will know if there are going to be any. Is that correct?

MS. POOLE: That's correct.

MR. LEE: All right.

THE COURT: All right.

MR. LEE: Subject to what the plaintiffs have to say tomorrow with regard to declarants, we plan only a very limited submittal of declarations, Your Honor. The Deputy Director of the Department of Water Resources Jerry Johns submitted two declarations in these proceedings; one dated July 9th, 2007 and one dated August 3rd, 2007. The declarations are, as they all are in this case, fairly lengthy. In order to expedite this process, we've gone over those declarations and we intend to only introduce them for a limited purpose with a limited series of exhibits, which I would like to describe right now.

With regard to the July 9th, 2007 declaration of Jerry Johns, it would be our intention to introduce that declaration for the following paragraphs and exhibits.

Paragraph 1 through 4, which lay the foundation for Mr. Johns background. Paragraphs 32, 33 and 34 and Exhibits B and C. Those would be the only purposes for which we would be proffering the July 9th, 2007 declaration of Jerry Johns.

THE COURT: And do you have the document number for the docket?

MR. LEE: I do, Your Honor. The July, 2007 -- July 9th, 2007 declaration of Jerry Johns is document No. 399.

THE COURT: Thank you.

MR. LEE: The second declaration by Jerry Johns that we wish to introduce is document Number 432 and that is the August 3rd, 2007 declaration. We only intend, again, to expedite this process, to introduce that declaration for purposes of paragraph 11 and paragraph 12.

So again, just for clarity, we intend to introduce portions of the July 9th, 2007 declaration, paragraphs 1 through 4, paragraphs 32, 33 and 34 and Exhibits B and C. On the August 3rd, 2007 declaration, we only intend to introduce that declaration for purposes of paragraphs 11 and 12.

THE COURT: Thank you.

MR. LEE: Your Honor, depending upon what Ms. Poole says in terms of the declarations she intends to introduce, it is possible that we may introduce one other declaration. But I would like to wait until tomorrow to hear what Ms. Poole has to say before we make that decision.

THE COURT: Understood.

MR. LEE: One other -- one other matter, Your Honor. If we could get a determination as soon as possible whether plaintiffs intend to cross-examine Mr. Johns, that would be important. He is a Deputy Director of the Department of Water Resources, very difficult to schedule him for these matters and we would need to know as soon as possible.

THE COURT: Yes. What I understood Ms. Poole to say and Mr. Wall was that until they see your additional designations, if any, their present plan -- that was before you identified these paragraphs from Mr. Johns' declarations, they were not planning on cross-examining. But that may change tomorrow.

MR. LEE: Any clarification of the plaintiffs would be of assistance on this point.

MS. POOLE: That's correct, Your Honor. We are -- we were understanding that we were going to proceed on the oral testimony with the addition of these new declarations, we need to have a chance to review those to decide what our response will be. Of course, we, you know, would certainly prefer, as Mr. Wall explained, that these proceedings are able to wrap up this week and we will be conducting that review with that hope in mind. If the proceedings go on longer than that, then our position may change.

THE COURT: All right. Thank you.

Thank you, Mr. Lee.

Mr. Wilkinson.

MR. WILKINSON: Yes, Your Honor. We were mindful of the Court's concerns about trying to winnow down the additional declarations that would be proffered. We have done that, we believe. We have three declarations that we have provided to the plaintiffs and counsel for the other parties. One is the declaration of G. F. Duerig, it's docket number 451. It's the declaration of August 13th.

THE COURT: That last name was?

MR. WILKINSON: D-U-E-R-I-G. She is the general manager of the Alameda County Flood Control & Water Conservation District Zone 7. Again, that's docket number 451.

A second declaration is that of Joan Maher, M-A-H-E-R. It is docket number 455. It is also a declaration that was filed on August 13th. Mr. Maher is a manager with the Santa Clara Valley Water District and would talk about the various impacts within Santa Clara that could occur under the different matrices that have been discussed.

The final declaration, Your Honor, is the declaration of David Fullerton. It is docket number 447. Also filed on August 13th. Mr. Fullerton's declaration is a more technical declaration and it responds to a number of points that were made by Dr. Swanson. I'm not sure that the copy, though, that

was filed with the Court contained the attachments to it. I have a second copy here that I would offer to the Court that contains two articles that were intended to be attached before. I don't know, frankly, whether those were attached to the copy that came to the Court or not.

THE COURT: Has the declaration been submitted and marked for identification or is that what you just handed me?

MR. WILKINSON: Your Honor, we haven't marked it yet. Our intention is to have all three of the declarants here in court on Friday.

THE COURT: All right.

MR. WILKINSON: And we would proffer the declarations at that time. So it's not our intention to proffer it at this point since they are not here.

THE COURT: All right. Well, as I'm looking at this declaration, it has ten pages of testimony and then, although they're not marked as exhibits, what appear to be --

MR. WILKINSON: Attachments to the declaration.

THE COURT: Attachments.

MR. WILKINSON: Yes, that's correct. And we weren't sure whether the attachments arrived at the court with the copy that was filed or not.

THE COURT: Well, we'll have to find out. But what I'm going to propose that everybody do on these exhibits is that, even if they're already on file, that you file, as the

marking as exhibits to go into evidence. Just as you've handed me this, the physical exhibit. We're not going to refer to documents that are in the docket and call those exhibits.

MR. WILKINSON: We're happy to do that, Your Honor. And it would be our intention to do so on Friday, when we have the witnesses here.

THE COURT: I'm going to hand this back to the courtroom deputy.

MR. WILKINSON: Your Honor, insofar as timing is concerned. We also would be appreciative if we could finish this proceeding this week. We have one witness and that's Dr. Charles Hanson who we'll put on today. It's our hope that we could get Dr. Hanson on and off in a day. I think there are two other witnesses who were designated as the original six. And we've got three days of proceedings this week and it would be my hope that we could get through those three witnesses this week. And we intend to do everything we can to assist in that.

THE COURT: Thank you very much. Mr. O'Hanlon.

MR. O'HANLON: Good morning, Your Honor. We have four witnesses to offer by way of declaration and a total of five, five declarations.

The first declaration was filed -- it's by James Snow, it is document No. 410. It was filed on July 23rd.

The second declaration by James Snow is document No. 462 filed August 13th, 2007. Mr. Snow essentially takes the analyses done by Mr. Leahigh and translates that analyses into water shortages for Central Valley Project contractors south of the Delta.

The next declarant and the third declaration is by Russ Freeman, who is an employee of Westlands Water District. This is document No. 459. It was filed August 13th, 2007. Mr. Freeman then takes those reductions and deliveries and translates them into physical impacts within the Westlands service area.

The third witness and the fourth declaration is by William Harrison. This is document No. 463. It was filed on August 13th, 2007. Mr. Harrison is the manager of the Del Puerto Water District and he identifies the impacts, physical impacts within the Del Puerto Water District under the shortages calculated under the various proposals.

The last declaration is by Daniel Nelson. He's executive director of San Luis and Delta-Mendota Water Authority. This is document No. 460. This was filed on August 13th, 2007 and Mr. Nelson generally describes that similar impacts would be felt throughout other portions of the authority service area.

I have redacted -- taken these declarations and redacted those portions that don't refer to either the water

supply shortages or physical impacts within the service area and I did provide copies of those to Ms. Poole this morning.

Our intention would be to offer these on Friday and have those witnesses available if the plaintiffs indicate they would like to cross-examine these witnesses. And we would offer them at that time.

As far as an estimate of time, Your Honor, we have one witness who is identified to testify already in the proceeding, that's Dr. William Miller. My anticipation is that his direct exam would take about three hours. I don't know how long the cross-examination will require.

And like Mr. Wilkinson, it is my hope that we will be able to finish these proceedings on Friday.

THE COURT: All right. Mr. Buckley.

MR. BUCKLEY: Yes, Your Honor. The Farm Bureau does not have any declarations to submit in addition to those that are being submitted by other parties. However, I would like to take this occasion to briefly mention that we -- although we did defer opening, as Your Honor may recall, and we have deferred cross -examining because my client and Mr. O'Hanlon's clients, although not identical, share many interests.

THE COURT: Yes.

MR. BUCKLEY: We would like to reserve the right to make a closing argument, albeit a brief one. I'm not sure we'll have the time for that, but if we do, I would like to

reserve the right to do that.

THE COURT: All right. Thank you very much.

MR. LEE: Your Honor, Clifford Lee here. We failed to note that we also have one witness for direct examination that we've designated. We anticipate that witness will be brought in on Friday. It is John Leahigh. We did designate him in our August 16th designation. And we anticipate the direct to be two hours.

THE COURT: All right. Thank you very much. Ms. Jordan.

MS. McDONALD: Good morning, Your Honor, Jackie McDonald.

THE COURT: Ms. McDonald. Excuse me.

MS. McDONALD: For defendant intervenors GCID, et al. Based upon the previous ruling, we don't intend to proffer any additional evidence or engage in cross-examination so long as the ruling last week regarding the contracts is adhered to.

THE COURT: Thank you.

All right. Anything further then, Mr. Maysonett, for the federal defendants?

MR. MAYSONETT: No, Your Honor. Mr. Milligan is in the audience. My understanding is we are not going to be conducting any cross on him at this time. So with your permission, I'd just like to release him.

THE COURT: When would he return?

MR. MAYSONETT: He would return on Friday, Your Honor, to answer any questions from the Court as necessary.

THE COURT: My sense is that that's getting awfully ambitious. That, if I'm counting correctly, is about seven or eight potential witnesses for Friday. And that is the day that we wanted to hear arguments, if you're going to present them, and to try to be in a position to make a ruling in the case. And so that is, I think, overly ambitious. Would it be possible to have Mr. Milligan here tomorrow, on Thursday?

MR. MAYSONETT: If I could just consult with Mr. Milligan.

THE COURT: Yes.

MR. MAYSONETT: Your Honor, Mr. Milligan can be made available tomorrow.

THE COURT: All right. Thank you very much. Then if you wish to excuse him today, the plaintiffs have indicated that they're not going to cross-examine him today. And so --

MR. MAYSONETT: Thank you, Your Honor.

THE COURT: Mr. Lee, are you ready to proceed?

MR. LEE: Your Honor, we had discussed Mr. Leahigh's availability and I believe we mentioned he would not be available until Friday --

THE COURT: Until Friday.

MR. LEE: -- this week. I understand that the State Water Contractors are ready to go forward with Dr. Hanson.

THE COURT: All right. Well, then, Mr. Wilkinson, you may proceed.

MR. WILKINSON: Thank you, Your Honor. Earlier, Your Honor, we had reserved our opening statement and I'd like to provide a brief opening statement at this time.

THE COURT: Yes, you may.

MR. WILKINSON: Your Honor, this case is about the delta smelt. But, necessarily, is also about the 25 million Californians who rely on the waters of the Delta, homes and farms and at their places of business. To these people waters of the Delta are in many, many ways their life's blood.

The cases require that the remedy fashioned by the Court protect the delta smelt during the limited period before consultation on a new Biological Opinion is completed. But the cases also require the remedy be narrowly tailored.

And in addition, the cases provide that where there is more than one remedy available, the agencies and, we believe by extension, the Court has the discretion to adopt a remedy that will protect the smelt with the least residual damage to other competing interests. The cases also provide that a remedy should not be adopted if it will impair public health and safety.

The remedy that has been offered by the plaintiffs will likely protect the delta smelt. But as the Fish & Wildlife Service has already recognized and as Ms. Goude has

testified, it is overly protective. It is not narrowly tailored as the cases require.

In some instances, such as Dr. Swanson's action number ten, it proposes the release of hundreds of thousands of acre feet of water based on an article whose author expressly said that the extent to which the findings and conclusions of that article could be used for management purposes is unclear. And Dr. Swanson could not tell us the increased smelt abundance that would result from her action number ten and, as Ms. Goude described, the action, according to the Fish & Wildlife Service, is unnecessary to protect the smelt during the limited period before a new Biological Opinion is adopted.

Similarly, Your Honor, plaintiffs' actions five and seven are based upon the work of a scientist who has not made his papers available for review by his peers. This science is not publicly available as required by the Endangered Species Act.

As applied by Dr. Swanson, her measures five and seven would impose limitations on the projects that would severely restrict their ability to provide exports to the 25 million people who depend on them at times when the projects propose absolutely no threat to the delta smelt.

The action matrix provided by the Fish & Wildlife Service is more narrowly tailored than the actions authored by

Dr. Swanson. It avoids the extreme measures proposed by the plaintiffs and as described by Ms. Goude. It is based on biology, not economic or other considerations.

The impact of Dr. Swanson's proposed actions would be devastating to much of California. To meet the terms of her actions, exports to the 25 million people in the state who depend on the CVP and the State Water Project could be reduced by up to nearly 60 percent. More if Dr. Swanson's action ten is satisfied by further export reductions as the plaintiffs have suggested. Doing so will raise serious issues of the adequacy of water supplies for the human beings in the state over the next year.

By comparison, the Fish & Wildlife Service action matrix is more narrowly tailored, as I mentioned, in that it would reduce SWP and CVP exports by only -- I use that term advisedly -- by about two million acre feet over the next year.

We asked Dr. Charles Hanson if he believed that the Fish & Wildlife Service action matrix could be more narrowly tailored than Fish & Wildlife Service had done and do so without adversely affecting protections provided by that matrix to the smelt.

Dr. Hanson is a well respected fisheries biologist with more than 30 years of experience dealing with Delta fisheries issues. Unlike Dr. Swanson, Dr. Hanson serves on

the delta smelt recovery team. Unlike Dr. Swanson, Dr. Hanson served with Dr. Moyle on the initial Native Delta Fishes Recovery Team. He serves on the current Native Delta Fishes Recovery Team Today. And he also serves as well on the National Marine Fisheries Service's Central Valley Salmonid Recovery Team.

Because he has studied Delta fishery issues for years and is well versed in the works of Dr. Bennett and others, Dr. Hanson was able to undertake and complete the studies necessary to develop a suite of measures that he believes will provide protection to the delta smelt over the next year that is equivalent to the protection afforded by the Fish & Wildlife Services action matrix. And indeed to a significant degree, Dr. Hanson's proposed actions are based upon the Fish & Wildlife Service matrix.

The studies that are necessary to provide a scientific basis for Dr. Hanson's measures are already done. They use the same tools that are used by other scientists involved in the Delta. If they are implemented, the measures proposed by Dr. Hanson would also reduce combined CVP and SWP exports over the next year by a very substantial manner.

Dr. Hanson's proposed measures will protect the delta smelt. They begin a month earlier than the Fish & Wildlife Service action matrix and they use the action matrix itself as a protective layer. We believe they are more precisely

tailored than the action matrix of the service. Almost certainly they will be less likely to raise health and safety concerns.

Frankly, Your Honor, I believe all of us on the defense side of this case recognize that we must take extraordinary steps to protect the smelt from extinction during the limited period before a new Biological Opinion is adopted. We also recognize this is not a situation where business as usual is going to be acceptable. We understand that. But even the Ninth Circuit --

THE COURT: Yes. And I don't know whether it is prudent to mention this at this time, but in reviewing, without listening, to the testimony, but in reviewing Dr. Hanson's analysis and approach, it does seem -- and the thing that I also haven't heard from the bureau is that addressing the serious decline in abundance and determining and actually implementing measures to address that seems not to have been done. And no explanation is offered for why it hasn't been done.

And so I think we're at the point, so everybody knows what I'm thinking, that we can't rely on the agency to do it. They haven't done it. And we have a number of years of so-called conditions that have led to what is now described as critical.

I don't find, until you just told me this now, that

Dr. Hanson has ever even acknowledged that there is a critical condition. And so he's not helping you in any way.

MR. WILKINSON: Well --

THE COURT: And so you need to get on the same page.

MR. WILKINSON: Sure.

THE COURT: Or I don't need to listen to it. Because what I am focused on is the bureau is not saying anything about what the difference is between what the scientists see and say and then what the operators are doing in response and what they think they need to do and what relative effects there are going to be if they do it.

I know that sounds general, but yet, we can discuss that in the terms of actual numbers and descriptions of various measures, various causes for the shortage and then this continuing, I'm going to call it, chronic uncertainty about the population of the species.

But it appears to me that everybody's acknowledging that we can nonetheless go ahead and analyze the case without knowing the population of the species by doing comparative analysis of year to year trends.

And so I'm willing to accept that as mathematically reasonable, although it certainly is not the kind of certainty that the Court would like to have or would like to see. But I've heard, I think now, from almost every side that it just can't be done. I'm not sure why it can't, but it can't.

MR. WILKINSON: We have a somewhat different view in that regard, Your Honor. And I will sort of preview a little bit of that. We believe that it's possible to develop what we would call the order of magnitude abundance figure. I don't think anybody is going to be able to tell you that we can come up with an exact number of fish.

What we can do, we believe, using the tools that were developed long before this case began, back in the late '90s by Dr. Bennett, Dr. Hanson, Dr. Hymanson and others, we believe we can come up with what is called an order of magnitude level of abundance. We can tell whether the fish are there in the tens or the hundreds or the thousands. How many hundreds or how many thousands is a little more difficult.

But I think, as you will hear from Dr. Hanson, knowing the order of magnitude on this gives us some ability to tailor measures accordingly. And I think you'll also find, when Dr. Hanson testifies, that his tier one, tier two, tier three measures are going to protect the smelt regardless of the level of abundance because they tend to prevent take by the projects. That's the purpose behind them.

That does not mean that the smelt will necessarily continue on unmolested, so to speak, because there are simply lots and lots of different threats to the smelt. But the point here is that we are trying to develop measures that will

remove the projects as a cause of jeopardy of the smelt. And we think we will be able to show that.

THE COURT: And you can address his, for instance, 1.8 July estimate because, as has been discussed, what I understand is that that's when the year, if you will -- I don't know what it's called. I heard the term "recruitment," but I don't know what the population of young smelt is, but it's in ascendency. And so we know from the scientists, and there doesn't seem to be disagreement, that by the fall into the winter before spawning, that that's going to materially, materially decrease in terms of --

MR. WILKINSON: And it is.

THE COURT: -- of what survives.

MR. WILKINSON: And it is.

THE COURT: So that isn't a real helpful figure, it's a misleading figure quite frankly.

MR. WILKINSON: We didn't intend it to be misleading. What we intended was a snapshot in time, if you will.

THE COURT: The best case.

MR. WILKINSON: Not so much the best case, but what we believe the abundance indices indicated at that point. And then there were subsequent indices that were provided and they indicated a different level of population and a lower one. And so we can't tell you that the population was 1.8 and it remains at 1.8 million today. I don't think anybody can tell

you that.

What we are able to do is get an order of magnitude what we're dealing with. And at the time that the initial declaration of Dr. Hanson was filed on July 23rd, his best estimate was 1.8 million and we do intend to tell you how that was arrived at.

And similarly, when the subsequent Summer Townet Surveys have been performed, yes, the numbers have gone down and we will be able to relate to you what the projects' impact during those periods were. Quite small.

So there are other things going on in the Delta. And we're not here to develop a recovery plan, we are not here to develop a Biological Opinion. What we think we're here to do is to develop a plan of operation that will apply during the next year ordered by this Court to the projects to protect the smelt from being jeopardized by the projects during that period of time. I'd love to be able to tell this Court --

THE COURT: And the critical habitat.

MR. WILKINSON: -- we have a solution for everything, but we don't. I'm sorry?

THE COURT: And the critical habitat.

MR. WILKINSON: And the critical habitat. That's correct. That's correct.

THE COURT: All right.

MR. WILKINSON: We think, Your Honor, that the

measures we will suggest to the Court are more precisely tailored to the biological forces that are at work on the smelt and they will avoid some, but as I've just said, not by any means all of the impacts that would be created by the Fish & Wildlife Service matrix nor are they intended to try and resolve all of the threats to the smelt.

Again, our purpose here, we believe, is to ensure that the projects do not jeopardize the smelt or adversely affect its critical habitat and that's our point.

So we ask that the remedies that have been proposed by Dr. Hanson be given consideration by this court.

THE COURT: Thank you very much.

MR. WILKINSON: And with that I call Dr. Hanson to the stand.

THE COURT: Please come forward.

CHARLES HOWARD HANSON,

called as a witness on behalf of the State Water Contractors, having been first duly sworn, testified as follows:

THE CLERK: Please state your full name for the record and spell your last name.

THE WITNESS: My name is Charles Howard Hanson, H-A-N-S-O-N.

THE COURT: You may proceed, Mr. Wilkinson.

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DIRECT EXAMINATION

BY MR. WILKINSON:

Q. Dr. Hanson, would you please introduce yourself to the Court by stating your name and your place of employment.

A. Good morning. My name is Charles Hanson. I'm employed with Hanson Environmental, Inc. located at 132 Cottage Lane, Walnut Creek, California.

Q. Thank you, Dr. Hanson. I'd like to have you begin by providing an overview of your educational background, please.

A. My education includes a bachelor of science degree from the University of Washington College of Fisheries. A masters degree in fishery science from the University of Washington College of Fisheries. I studied environmental engineering at John Hopkins University. And I have a Ph.D. in fisheries and ecology from the University of California Davis.

Q. Dr. Hanson, would you please describe your experience in addressing fishery issues?

A. I've been working on fishery issues specifically within the Bay-Delta Estuary since 1976. I have over 30 years of experience in working on various fisheries issues, including the compilation and analysis of information collected by the Department of Fish & Game, Fish & Wildlife Service, National Marine Fisheries Service, DWR, the bureau, as well as extensive involvement in my own fishery investigations on behalf of various clients.

I have undertaken investigations that have led to the preparation of biological assessments and have contributed to Section 7 consultations. I have been extensively involved in various proceedings dealing with fishery issues as they pertain to project operations, upstream reservoir operations as well as within Delta operations, as well as a variety of other projects that have been undertaken within the Delta.

Q. Are you involved with the Delta Risk Management Strategies project, Dr. Hanson?

A. Yes.

Q. What is that?

A. The Delta Risk Management Strategies are -- sometimes referred to as DRMS, is a project that has been undertaken by the Department of Water Resources to evaluate the potential effects of the catastrophic levy failure on the habitat conditions, the infrastructure, economics and other aspects that would occur within the Delta in the event, for example, of a large earthquake. I was responsible within the DRMS project for directing the environmental assessment component of that analysis.

Q. Did you also have any involvement with what is called the Vernalis Adaptive Management Plan?

A. Yes. I was a co-author with Dr. Bruce Herbold from the USEPA in developing what's referred to as VAMP. It's a program that has two fundamental purposes. The first purpose

is to provide improved protection for juvenile Chinook salmon who migrate through the lower San Joaquin River through the Delta.

And the second is provide a framework for scientific investigations to further evaluate the potential influence of the Head of Old River Barrier, the magnitude of flow within the lower San Joaquin River and combined state and federal water project exports on the survival of juvenile Chinook salmon as they migrate downstream through the Delta.

Q. Do you hold any professional certifications, Dr. Hanson?

A. I do. I'm certified as a professional fishery biologist by the American Fishery Society.

Q. And have you had any experience dealing specifically with Endangered Species Act issues in the Bay-Delta Estuary?

A. I have -- with a number of fish species that have been recently listed for protection under both the California and the Federal Endangered Species Act, I have been involved in the compilation and analysis of data on the abundance and geographic distribution of various species as they relate to various project proposals, both existing and proposed.

I have also participated in the preparation of biological assessments that outline and describe the potential effects of various projects on listed species, including delta smelt and salmonids. I participated in Section 7 consultations under the Endangered Species Act.

And I've also been responsible for preparation of habitat conservation plans, including the preparation of an HCP for steelhead within Arroyo Grande Creek in San Luis Obispo County.

I'm responsible for the preparation of multispecies Habitat Conservation Plan, including Chinook salmon and steelhead within a program called the Fisheries & Aquatic Habitat Collaborative Effort referred to as FAHCE, which resolves water right settlement dispute with the Santa Clara Valley Water District with respect to operations of upstream reservoirs and releases on fisheries habitat within the Guadalupe River, Coyote Creek and Stevens Creek, which are tributary to the southern portion of San Francisco Bay.

Q. Are you also involved in something called BDCP, Dr. Hanson?

A. I am. BDCP is the current Bay Delta Conservation Planning effort. It's a collaborative effort that includes participation by various water agencies, both state and federal, it includes participation by state and federal resource agencies as well as the environmental community.

And it's designed as a forum to be able to identify appropriate conservation strategies, which may involve consideration of both physical habitat as well as water conveyance facilities within the Delta that would provide a long-term plan for the protection and enhancement of habitat

conditions for a variety of aquatic resources, including delta smelt, Sacramento split-tail, Chinook salmon, steelhead, longfin smelt and others. I'm responsible for the aquatic component of that plan.

Q. Do you participate on any technical advisory committee's relating to fishery issues?

A. I do. I am a member of the current US Fish & Wildlife Service Delta Smelt Recovery Team. I also served previously on the US Fish & Wildlife Service Native Delta Fish Recovery Team. I am a member of the National Marine Fisheries Service Central Valley Salmonid Recovery team. I've also participated, since its inception, on the Mokelumne River Technical Advisory Committee, the American River Technical Advisory Committee, the Santa Ynez Technical Advisory Committee, the San Joaquin Technical Advisory Committee. And I serve on a peer review panel dealing with the issues of the effects of water temperatures on salmonids within the San Joaquin River.

Q. As part of your professional activities, Dr. Hanson, have you had any opportunities to present results of your research, of your findings to your peers?

A. I have. Over the course of my career, I've made presentations at a number of public forums and conferences and workshops. Those include workshops that have been hosted by the CALFED program. Workshops such as the annual Interagency

Ecological Program or IEP conference in Asilomar.

I've also participated in regional and national conferences of various organizations, including the National Marine Fisheries Service. In early September I'll be making a presentation to the National Conference of the American Fisheries Society with respect to the San Joaquin River restoration issues.

Q. Have you prepared any peer review journal articles for publication?

A. I have. I've published peer review journal articles in a number of different publications, including the Transactions of the American Fisheries Society, the Journal of Ecology, the Journal of Wildlife Management, San Francisco Estuary & Watershed Science and several others.

Q. Have you also designed or managed any fisheries sampling programs within the Bay-Delta Estuary?

A. I have. I've been involved in conducting fishery sampling programs since 1976, when I came to California to work with the California Department of Fish & Game investigating salmonids and other resident fish within the San Francisco Bay-Delta Estuary as it related to evaluating potential impacts of water project operations on those species.

I've also been responsible for conducting delta smelt studies within Clifton Court Forebay as a comparative analysis with similar sampling being conducted by the Department of

Water Resources within Old and Middle River. I've conducted studies within Clifton Court Forebay on the vulnerability of juvenile steelhead to predation mortality.

I was also involved with DWR on a study to investigate changes in the geographic distribution of delta smelt with respect to changes in SWP and CVP export operations.

I conducted a study in 2006 that was a cooperative study with the California Department of Fish & Game using their 20 millimeter delta smelt survey techniques to allow us to develop a comparison between the densities of delta smelt in the main channel areas of Suisun Bay, where Fish & Game typically samples, with our augmented sample in the shallow water areas adjacent to the channel sholes, specifically in the vicinity of both the Pittsburg and Contra Costa Power Plants to be able to provide some additional information on the ability to extrapolate data from the Fish & Game 20 millimeter survey to the power plant intake structures.

I've also been involved in conducting the entrainment, impingement and thermal effect studies, investigating the potential impacts of power plant cooling water system operations, specifically at Contra Costa and Pittsburg Power Plants located in the Delta on a variety of resident and migratory fish species, including striped bass, which was our target species, but also giving consideration to

other resident and migratory fish, including Chinook salmon, steelhead and delta smelt.

Q. Dr. Hanson, have you participated previously as an expert witness or submitted expert declarations in any prior legal proceedings?

A. I have. I participated as an expert witness on fisheries issues and the effects of water temperature on various life history stages of salmonids in the American River proceedings with the East Bay Municipal Utility District in Sacramento County.

I also have submitted and participated in presentations to the State Water Resources Control Board regarding a variety of water right related issues that pertain to water project operations, water quality and their impacts on resident and migratory fish within the Bay-Delta Estuary.

I have participated through providing declarations in the CVPIA litigation. And I was designated as an expert fishery witness with respect to the San Joaquin River Fishery Restoration Program Downstream of Friant Dam in the NRDC versus Friant litigation.

MR. WILKINSON: Your Honor, at this time I would move that Dr. Charles Hanson be accepted as an expert witness on the subject of fisheries biology.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: The Court finds that Dr. Hanson is qualified by education, experience and training to render opinions in the field of fisheries biology.

MR. WILKINSON: Thank you, Your Honor.

Q. Dr. Hanson, I would ask you first, have you produced any declarations in this case?

A. Yes, I have. I produced declarations dated July 23rd, 2007, which provided information and some of my views with respect to the agency action matrix and some proposed refinements to that matrix as well as the declaration dated August 13th that provided additional updated information.

Q. I've handed you two documents, Dr. Hanson. Do you recognize those?

A. Yes, I do.

Q. Looking at the first of those, is that -- we'll mark that as State Water Contractors next in order, which I believe would be Exhibit F.

THE CLERK: Correct.

(Defendants' Exhibit SWC F was marked for identification.)

BY MR. WILKINSON:

Q. Is that your declaration, Dr. Hanson, of July 23rd, 2007?

A. Yes, it is.

Q. And the second document, which I would like to have marked as State Water Contractors Exhibit G.

(Defendants' Exhibit SWC G was marked for identification.)

BY MR. WILKINSON:

Q. Do you recognize that document, Dr. Hanson?

A. Yes, I do. That was my second declaration.

Q. That was produced and filed on August 13th, 2007?

A. Correct.

Q. Dr. Hanson, are you familiar with the delta smelt action matrix developed --

THE COURT: Are you moving the introduction of these exhibits at this time?

MR. WILKINSON: Not at this point, Your Honor. I think I'll hold off on that until a bit later, if that's all right. In fact, I was thinking in terms of moving this along more quickly, would it be preferred that I hold these and move them all in one go at the end or would you rather have it done item by item?

THE COURT: For the Court, it's always better to do it as they're presented unless there's some reason to wait.

MR. WILKINSON: All right. I'm going to hold these just for a moment if that's all right.

THE COURT: You may.

BY MR. WILKINSON:

Q. Dr. Hanson, my question is: Are you familiar with the delta smelt action matrix that was developed by the Fish &

Wildlife Service?
A. Yes, I am.
Q. Were you asked to undertake an evaluation of that matrix in terms of whether operation of the state project and Central Valley Project in accordance with the matrix would avoid jeopardy to the continued existence of the delta smelt until a new Biological Opinion is issued?
A. Yes. I was asked by the State Water Contractors to perform that analysis.
Q. Would you describe generally how you undertook your evaluation of the matrix?
A. The assessment that we did of the matrix started out with, first of all, understanding the basic components that were being presented within the context of the matrix; understanding what some of the scientific information was used to develop the measures that were presented; and to understand better what those measures were intended to do in terms of providing either improved habitat conditions or reduced vulnerability of delta smelt to direct entrainment of -- at the SWP and CVP export facilities.

The next step in our assessment was to exercise various modeling tools that we had at our discretion. Those include the CALSIM II modeling as well as the DSM II and the particle tracking modeling to be able to further investigate how the various actions that were embodied in the matrix may

affect the hydrodynamic conditions within the estuary that we think were important in terms of the vulnerability of delta smelt to export related losses. And to use that improved understanding of what those changes might be, in combination with information on the geographic distribution of delta smelt, as well as this order of magnitude population estimate that we had developed, to be able to better assess what we thought about the ability of the action matrix actions to be able to reduce and avoid adverse impacts and thereby provide protection for the delta smelt and avoid jeopardy.

Q. As a result of your evaluation, Dr. Hanson, did you reach any conclusion about whether operation of the two projects in accordance with the action matrix would jeopardize the smelt?

A. We did.

Q. What was that conclusion?

A. The conclusion was that the elements that were contained in the action matrix, which were largely focused on reducing reverse flows in Old and Middle River would be expected to improve habitat conditions within the central and southern portions of the Delta and that they would be able to reduce the potential vulnerability of sub-adult and pre-spawning adult delta smelt based on our best understanding of those relationships.

The other factor that we took into consideration was that the period that the interim actions would be in place was

relatively short, estimated to be 12 to 18 months before a new Biological Opinion would be prepared and authorized by the Fish & Wildlife Service.

And one of the features of the matrix that I found particularly appealing was the ability of the matrix to respond to new information that becomes available for many of the surveys that are underway, such as the 20 millimeter delta smelt survey, the Summer Townet Survey, information on turbidity and hydrologic conditions, result of salvage monitoring as well as these population estimates, to be able to respond to conditions that were occurring within the Delta over that interim period to provide a range of levels of protection that were responsive to the anticipated level of risk.

So within the context of looking at the range of actions, which in the matrix go from zero reverse flow to minus 4,000 or so, it gives you the ability to use all of these various pieces of information to be able to make appropriate adjustments within that range to provide an adequate level of protection.

Based on those various factors, I concluded that the matrix would provide an adequate level of protection to avoid jeopardy.

Q. Did you also make any conclusion or reach any conclusion, Dr. Hanson, about the ability of the matrix to prevent the

projects from adversely affecting critical habitat to the smelt?

A. We did. In terms of looking at the operations of the project and their affects on critical habitat, we considered several things. One is that an important component of critical habitat for delta smelt is the location of the low salinity regime, the low salinity area that is defined by the two-part per thousand isohaline during the spring months. Typically extending from February through May.

And that is an acknowledged action that we think benefits not only delta smelt, but food supplies and a variety of other species. It was an action that was identified during the course of the D 1641 hearings, it's an action that's required for the protection and enhancement of fishery habitat.

And one of the questions we asked is there anything in the matrix that would adversely affect the ability to achieve those habitat conditions? And the answer to that was no.

The second thing we looked at is would there be a change in the hydrodynamic conditions occurring within the central Delta, Old and Middle River areas, for example, that would respond to the management actions contained within the matrix. And the results of the particle tracking modeling and the results of some of the other modeling indicated that there

would be a change that would be anticipated to be more favorable for delta smelt and other species within that area.

Q. Dr. Hanson, you mentioned that you made an estimate of the order of magnitude of delta smelt abundance as part of your evaluation of the matrix. What do you mean by "an order of magnitude estimate"?

A. Well, there's been, I think, a lot of confusion in the prior testimony about how we intended to use our population estimates. And in doing our estimates, we felt that it was useful and informative if we had some type of a population level context to use as a sounding board, to look at how we make decisions within the context of these matrices.

And so we recognized, in preparing these estimates, that there were a number of assumptions that needed to be made, there was certainly uncertainty in how these estimates accurately project true population levels. And we recognized and acknowledged that.

But the real value of these estimates, I think, is in looking at whether or not we have 10,000 delta smelt inhabiting the system, 100,000, a million or ten million. Because that informs our decisions in two ways. It informs our decisions about the sensitivity of our various triggers, the kinds of monitoring and the way we approach those triggers for implementing various actions. And I think it also serves as an important backstop to be able to say within these

various ranges, that are proposed as part of the action matrix, which end of that matrix would be most appropriate in terms of providing the level of protection necessary to avoid adverse consequences to the delta smelt.

Q. You said "which end of the matrix," did you mean which end of the range?

A. Which end of the range. So, for example, if we had population estimates that suggested that there were millions of delta smelt inhabiting the Delta. Then when we exercised a management decision with respect to the initial implementation of the reverse flow criteria within Old or Middle River, we might, as a first step, exercise the option at the minus 4,000 level. That being a little less protective.

If, on the other hand, our order of population estimate suggested that there's only 100,000 delta smelt inhabiting the Delta, the level of protection and the sensitivity of the triggers would need to be increased. And that would include that exercising discretion in how you select the appropriate level of operations for that Old and Middle River criteria should favor the lower end of the range.

Q. Dr. Hanson, have you previously attempted to calculate the population abundance of delta smelt independently of and prior to this litigation?

A. I have.

Q. Where did you do that?

A. Well, as part of our ongoing collaborative investigations, working with Fish & Game, Fish & Wildlife Service, academic investigators and others, we've been debating how to calculate population estimates. Not only for delta smelt, but for other fish species, for over a decade.

I began the early efforts as part of my work with the Pacific Gas & Electric Company power plant impact assessments, focusing at that time on striped bass population abundance. And we struggled with making those estimates. That began in the 1980s.

That effort continued in the early to mid 1990s and extending through the late 1990s. A variety of us, including Bruce Herbold, or Dr. Herbold from EPA, Dr. Wim Kimmerer, K-I-M-M-E-R-E-R, from San Francisco State University, Dr. Bill Bennett, Dr. Rick Sitts, myself and others have all been debating about how best to make these kind of population estimates, how to address the various assumptions that are inherent in these estimates, what kind of data are most suited for making those estimates and how best to proceed.

Q. Were you ever commissioned to independently calculate delta smelt abundance prior to this case?

A. I was.

Q. When was that?

A. That was in the late 1990s. I was asked by the State Water Contractors to participate in a series of discussions

and meetings and exercises to try and develop population level estimates for delta smelt.

Q. At the time you were commissioned in 1999 to calculate the population abundance of the delta smelt, Dr. Hanson, did you develop a methodology to make that calculation?

A. We had been developing a methodology throughout this time period. We had a lot of discussions with the Department of Water Resources staff, the Fish & Wildlife, the Department of Fish & Game staff and others about how best to use the existing information and what an appropriate method or the best method available would be. And yes, I did develop and use that fundamental framework for developing population estimates in the late 1990s.

Q. Did your work in calculating an order of magnitude of delta smelt abundance in this case grow out of your earlier work?

A. It did. The earlier work that we were doing back in the late 1990s led to the development of similar population level estimates that I included as part of the DRMS program. In that case, what we wanted was to get some sort of magnitude of estimate, if there was a major earthquake and a levy failure and delta smelt and other fish were lost as a result of entrainment on to a flooded island, what would that mean in terms of impacts to the overall population of smelt inhabiting the Delta?

And so a lot of what we've done originated and was refined as part of the DRMS project. And then because that was available and I knew it and we had the information readily at hand, we used that same method and protocol in preparing the order of magnitude estimates that were presented in my declaration.

Q. Has that method or protocol ever been peer reviewed?

A. That method has been peer reviewed in two contexts. One is that, as I mentioned, we've had a lot of technical debate over the years about these assumptions and these methods. That serves as an informal peer review.

The method that I have used is virtually identical to the method that Dr. Bill Bennett used in estimating delta smelt abundance and published in his 2005 paper. It's also comparable to the estimates that Dr. Wim Kimmerer used a similar approach for calculating striped bass juvenile abundance. Those have both been formally peer reviewed.

Q. And where was Dr. Bennett's use of this methodology peer reviewed?

A. It was peer reviewed with his submission of his delta smelt white paper for publication in the San Francisco Estuary & Watershed Science online journal.

Q. And that paper that Dr. Bennett produced, using this methodology, was published; was it not?

A. Yes, it was.

Q. And is the publication San Francisco Estuary & Watershed Science considered by fisheries biologists to be reputable scientific journal?
A. It is a reputable journal. It focuses primarily on issues of relevance with respect to the Bay-Delta region as opposed to a national perspective. But yes, it is a reputable and well regarded journal.
Q. Dr. Hanson, is the methodology that you used to calculate smelt abundance in this case a method that is used by other fish biologists to calculate abundance of resident fish?
A. Yes, as I mentioned, it's the same basic method that Dr. Bill Bennett used in calculating delta smelt abundance for the 20 millimeter survey data, for the Summer Townet Survey data and for the Fall Midwater Trawl Survey data.
Q. Are you aware of any other methodology that could be used to attempt to estimate the order of magnitude of the smelt population?
A. Well, over the years we've explored a variety of different approaches. And in doing so, we consider, you know, what the various methods require, how they're employed, the kind of data that are used. And there are several alternative methods that have been used in estimating population abundance for other fish species. For example, one of the classic techniques is a mark recapture program.
Q. What's involved with that kind of program?

A. That type of a program, you mark with typically an external mark, a fin clip or some other identification of a known number of the target species, in this case it would be delta smelt. Those marked fish are then released into the habitat and commingled with the wild population or unmarked portion of the population.

And then through subsequent resampling, looking at the proportion of your marked fish that are recaptured relative to the proportion of unmarked fish, you can calculate a population estimate.

Q. Can that method be used with delta smelt?

A. We didn't feel that it could be. The reasons are several fold. One is that our readily available source of delta smelt is through the captive breeding program conducted by the University of California. They produce delta smelt at the State Water Project facility for use in experimental investigations. But as part of their permit, the US Fish & Wildlife Service prohibits that any of those captive smelt be released into the wild.

The second -- and therefore, in order to get fish to mark, we would need to do some type of fishery sampling in the Delta. And fishery sampling for delta smelt in the Delta is difficult to perform without incurring elevated levels of stress and mortality on the population.

In addition, once you've collected these delta smelt,

you then need to handle them, mark them and subsequently release them. All assuming that they're now responding and surviving as if none of those traumas had occurred. Delta smelt are an extremely sensitive fish species, they have high mortality rates when handled, and we didn't feel that that was an appropriate technique for application in this instance.

Q. Is the counting of fish carcasses another way of determining fish population?

A. It is for salmon. And salmon have the attribute that after they spawn, they die. And therefore, you can go in to the areas adjacent to the spawning habitat, you can mark those carcasses, they're typically restricted in a relatively small area adjacent to the spawning habitat. And again, through marked recapture types of estimates, you can calculate the numbers of total spawning Chinook salmon in this instance.

Q. Is that a method that's feasible to use with delta smelt?

A. It really isn't. Even though delta smelt are a one-year species for the most part. And we think that they all die or majority die after spawning, delta smelt are relatively small. They're three or four inches in length. They're translucent for the most part. The Delta is extremely large. It's extremely turbid and frankly we don't know where delta smelt spawn within the estuary. And so our ability to go out and count or even find carcasses and make representative estimates on a mark recapture basis is just impractical.

Q. If we can't use mark recapture, Dr. Hanson, and we can't use carcass counting, is there any other method you're aware of for calculating the order of magnitude of smelt abundance than the one you used?

A. No. We think that using the Department of Fish & Game fisheries sampling information is the best information available for making these estimates. A variety of investigators, including Dr. Ken Newman from the US Fish & Wildlife Service, are further investigating not the data sources so much but how better to characterize the variability and how better to characterize and address some of the assumptions.

But fundamentally, we have not identified a more appropriate or better approach for doing these order of magnitude estimates.

Q. Dr. Hanson, I'd like to show you --

THE COURT: Is that because the field has been exhausted and there are no other tests or calculations or fora that can be brought to bear on this?

THE WITNESS: No, it's the surveys that we conduct, that the Department of Fish & Game conducts, provide really good information almost at a two-week interval on the abundances measured by density and the distribution of delta smelt throughout their habitat. There are a number of refinements, however, that could be made to that sampling

program that would provide better reliability for making these estimates.

THE COURT: What about this question of the vertical, if you will, representativeness of the samples where at least, as I've understood it, what Dr. Swanson has been saying, that below ten and a half feet, that you don't have an even distribution and that the smelt are varied.

THE WITNESS: And for some of the surveys, such as the Summer Townet Survey, that net samples the upper part of the water column. And therefore, information on the vertical distribution is one of the assumptions that needs to be addressed.

For the 20 millimeter survey, however, the Department of Fish & Game uses an oblique tow and the oblique tow, they drop the net all the way back to the bottom and they sample for about three minutes on the bottom, they raise the net to the mid portion of the water column, sample for three minutes, then they raise it to the surface and sample for three minutes. So over the course of that ten-minute tow, they have sampled representative water from all three ranges of the water depth and therefore that particular extrapolation or assumption is not required for the 20 millimeter survey. But it is an issue with respect to the summer townet and the Fall Midwater Trawl Surveys.

THE COURT: And on the distributions, as to its

representativeness, again, I've understood Dr. Swanson's testimony to be that the fish aren't uniform, they're not in clear intervals where they can be identified throughout the Delta. There are obviously areas where they concentrate and areas where they may not be present.

THE WITNESS: And there's no question that there is heterogeneity to these distributions. There are aggregations in fish that occur more densely in some areas than in others. And to be able to address that, what we've done is several things.

One is we've tried to divide the Delta into manageable regions so that although we're extrapolating, we're extrapolating within a more confined volume of water. And that helps reduce the influence of that heterogeneity. To the extent that we have -- and we have a map that shows the distribution of those sampling sites relative to our regions.

Many of the regions have multiple sampling sites within the region. And in those areas that have multiple sampling sites, we've used the average density for all of those sites to represent the density within that given portion of the water volume. But there's no question, we, by necessity, have made the assumption that there is a uniformity of distribution.

One of the things that we've recommended in my declaration in August is that it would be extremely helpful if

the Department of Fish & Game were to go out and conduct an experimental investigation that gave us better information on the vertical distribution and the spacial heterogeneity within these areas. There's a lot of interest in generating these kinds of estimates for delta smelt. That additional sampling would help us dramatically improve our estimates.

The downside to that sampling is that, as a result of doing those surveys, there would be incidental take of delta smelt. And at these extremely low population abundance levels, there's a serious decision to be made as to whether or not the value of the information from the sampling and the improvements in our estimates outweigh the risk and the vulnerability of collecting and killing additional delta smelt. And to date, the Department of Fish & Game, and I think appropriately so, has said that we feel that this population is at such low levels that we're not willing to take that risk.

THE COURT: And just an estimate, what quantity are we talking about in terms of the take to conduct these kinds of studies?

THE WITNESS: Estimates to conduct these kinds of studies in the past, I would have said would have resulted in the potential collection of as many as thousands of delta smelt. Under the low population levels that we currently have and based on the low numbers of fish that have been reported

in the Fish & Game surveys in the past several years, we're probably talking about an additional take that's in the hundreds of fish.

THE COURT: And you agree with Fish & Game's decision not to conduct these kinds of samples because of the threat to the species?

THE WITNESS: I have proposed several fishery sampling programs that were to be implemented in 2007 that would have provided information to address specific issues of interest, for example, to the National Marine Fisheries Service.

THE COURT: Let's do one thing. Before you give me that, answer my question.

THE WITNESS: No, I will.

THE COURT: If you would, please.

THE WITNESS: I'm getting there.

THE COURT: You're getting there?

THE WITNESS: I am.

THE COURT: All right.

THE WITNESS: The Department of Fish & Game -- when I submitted those proposals, I indicated that, you know, I would have some additional delta smelt take as a result of that sampling. The proposals were endorsed by the National Marine Fisheries Service, my clients, everything was in place and the Department of Fish & Game denied my permits. And I agreed

with that decision. And that's a reflection of the low numbers of delta smelt that we currently have and the precautionary nature that Fish & Game is taking.

THE COURT: And you answered -- anticipated my next question, which is that you agreed with that decision not to issue permits.

THE WITNESS: I did.

THE COURT: And do those conditions still pertain as of today?

THE WITNESS: As of today, if anything, those conditions are worse, Your Honor.

THE COURT: Okay. Thank you. You may continue.

BY MR. WILKINSON:

Q. Dr. Hanson, I've put on the easel a map, which I would like to have marked as State Water Contractors Exhibit H.

(Defendants' Exhibit SWC H was marked for. identification.)

BY MR. WILKINSON:

Q. Do you recognize that map? We also have it, Your Honor, on the Elmo here. If you can't see the map.

THE COURT: Yes.

BY MR. WILKINSON:

Q. Dr. Hanson, do you recognize Exhibit H?

A. Yes, I do. This was a map that we originally prepared and was included in the DRMS technical memorandum regarding the

environmental assessment of levy failures. It was subsequently used as one of the exhibits in my earlier declaration.

Q. And you prepared this map, did you?

A. I had this map prepared for me.

Q. It was under your direction and control?

A. Yes, it was.

Q. Using the map, Dr. Hanson, would you describe how you undertook your evaluation of the order of magnitude abundance of delta smelt?

A. The approach that we used had several steps. The first was that we needed to identify various regional areas within the Delta estuary that would be used for our estimations. And those areas are shown on this exhibit, for example, as area A3 being in the far northern portion of the Delta. Area A5 being in the lower San Joaquin River. Area A2-B being in the Suisun Bay area.

So we divvied the Delta up into this geographic regions trying, to the extent we could, to have multiple Fish & Game sampling sites within the various regions of most interests.

Q. Let me ask before you continue. Have these geographic regions been developed specifically for this litigation or were they some prior effort to divide the Delta into regions?

A. These were developed specifically as part of our DRMS

investigations. And they were done over the past year and a half or so.

Q. Please continue.

A. Once we've identified the various geographic regions, then the next question that arises is how much water is contained within those regions. And in order to estimate the volume of water within each region, we use mathemetric information, information on the water depth from various surveys conducted by USGS and the Department of Water Resources. We then imported that detailed mathemetric information into a GIS system. We use that to calculate the surface area and the volume of aquatic habitat within each region. And then we summed over those various portions of the channel within a region to calculate the volume of water within each of the geographic regions depicted on the exhibit.

The next step in --

THE COURT: Before you go to the next step.

THE WITNESS: Yes.

THE COURT: Describe the location of some of these geographic regions. Was there any criteria that you were applying in choosing or is it just geographic, that they're in different places where the conditions are different?

THE WITNESS: There's several different ways to identify these geographic regions. Ours was primarily based on geography and it was primarily based on the distribution of

Department of Fish & Game sampling sites that would provide us data.

Alternative methods have been employed by Bill Bennett and others that have used different geographic regions, they cover the same extent, but they divvy the Delta up into different areas so that there's a different weighting factor based on the volume, for example, of habitat in the lower Sacramento River versus the lower San Joaquin based on habitat differences. In my scenario, we did not do that.

THE COURT: And the reason?

THE WITNESS: The reason was that that when we originally developed this, this was the approach that we had originally adopted. And in the course of reviewing this, we asked a variety of experts for their opinions about this geographic distribution. And they included Dr. Wim Kimmerer, Dr. Moyle and others. And we had an extensive discussion about the geographic nature of these and how best to divvy these up.

They basically said there are some alternative ways to do this. We think those alternative ways might better be explored to see what difference they make in terms of the population estimates. But frankly, given the short period of time, we didn't have the opportunity to conduct those. That, I feel, is one of the areas of refinement that folks like Dr. Ken Newman and others will be exploring.

THE COURT: And in terms of, if you will, the scientific reliability of the difference in the two systems identifying the areas to be analyzed, is the difference in terms of its quantitative effect significant?

THE WITNESS: The question of whether it's significant depends on how you plan to use the data and what resolution you're looking for. We never intended our estimates to have an adequate resolution to be able to detect a difference in the population estimate of, say, 100,000 versus 101,000. Or 100,000 versus 110,000. If you're looking for that degree of confidence in resolution, then there are lots of refinements that would need to be made to this approach in order to achieve that. If, on the other hand, your question is do we think we have 100,000 delta smelt or a million, then I think this question is less relevant.

THE COURT: I think the question is are these identified areas and this methodology sufficient to achieve the goal of protection of the species and its habitat for analytical purposes in deciding what you're going to do.

THE WITNESS: I think for that purpose, they are. Because they provide us enough information on the context of the population level to be able to say what types and what magnitude of thresholds would be most appropriate, what range of actions we should be working in. The way I've approached these estimates, Your Honor, was never intended to make

judgments as to whether or not delta smelt should be delisted, whether or not its population abundance has increased or decreased in the context of trends over years.

And I think there's been a misunderstanding that a population estimate of a million fish may sound like a lot to a layperson, in the context of a pelagic species like delta smelt, a million larval and early juvenile fish is still a remarkably low number.

THE COURT: Thank you. You may continue.

BY MR. WILKINSON:

Q. Dr. Hanson, you've mentioned a number of assumptions that you've made in the course of developing your order of magnitude abundance estimate. Did you discuss the assumptions that you've described with other scientists?

A. Yes. We've been discussing these assumptions collaboratively for years.

Q. So you discussed the assumption with these scientists about even distribution throughout the region?

A. I have. And some scientists have tried to stratify their estimates to account for vertical variation in the distribution. For example, I believe that Dr. Miller's estimates using the summer townet use only the top six feet of the water column when he's estimating his densities and his volumes.

Q. Is there a reason, Dr. Hanson, why you did not make that

assumption?

A. I didn't make that assumption for two reasons. Well, three actually. One is that we don't have information that gives us a high degree of resolution about the vertical distribution or the lateral distribution of delta smelt at various lifestages and under various environmental conditions. So the body of information we have to make those refinements is somewhat limited.

Second is that if you're going to start making refinements to these estimates, it doesn't end with simply the assumption of uniformity of distribution. You have to also account for other assumptions and sources of error and uncertainty in the calculation. And those go to such things as the size selectivity of the various nets that we use. And there again, I didn't feel that we had good information at this time. Although we've recommended some additional studies that would help that -- that would give us the information to be able to address that specific relationship.

And so rather than embarking on a whole series of unknowns and some of these other assumptions, I chose to simply simplify my approach. Recognize that we had made assumptions that could lead to both over and underestimation of the population abundance, put that out as the fundamental assumptions and approach that we've used and rely on the fact that we're not trying to be overly precise in our estimates,

but we're trying to just simply give an order of magnitude for purposes of informing our decisions.

Q. You mentioned earlier that Dr. Bennett uses a methodology that's essentially the same as your methodology. Does Bennett make similar assumptions to those that you made?

A. Dr. Bennett did make similar assumptions. Dr. Bennett, as did I, assumed that each of the gear types is 100 percent efficient in collecting all size classes of delta smelt.

Dr. Bennett, as did I, also assumes that there is uniformity of distribution as represented by the density of delta smelt at the various Fish & Game sampling sites. And Dr. Bennett also made the assumption that you could multiply the density of delta smelt, the number per acre feet, times the number of acre feet in a region and calculate a standing stock estimate for that abundance estimate.

Q. Did Dr. Bennett also use the same data sources that you've used, the 20 millimeter survey data and the Summer Townet Survey data?

A. Dr. Bennett used the same data sources, being the 20 millimeter Fish & Game surveys, the summer townet and the fall midwater trawl. The difference is that Dr. Bennett used data from earlier years. I restricted my analysis to only those data available during 2007.

Q. Do you have an opinion, Dr. Hanson, about the suitability of the 20 millimeter survey data and the summer townet data

for purposes of calculating smelt abundance?
A. For purposes of calculating abundance, they are the best data source that we have. We considered a variety of other data sources, like salvage. And we rejected those because they sample at only one site and don't portray the geographic distribution of delta smelt.

As you can see by the map, the surveys that are done by Fish & Game, in this example for the 20 millimeter survey, cover a large geographic area. And that's an important consideration when developing these types of estimates because the delta smelt population moves geographically throughout the estuary and you need to take that into account.
Q. Are there any other data sources that you could have used but didn't?
A. The two other data sources that we could have used, but didn't. One is the Department of Fish & Game Bay Survey. And we didn't use that because its focused primarily on developing information on the abundance and species composition and distribution of fish in the lower parts of the estuary, central and northern San Francisco Bay, San Pablo Bay and Suisun Bay.

The other survey that could have been used is the Fall Midwater Trawl Survey. It has a good geographic distribution of sampling sites, but the fall survey is conducted in September, October, November and December. And

those surveys have not been conducted in 2007 and hence those data are not available.

Q. Dr. Hanson, referring your attention to State Water Contractor Exhibit F, your declaration of July 23rd. Do you recall whether you disclosed the assumptions that you used in calculating your order of magnitude abundance estimate?

A. Yes, we discussed the assumptions that we used and the implication of some of the assumptions in both my July and August declarations.

Q. In your declaration of August 13th marked as Exhibit -- State Water Contractor Exhibit G, did you discuss the investigations you've described that might be helpful in your view to address the issue of the population abundance and refine those estimates?

A. Yes. Starting on paragraph six, page two, we discuss the uncertainties inherent in the CDFG sampling program in meeting these needs. And in fact, I have the first sentence of paragraph six says, "Despite the uncertainties inherent in the CDFG fishery sampling program in providing representative estimates of actual delta smelt," their distribution, you know, there's a desire to make these estimates.

And so we have identified -- and I believe it's in paragraph 37 of my declaration, starting on page 22, some of the types of additional experimental investigations that we think would be appropriate to be implemented as part of the

ongoing monitoring program that helped -- that would help provide greater resolution with respect to these issues. The issues of the geographic distribution and spatial heterogeneity through these additional sampling programs that we've discussed. Studies that --

THE COURT: You know, doctor, if I could. Unless I'm looking at the wrong declaration, the declaration I'm looking at doesn't have a page 37 or page 22. It has 14 pages.

THE WITNESS: This would be my declaration of August 13th.

MR. WILKINSON: That declaration, Your Honor, has 31 pages of text.

THE COURT: All right. I have that. Page 22, paragraph 37.

THE WITNESS: And all I'm pointing out there, Your Honor, is that there is a need, if we're going to expand our understanding of the population dynamics of delta smelt, we can't rely exclusively on the surveys that have been conducted to date. They form the foundation, but there's additional information that could be conducted or compiled through focused experimental studies that would really help us improve our understanding of some of these assumptions. For example --

THE COURT: Any idea why they haven't been done in the last 25 years?

THE WITNESS: I really hesitate to speculate on why Fish & Game has not done some of these. For some of these studies, they have been done, but they've been done on striped bass. For some of the studies, they have been done in part, but not to the extent that would be necessary to really lay the foundation for extrapolating this.

And I'm confident with the interest in developing these types of population estimates and with the introduction of Dr. Ken Newman, who's now on staff with the Fish & Wildlife Service and working on this issue, Dr. Mike Chotkowski from the Bureau of Reclamation, the interest within the context of the Delta Smelt Recovery Team, I think will make good strides in improving these estimates.

THE COURT: All right. Let me address a logistical issue. You refer to this as Exhibit F. But I'm looking at the date -- there isn't any docket information on the declaration I'm looking at. But the signature date of the declaration by Dr. Hanson is August 13th.

MR. WILKINSON: I believe that's Exhibit G, Your Honor.

THE COURT: And I got 28 pages. That's my point. It's marked Exhibit G. And so if I look at Exhibit H, it's one page. And I've got Exhibit F here and Exhibit F --

MR. WILKINSON: Should be Dr. Hanson's declaration of July 23rd.

THE COURT: It is. But it's 14 pages long. So I --

MR. WILKINSON: Okay.

THE COURT: I'm still puzzled. Unless you didn't intend to refer to Exhibit F when you asked him to refer to Exhibit F.

MR. WILKINSON: Well, I meant --

THE COURT: Instead it was Exhibit G.

MR. WILKINSON: -- declaration of July 23rd.

Q. Dr. Hanson, can we straighten this out. Which declaration were you referring to?

A. In my declaration of July 23rd, I do have a brief discussion of the assumptions that went into making my estimates. Those assumptions are reiterated and expanded on in my declaration of August 13th.

THE COURT: All right. So in Exhibit F as in Frank, that's at page two, paragraph six. And then we go to Exhibit G for page 22, paragraph 37?

THE WITNESS: I believe --

THE COURT: That's the 13th, August 13th declaration. Because you referred by the date of declaration. First you used the exhibit declaration, then you didn't use it again for the second reference. So I'm trying to keep straight what I'm supposed to refer to.

THE WITNESS: Okay. The original reference that I made, Your Honor, to paragraph six, page two.

THE COURT: Yes.

THE WITNESS: Refers to information contained in my August 13th declaration.

THE COURT: That is Exhibit G as in garden.

MR. WILKINSON: That's correct. That's Exhibit G.

THE COURT: All right. And then you referenced on page 22, paragraph 37, is that also in G?

THE WITNESS: Yes, Your Honor.

THE COURT: All right. Well, let's take the morning recess at this time. What we're going to do is this. We're going to add to our hours of operation. We're going to go 12:15 to 1:15. We're going to shorten the noon hour. And we are going to go to five p.m. and we'll try to get the reporter an extra recess in there to try to expand our hours of operation.

We're in recess until -- 15 minute recess. I won't say facetiously you figure it out, but please do.

MR. WILKINSON: I think we can calculate that.

THE COURT: Yes. We're in recess.

(Recess.)

THE COURT: We're going back on the record in NRDC versus Norton. Mr. Wilkinson can continue with Dr. Hanson.

MR. WILKINSON: Thank you, Your Honor. We have marked as State Water Contractor Exhibit H the large poster board size map. I would like to offer that into evidence at

this time.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: Exhibit H is received in evidence.

(Defendants' Exhibit SWC H was received.)

THE COURT: So we have the description of it, it is a survey by area of --

THE WITNESS: Exhibit H is a map of the Delta showing the various regions that were used in developing the order of magnitude population estimates and also showing the location and number of the Department of Fish & Game sampling sites.

THE COURT: Let's call it an area of magnitude location map. You may continue.

MR. WILKINSON: Thank you, Your Honor.

Q. Dr. Hanson, I would like to have marked as -- Your Honor, I'd like to have marked as Exhibit I for the State Water Contractors a document that I'm going to hand to Dr. Hanson.

(Defendants' Exhibit SWC I was marked for identification.)

BY MR. WILKINSON:

Q. Have Hanson, have you seen State Water Contractor Exhibit I previously?

A. Yes, I have.

Q. And could you tell us what that is?

A. This is Exhibit 4 from my July declaration. It's a

graphic in histogram form that shows the estimates of the delta smelt population that we derived from Fish & Game 20 millimeter surveys numbers four through nine in 2007.

Q. And does it show what the estimated order of magnitude abundance was as of the completion of those surveys?

A. It does. As reflected by the height of each of the individual bars representing the population estimate for a specific 20 millimeter survey.

Q. And can you explain what's shown then on the graph?

A. What's shown is that our estimates of the larval and early juvenile delta smelt population were roughly less than 100,000 based on the data that were available from surveys four, five, six and seven. The estimate based on the survey results from survey eight suggested that the delta smelt population at that time, as reflected in these indices, was approximately 700,000 delta smelt and increased in survey nine to an estimate of 1.8 million delta smelt.

Q. Was this graph intended to demonstrate a trend of increasing delta smelt abundance across years, Dr. Hanson?

A. It was not. This graph was intended only to present information on the discrete 20 millimeter surveys that had been conducted by Fish & Game during their 2007 surveys. It does not purport any relationship between these abundance indices and any of the abundance indices from earlier years.

Q. What was its purpose?

A. Its purpose was to try and provide some context for evaluating the triggers and the decisions that would need to be made in order to provide an adequate level of protection for delta smelt given the ranges of management options that were contained in some of the proposals.

Q. Based upon the estimate of the order of magnitude abundance shown on the State Water Contractor Exhibit I, Dr. Hanson, did you conclude that the delta smelt is no longer at risk?

A. I did not.

Q. Did you conclude that the smelt should no longer be a species of concern?

A. No. And it would be inappropriate to make that kind of conclusion based on the results of just one year of any survey.

Q. Did you recommend that the smelt be delisted?

A. I did not.

THE COURT: And can I ask you, if we were to put a survey ten, if there was one, for the period of July 7th or 8th to August 8th, where would the graph be going or the histogram?

THE WITNESS: It's somewhat speculative, Your Honor. At the completion of survey nine --

THE COURT: I want you to estimate, don't speculate.

THE WITNESS: What I would estimate is that the

population in I survey ten would go down from what we have in survey nine. And the reason for that is that the delta smelt at that time not only would have experienced some level of mortality within the Delta, but the second is that we've talked about the gear selectivity and there are two aspects to that.

One is that the 20 millimeter net is not efficient at retaining very small fish because of the size of the mesh. The second is that it's not very effective in capturing larger delta smelt that have a greater ability to avoid the net. And both of those sources of bias would need to be taken into account. But given that, I would expect the number to go down.

THE COURT: What do you expect the survey to do or the histogram, if we were to complete the year?

THE WITNESS: If we were to complete the year, I think what you would see, Your Honor, is that we would have relatively marked reduction in population abundance as we came into and through the summer months. And that's based on the fact that delta smelt, as with virtually every pelagic species, produces a large number of larvae that then experience substantial mortality over the remainder of the year.

As you start to go out into the fall and the wintertime period, those fish are larger, they're sub-adult

pre-spawning delta smelt. And at that time, the population I would expect to somewhat stabilize as the mortality rates decline with increasing size. Once spawning occurs, then there would be a marked mortality of those delta smelt that have spawned.

THE COURT: And just based on your experience year after year, if you were again to estimate only based on your observations of the actual, where does the population go, for instance, from September through December?

THE WITNESS: From September through December, we have -- at that point in time, the delta smelt are sub-adults. We're at a point where the temperatures in the Delta are starting to decline. We're at a point where many of the other diversions that are occurring within the Delta are starting to decline. We're past the irrigation season.

And based on all of those factors, I would expect the rate of mortality, from September through December, to be relatively stable but still continuing to decline slightly.

THE COURT: And what is your opinion about the efficacy of the four to five percent survival opinion?

THE WITNESS: The four to five percent survival opinion is based on useful and relevant data, but it's based on data extending from the juvenile stage through the pre-spawning adults. So it would be an overestimate of mortality rate from September through December.

THE COURT: Well, let's take this in two steps. If you're to take the latter, which is September through December, what is your best estimate, by way of opinion, of what the mortality for delta smelt is? And that's from the pre-adult pre-spawning to whatever they are by the end of December.

THE WITNESS: From -- let me do it sort of sequentially, Your Honor. From the period of the late spring, when delta smelt are in their early larval and early juvenile lifestages, mortality rates are extremely high and our expectation of a larval fish at that stage surviving to become a reproductive adult is somewhere in the range of that four percent.

If you took that same pre-spawning sub-adult delta smelt in September and projected that forward to the number of anticipated spawning adults later in the winter, you're in the range of probably 25 to 50 percent survival.

THE COURT: Would it then be fair, would it be a reasonable estimate to apply the four percent survival up to September and then the greater survival rate after?

THE WITNESS: That -- we frequently break up the life histories into segments that way, reflecting changes in mortality rates.

THE COURT: And I don't think we've talked about it yet in this case, but I'm going to ask you now. From the time

of spawning, what does the population look like? In other words, we've got the dying spawned fish and then the new, if you will, eggs or larval, those can't be counted?

THE WITNESS: Those cannot be counted, Your Honor. The eggs are adhesive and we don't know where the spawning occurs. But at the egg stage is when you have the highest population abundance in the year. From that point forward, that fish experiences substantial mortality.

THE COURT: And from the egg stage, are all the fish that have spawned dead?

THE WITNESS: No. There's a small percentage of delta smelt that appear to survive to age two. But their contribution to the reproductive population in subsequent years is debatable.

THE COURT: All right. And so not countable.

THE WITNESS: We don't -- I think they're part of the population, but we don't rely on them, Your Honor.

THE COURT: All right. And compared to the July estimate, where would the January estimate of the delta smelt be if we were in January of '08?

THE WITNESS: Probably somewhere in the range, depending on environmental conditions, between about 10 or 20 percent of those fish would be expected to survive to become spawning adults.

THE COURT: And if we can quantify that? A number?

THE WITNESS: The number that we had generated from the survey three of the Summer Townet Survey, Your Honor, was about 700,000 fish. And that was in early July.

THE COURT: So we would be looking at 140,000 fish in January?

THE WITNESS: Correct, Your Honor.

THE COURT: Thank you. You may continue.

MR. WILKINSON: Thank you, Your Honor. At this time I'm going to offer into evidence State Water Contractor Exhibit I.

THE COURT: Any objection?

MR. WALL: No, Your Honor.

THE COURT: Exhibit I is received in evidence.

(Defendants' Exhibit SWC I was received.)

BY MR. WILKINSON:

Q. Dr. Hanson, you described just briefly the subsequent calculation that you made. Can you elaborate a little bit upon that? Did you make a subsequent calculation of order of magnitude abundance and what data did you use to do that?

A. Yes, I did. The 20 millimeter estimates were presented in my late July declaration, because they were the most recent information available at the time. Between the period of submittal of the July declaration and the submittal of the August declaration, information became available from the Department of Fish & Game Summer Townet Surveys.

The latest of those surveys was survey three. And I used survey three summer townet data within the same structure of analysis that we've described to generate an estimate of delta smelt abundance at that time. And that estimate was about 680 or 700,000 fish.

Q. All right. Dr. Hanson, I'd like to show you a graph that has been marked for identification as State Water Contractor Exhibit J.

(Defendants' Exhibit SWC J was marked for. identification.)

BY MR. WILKINSON:

Q. Do you recognize that exhibit, Dr. Hanson?

A. Yes, I do.

MR. WALL: Mr. Wilkinson, counsel have not yet received a copy of that.

MR. WILKINSON: I'm sorry. I'll repeat myself.

Q. Dr. Hanson, do you recognize Exhibit J?

A. I do. It's Exhibit 8 to my mid August declaration.

Q. And can you tell us what's shown on Exhibit J?

A. What's shown on Exhibit J are the previous 20 millimeter delta smelt estimates that we've discussed. But in Exhibit J, we have also included the results from the Summer Townet Survey number three, which was conducted between July 9th and July 14th.

Q. And are those results shown on the graph?

A. They are. They're shown on the right-hand side of the histogram. It's a faint gray bar in this rendition. And marked at the top with "STN," referring to summer townet.
Q. And what does the histogram show in terms of the order of magnitude abundance?
A. It shows that the order of magnitude abundance from summer townet number three is about 700,000 fish.
Q. Dr. Hanson, do you have an explanation for why the estimated abundance of juvenile smelt would drop from 1.8 million on July 2 to approximately 700,000 on July 7?
A. Yes. In fact, in my declaration, we provide some speculations on some of the factors that would account for that decline. And those include two important things.

One is that between each of these surveys, as we've just discussed, there is mortality that's occurring to the delta smelt. The magnitude of that mortality is unknown and somewhat variable from one year and one period to the next.

The second factor that goes into these calculations that we've already talked about is the size selectivity of the gear. And for the 20 millimeter sampling techniques, as the delta smelt are growing larger through the late spring and summer, they're attaining a size where they are more efficiently retained by the net and hence, for survey nine, for example, with larger delta smelt, we would very likely be approaching that 100 percent retention of the net that we had

assumed in our calculations.

With the change from the summer townet to -- or from the 20 millimeter data to the summer townet, we're now at a point where the delta smelt size is relatively small compared to the mesh of the net and hence the efficiency of the gear in the Summer Townet Survey would be expected to go down. Those factors combined led us to, you know, fully expect that there would be a decline in the population estimate. And that's what we saw.

Q. In the course of developing your estimates of smelt abundance, did you consider the work of any other scientists?

A. I did.

Q. And who were they?

A. I considered the work of Dr. Bill Bennett. And in that context, even though Dr. Bennett had not produced population estimates for 2007, one of the persuasive pieces of evidence that Dr. Bennett provides are highly significant correlations between his population estimates and the corresponding summer townet or fall midwater trawl.

And that good relationship gave me some comfort and some confidence that we, at least, had a structure for doing these estimates that fell within an appropriate order of magnitude and reflected the data that was being reflected in the indices as well as the population estimates. And that included his relationship between the 20 millimeter delta

smelt population abundance and the corresponding townet -- or Summer Townet Survey.

The second set of information that I relied on were some independent population estimates that were being produced at the time using the 2007 data by Dr. Rick Sitts. Dr. Sitts uses a slightly different set of assumptions. He does include corrections for size selectivity of the gear and some of the other things. But using the 20 millimeter survey nine data, Dr. Sitts estimated the population abundance of about a million delta smelt. And I felt that that was within the same order of magnitude as my estimate.

Dr. Sitts subsequently then also used the summer townet data from survey three to recalculate his estimate of abundance, calculating about 600,000, which was, again, close to my 680,000 estimate. And the fact that we were getting roughly the same numbers gave me some comfort.

I also provided my spreadsheets and my calculations to Dr. Sitts and his staff so that they could independently go through and validate the calculations and reproduce my results. And we were able to do that within a small margin of error.

I also relied on another set of independent estimates made by Dr. V. J. Miller using the Summer Townet Survey. Dr. Miller estimated from survey nine that the population abundance at that time was about a million fish. And again,

that fell within the rough magnitude that I had also calculated.

MR. WILKINSON: Your Honor, I'm going to offer into evidence at this time State Water Contractor Exhibit J.

THE COURT: Any objection?

MR. WALL: Your Honor, counsel is moving into evidence selected pages of Dr. Hanson's declaration without the entirety of it. And I believe if he's going to do that, it would make sense to just move in the entirety of it rather than selecting pages for submission.

THE COURT: I understood that was going to be done at some point, although there might have been redactions. Do you want to just move in --

MR. WILKINSON: I'm happy to do that now, Your Honor.

THE COURT: -- Dr. Hanson's declaration with the attached exhibits. The one advantage this does have, Mr. Wall, is it keeps it focused exhibit by exhibit on what we're being asked to look at. And if I don't have to read every exhibit and every word, then that helps me in not having to look at something that -- unless you want me to look at it. You want me to look at the whole thing, I will.

MR. WILKINSON: Your Honor, I'm happy to do both. I will go ahead and --

THE COURT: All right.

MR. WILKINSON: -- offer into evidence State Water

Contractor Exhibit F, which is Dr. --

THE COURT: Any objection to Exhibit F?

MR. WALL: No objection to that except that I am concerned that this is Exhibit I perhaps or --

MR. WILKINSON: Well, I'm going --

MR. WALL: -- J. I'm sorry. Okay. I'm sorry. I understand.

THE COURT: This is J. The one-page survey for estimated population from the Summer Townet Survey. J is received in evidence.

(Defendants' Exhibit SWC J was received.)

THE COURT: And then the whole declaration is marked what?

MR. WILKINSON: The entire declaration, Your Honor, is, for this exhibit, it comes as Exhibit 8 to State Water Contractor Exhibit G, which is the declaration of August 13th. I was going to move that in to evidence as well. So we'll have three exhibits, the two declarations and then Exhibit J, which I believe, Your Honor has --

THE COURT: Exhibit F. Any objection to Exhibit F?

MR. WALL: No objection.

THE COURT: Received in evidence.

(Defendants' Exhibit SWC F was received.)

THE COURT: Exhibit G. Any objection?

MR. WALL: No objection.

THE COURT: Received in evidence.

(Defendants' Exhibit SWC G was received.)

THE COURT: And then we've just received Exhibit J in evidence. And it's the --

MR. WILKINSON: I think we're now current, Your Honor.

THE COURT: Yes. It's the last exhibit that's marked.

BY MR. WILKINSON:

Q. Dr. Hanson, apart from the determination that delta smelt abundance -- or determinations, I should say, that you've already described, are you aware of any other data from the Summer Townet Survey that may bear upon the order of magnitude abundance of delta smelt?

A. The Department of Fish & Game conducts multiple Summer Townet Surveys at about two-week intervals. I used the data through survey number three in preparing my estimates. Since that time, the department has completed survey four and survey five.

Q. When was survey five of the Summer Townet Survey undertaken by the Department of Fish & Game?

A. I don't have the exact date, but it would have been in early August.

Q. And would you describe for us what the preliminary results are of survey five, as you understand it?

A. I can only briefly describe those. I saw the results of survey five posted on the Fish & Game website for the first time late yesterday afternoon. What those survey results show is that the delta smelt that were collected occurred in two locations within the estuary. There was a higher density of delta smelt collected in the lower Sacramento River adjacent to Decker Island. And a smaller number of delta smelt collected in Suisun Bay adjacent to Montezuma Slough.

Q. Based upon the results that you saw yesterday, would you expect the current population abundance of delta smelt to be higher or lower than your estimate from the Summer Townet Survey number three?

A. When I -- I haven't done a population estimate to actually quantify the difference. But just looking at the densities and their distribution within the estuary, I would expect the results from survey five to be substantial lower than the estimates that I developed from survey three.

Q. Dr. Hanson, is there any record that you are aware of State Water Project or Central Valley Project salvage during the period after survey three and prior to and including survey number five of the summer townet?

A. Yes. As part of State Water Project and CVP export operations in compliance with the biological opinions, there is ongoing salvage monitoring for all species of fish.

As part of the reporting, the US Bureau of

Reclamation Central Valley Project office publishes a daily summary of the numbers of delta smelt that were collected in the salvage operation separately at both the SWP and CVP as well as publishing information on the rates of water diversion at those two export facilities.

(Defendants' Exhibit SWC K was marked for identification.)

BY MR. WILKINSON:

Q. All right. Dr. Hanson, I'm going to hand you a chart that has been marked for identification as State Water Contractor Exhibit K.

Dr. Hanson, have you seen State Water Contractor Exhibit K previously?

A. Yes, I compiled Exhibit K.

Q. Can you tell us what it is intended to show?

A. What it's intended to show is a daily compilation of the estimate of expanded salvage of delta smelt at the State Water Project and Central Valley Project fish salvage facilities from July 15th, 2007 through August 15th, 2007.

Q. And why did you pick those dates?

A. I picked those dates because July 15th occurred the day after the completion of summer townet number three and I picked the August 15th date because it included the early August period of Summer Townet Survey number five.

Q. And if we look at Exhibit K. Can you tell us what it

shows in terms of the salvage by the state and federal projects during that period of time?

A. What it shows is that there were expanded salvage estimates for the State Water Project on four days, which included July 15th, July 16th, July 17th and July 18th totaling 39 delta smelt for the entire period from July 15th through August 15th.

Correspondingly, there were no delta smelt reported in the salvage for the CVP. And yet, during both of these time periods, State Water Project exports were within the range from approximately 5 to -- 5,000 cfs to 7500 cfs. CVP export rates were typically about 4,400 cfs.

Q. You used the term "expanded salvage," could you describe what that is?

A. As part of the salvage operations at both the state and federal water project, it's impractical to collect and count every single fish that entered the salvage facilities. And so a protocol has been established over time for specific methods that allow for the subsampling of a portion of the water that's entering the salvage facilities. Based on the time period and the proportion of water that is then sampled and the corresponding number of actual fish that are collected, an expansion factor is applied to account for the subsampling procedures.

Once you've applied the expansion factor that's

referred to as expanded salvage and it's designed to reflect the overall estimate of the total number of the given fish species that would have been salvaged during that time period.

THE COURT: Is there a difference between this study of salvage at the CVP and the estimates of take of smelt that have occurred, including salvage, that were provided by the plaintiffs for the same period? Because I understood the number to be in the thousands.

THE WITNESS: The variation, Your Honor, in terms of the numbers of fish that are reported in the salvage is very highly dependent on the season of interest. Early in the season, when we have lots of larval and early juvenile delta smelt, their vulnerability to salvage is increased. Both because of their geographic distribution as well as their numeric abundance.

During the summer season, many of the delta smelt have moved geographically down into the Suisun Bay area or into the lower Sacramento River adjacent to Decker Island where they're no longer vulnerable to SWP and CVP salvage.

So you need to look at the salvage records in terms of the geographic distribution and the seasonal time periods.

THE COURT: Where could the figures the plaintiffs are referring to be coming to? Aren't they salvage figures?

THE WITNESS: They are salvage figures. They were from the same data source that I've used here, but they

reflected an earlier period.

THE COURT: How much of an earlier period?

THE WITNESS: I don't remember explicitly, but I imagine that their salvage records, as did some of ours in my declaration, extend back to April.

THE COURT: Well, I distinctly remember, you correct me if I'm wrong, that there are salvage figures in the thousands in late June and July going into early August that the plaintiffs have presented. Can that be?

THE WITNESS: Unless it was for a much earlier year when delta smelt are much higher abundance and in other circumstances, it would be unlikely, Your Honor, that that many delta smelt would show up in the salvage under today's condition during the summer.

THE COURT: I remember in the 2000 plus range. Let me ask Mr. Wall what he recollects of this.

MR. WALL: Your Honor, I'd be happy to find the exhibit page. But I believe those salvage figures pretty much stopped in mid July at the latest. And so the figures the Court may be recalling would be from an earlier period, May, June, and the beginning of July, when there are very high take levels. This table begins in mid July after that take has effectively began to end.

THE COURT: All right. Thank you.

MR. WILKINSON: I'm thinking, Your Honor, it might be

helpful, we haven't had a witness do this. But I would ask Dr. Hanson, using Exhibit H map that we've previously admitted into evidence, to take us through where the smelt are during the course of a year's period of time. I wonder if you could do that, Dr. Hanson.

THE WITNESS: I could. Can I approach the map?

THE COURT: You may.

BY MR. WILKINSON:

Q. Sure. Can you see the map from there, Your Honor?

A. I can see it. Can all counsel?

THE COURT: I can see it. Can all counsel see it? Why don't you move it towards them a little bit. I can see the top.

THE WITNESS: And I'll use 2007 as an example, Your Honor.

THE COURT: Yes.

THE WITNESS: During the late spring and early winter, prior to the 2007 spawning event, the majority of sub-adult and pre-spawning delta smelt were concentrated in the lower Sacramento River in the vicinity of Decker Island, which is shown on this exhibit around Station 704, 706 and 707.

THE COURT: That's area A4?

THE WITNESS: It's within my area A4, yes, sir.

THE COURT: Now, let me understand. You say it seems

to me to be quite a wide temporal variance. I heard you say late spring and early winter. Now, early winter would be December, I assume and late spring would be May?

THE WITNESS: I may have misspoken, Your Honor. The Delta --

THE COURT: We can have the reporter check it.

THE REPORTER: That's what he said.

MR. WILKINSON: Why don't you clarify.

THE WITNESS: I'll clarify because I misspoke. The delta smelt during the late summer, early fall time period, say starting around September, begin an upstream movement from the Suisun Bay area up into the upstream tributaries.

BY MR. WILKINSON:

Q. And what are those upstream tributaries, Mr. Hanson?

A. The Sacramento and San Joaquin River systems. In 2007, during that fall time period the sub-adult pre-spawning adult delta smelt were generally concentrated in the lower Sacramento River in this area adjacent to Decker Island, the Station 704, 706, 707 area. That would be the period from, say, September through December or January.

Q. Dr. Hanson, you said 2007, did you mean --

A. This would be --

Q. 2006?

A. -- late fall of 2006.

THE COURT: 2006. All right. That's clearer. So

they -- in the late spring, you haven't told us yet where they are in the early spring and late winter.

THE WITNESS: Right.

THE COURT: But they're in the area of A4 and A5, which is the Sacramento River?

THE WITNESS: The Sacramento River is predominantly in this area, in Section A4.

THE COURT: All right. Then they move to the A2-B, A2-A, Suisun Bay area?

THE WITNESS: No, Your Honor. During the wintertime period, they migrated upstream into the area adjacent -- in this figure in A3, adjacent to Station 716, which is the Cache Slough area.

THE COURT: We call that the north Delta or something else?

THE WITNESS: That is the north Delta, Your Honor. And at that time, the adult delta smelt were maturing and beginning to congregate in the area where we think spawning was to occur.

THE COURT: All right.

THE WITNESS: So we think that in 2007, in the January --

THE COURT: January, February.

THE WITNESS: -- February time period, that the adult delta smelt were concentrated here in the northern part of the

Delta. We think that they spawned in that area. The eggs, which are adhesive, would have remained in that area while they incubated. And then starting in about March, those eggs would have hatched. And at the time they hatched, the larval smelt are four, five, six millimeters in length. They're what we refer to as icthyoplankton. They passively drift planktonically with the water. And they would have been moving then downstream in the Sacramento River.

THE COURT: To the A4, A5 area?

THE WITNESS: To the A4 area. Some of those delta smelt larvae would have then been transported further downstream into the Suisun Bay area, Sections A2-B and the lower Sacramento -- or San Joaquin area around Sherman Island, Section A5.

What we saw, Your Honor, in the spring of 2007, is evidence that some of those larval delta smelt transporting planktonically down the Sacramento River, entered the central portion of the Delta through Three Mile Slough. And showed up in the more central portion of the Delta.

THE COURT: And that is inhospitable as it gets to be summer?

THE WITNESS: That is the area of the Delta that then starts to be hydraulically influenced by the export operations. So a larval delta smelt that enters this portion of the central Delta is then vulnerable and at risk to being

subject to export losses as they pass through Old and Middle River. That portion of the smelt population that successfully migrates downstream into the Suisun Bay area is largely outside of that zone of influence.

THE COURT: And from -- again, recognizing it's an estimate, how is the population divided?

THE WITNESS: The population divides among these different rivers differently from one year to the next. The description I've given you is based on the 2006/2007 migrations.

There are other occasions, Your Honor, where delta smelt sub-adults migrate up into the central part of the Delta where spawning occurs. And under those circumstances, the vulnerability of their offspring is substantially increased as opposed to those in the Sacramento River.

Also the numbers of fish that come down through Three Mile Slough is developed based on the Fish & Game's 20 millimeter surveys. And the number that come into that area is influenced by the magnitude of water passing down through the Sacramento River. It's influenced by the magnitude of tidal exchange and interaction that occurs within Three Mile Slough with respect to the lower Sacramento River. It's influenced by the hydrodynamic conditions that occur within the central Delta as influenced by both natural tidal events, but also SWP and CVP export operations during the spring

months.

So a variety of factors influence their geographic distribution --

THE COURT: And in '07, what's the estimate of the population divide as part of the population moves to the west and part of it stays or goes down Three Mile Slough?

THE WITNESS: To give you a really precise estimate, Your Honor, I'd like to refer and review those data from the Department of Fish & Game. But a rough estimate would be, oh, possibly 75 percent moving down the Sacramento River and 25 percent or so moving in to Three Mile Slough.

The second path --

THE COURT: And can we -- let me just ask one more question and finish that.

THE WITNESS: Yes.

THE COURT: Can we then reasonably predict that what went into Three Mile Slough are all going to be killed?

THE WITNESS: No, Your Honor. Some of those fish that come into Three Mile Slough, since they're still subject to tidal action and they're still subject to the Delta hydrodynamics, some of those fish are expected to move further to the east and have greater vulnerability to the hydraulic influence of the exports. But some of those fish are also expected to move tidally to the west based on ebb tide and net Delta outflow. And based on those circumstances, they would

have reduced risk.

THE COURT: And are there any flows -- we've been talking about reverse flows in these rivers -- that extend that far west or is that beyond the influence of the project operations?

THE WITNESS: The flows that we have talked about to date in these proceedings, Your Honor, have primarily focused on flows in Old and Middle River and the reverse flow in that region of the Delta. The influence of the exports, though, extends beyond Old and Middle River as do the influences of tidal action.

And so one of the other pathways, Your Honor, that could occur is fish could successfully bypass Three Mile Slough, but as they're coming around the tip of Sherman island, if there were to be reverse flow in the lower San Joaquin River, there would be the potential on a tidal basis for some of those fish to go from the Sacramento River around Sherman island and into the lower San Joaquin River. And that would then put them, again, in an area where they would potentially be vulnerable to moving either upstream or downstream, depending on the hydraulic balance between exports and tidal influence, San Joaquin River flow and the other factors that influence their distribution.

THE COURT: But into areas of vulnerability?

THE WITNESS: It would be areas of vulnerability,

Your Honor.

THE COURT: All right. Thank you. You may resume your seat.

BY MR. WILKINSON:

Q. Dr. Hanson, I'd like to resume the story of the 39 fish.

A. Yes.

Q. Do you have an explanation of why the SWP and CVP salvage, over the period of time between the conclusion of Summer Townet Survey number three and the conclusion of Summer Townet Survey number five, was limited to 39 fish?

A. I think several factors influence that. The first thing we would look at is were the exports substantially reduced during that time period and that could help account for the low number of delta smelt. And by review of these records, it -- the state and federal water projects exported at moderately high levels throughout this time period. So reduced exports weren't the cause.

The second factor, when you look at the results that were posted on the Fish & Game website last night, shows that the geographic distribution of the smelt that were collected during survey four and survey five were located either in the lower Sacramento River, near Decker Island, as shown on Station 706 in this example, or further to the west in Suisun Bay near Montezuma Slough in the general area shown by Station 602 in Section A2-B. Up. There you go. And with the

geographic distribution of smelt in those areas, they're downstream and outside of the area that would be affected by SWP and CVP export operations.

The third factor is that, as Dr. Swanson has testified and others that looked at, delta smelt are a species that are sensitive to exposure to elevated water temperatures during the summer months. And it's during the summer, the July and August and September time periods, that air temperatures are high in the Delta and that water temperatures are seasonally elevated in that area. And as a general rule, we use about 25 degrees centigrade as an indicator of water temperature conditions that would not be favorable for delta smelt habitat.

MR. WILKINSON: Your Honor, at this point I will offer State Water Contractor Exhibit K into evidence.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: Exhibit K is received in evidence.

(Defendants' Exhibit SWC K was received.)

THE COURT: And do you agree that a fair range is the 25 to 28 degrees?

THE WITNESS: When we look at the delta smelt, Your Honor, there's several ways to interpret those results. One is under the laboratory conditions as to what temperatures actually result in mortality. The second is what are the

temperatures in the Delta where we actually find delta smelt. And we use the smelt as an indicator of their habitat or their response to temperatures.

Now, it's not a cause and effect, Your Honor, it's a distribution with respect to delta smelt and their temperature. And what's shown on Exhibit L --

(Defendants' Exhibit SWC L was marked for identification.)

BY MR. WILKINSON:

Q. Let me -- let me just indicate, Dr. Hanson, I've handed you a histogram marked as State Water Contractor Exhibit L for identification.

Do you recognize that document?

A. I do.

Q. Can you tell us what it is?

A. What it is, a histogram that we developed based on the Department of Fish & Game Summer Townet Surveys. And as the department does their surveys, and this is based on data between 1973 and 2005, at each sampling site, they record the water depth, the water temperature, the specific conductance or indicator of salinity, as well as the Secchi disk. Then they deploy their net and if they collect delta smelt, you can then develop correlation between what the temperature was at the sampling site and the numbers of delta smelt that were subsequently collected.

And what I've plotted here is a histogram that shows water temperature at the sampling sites that were occupied versus the total number of delta smelt that were collected at each of those individual water temperatures over the period from 1973 through 2005.

A couple of important things from the histogram. This encompasses years early in the period when delta smelt abundance was relatively high. And so you can see that many of these individual bars on the histogram represent two, three, 4,000 delta smelt collected at a specific temperature. So there's a lot of information, a lot of fish that were included in these collections.

The second is that you can see that, as we come towards water temperatures of 23, 24 and 25 degrees, the numbers of delta smelt collected in these surveys decline substantially. It's not completely eliminated. There still are a very few delta smelt that have been collected in this survey at temperatures above 25.

But review of this kind of information suggests that from a practical standpoint, it serves as a useful indicator of where delta smelt are likely to occur and where they're -- if we can use water temperature as a surrogate for looking at the potential risk of smelt.

Q. Dr. Hanson --

THE COURT: If we're looking at the 26 to 28 degree

Celsius range, what is your opinion? Do the fish survive in that temperature range?

THE WITNESS: I think the fish do survive, Your Honor. It depends on their acclimation temperature. It depends on their food availability. They may be highly stressed at those higher temperatures. But the results of the work that Dr. Swanson has done in the laboratory suggest that certainly under higher acclimation conditions, delta smelt do have a higher thermal tolerance that can extend up to 28 degrees.

THE COURT: Thank you.

BY MR. WILKINSON:

Q. Dr. Hanson, from what we know about the location of the fish currently, from what we know about the relationship between smelt and temperature and from what we know about the size of the fish and the numbers of fish that were salvaged during the period between survey number three of the summer townet and survey number five of the summer townet, do you have an opinion as to whether the projects are the cause of the decline that you've testified to in abundance between survey number three and survey number five?

A. No. I testified that the decline in population abundance between survey three and survive five, I think, is a substantial level of decline. And if that were to have been the result of SWP and CVP export operations, I would have

expected to have seen substantially more, thousands of delta smelt showing up in the salvage during that time period. And the fact that we didn't see that in combination with the temperatures and the geographic distribution reported by Fish & Game, it was my conclusion that the salvage operations did not -- were potentially a contributor, but were not the cause of the decline between survey three and survey five.

Q. Do you have an opinion as to what the possible cause of decline between survey three and survey number five would be?

A. We really don't know the specific factors that might have caused that apparent decline. But, you know, a variety of factors influence delta smelt at that point. They're vulnerable to predation mortality. There are concerns with respect to food availability and the ability of delta smelt to successfully forage adequately to grow and survive over the summer months.

But there's anecdotal information -- and I haven't looked at any reports or any details, but anecdotally, I've been told that there was evidence of potential toxicity in Suisun Bay during the summer months.

Q. Do you have any idea what the source of that toxicity might be?

A. I don't.

Q. Given the lower catch numbers, Dr. Hanson, that were indicated by survey five in the Summer Townet Survey and the

likely lower population abundance that you believe would result from those numbers, do you have an opinion of whether operation of state and federal projects pursuant to the Fish & Wildlife Service matrix would cause jeopardy to the smelt?

A. I do have an opinion and I think under these lower population abundance levels, the action matrix put forward by the Fish & Wildlife Service still has the opportunity and would still be effective in reducing jeopardy of the delta smelt.

The two caveats to that, though, is that as the population of delta smelt declines as suggested by the most recent surveys, greater attention would need to be placed on the triggers that are used to move from one range within the service's matrix to another as we see changes in the distribution of the delta smelt population continuing to inhabit the estuary.

The second is that with the lower numbers of delta smelt in the population, it would strongly urge that more protective actions, hence operating at the lower end of the ranges of Old and Middle River flows, would be an appropriate action in the event that there's evidence that delta smelt are at risk of salvage mortality.

Q. Is it your understanding, Dr. Hanson, that the Fish & Wildlife Service action matrix accommodates both of those concerns and caveats that you described?

A. It does in the sense that Fish & Wildlife Service matrix, for example, as I remember, has Old and Middle River flows ranging from zero to minus 4,000 cfs. And so there are opportunities to adjust their actions to accommodate the risk of delta smelt in any given period, based on the most recent information available, and also to provide operations that are more protective for delta smelt by preferentially operating towards the lower end of their operational range as purported in their matrix.

Q. Let me ask you the same set of questions with regard to the impact upon critical habitat. Given the low numbers that we appear to be seeing as a result of the survey five, do you have an opinion whether operation of the two projects, in accordance with the Fish & Wildlife Service matrix, would adversely affect critical habitat from delta smelt?

A. No. I don't believe that it would adversely impact critical habitat during the period that their measures are in place. They do have controls on Old and Middle River reverse flows. Those would be, we think, beneficial in terms of hydrodynamics of the south and central portions of the Delta.

At these low population abundance levels, we have no reason to believe that habitat availability is a limiting factor for delta smelt. We appear to have adequate volume of habitat, particularly at these low levels, that it doesn't appear that habitat in and of itself would be a limiting

factor on carrying capacity.

Now, other factors like food availability may influence how delta smelt use the estuary. They may preferentially select areas such as the lower Sacramento River near Decker Island, for a variety of reasons, including food availability. But I think the action matrix would not adversely impact habitat quality in those areas of the Delta.

MR. WILKINSON: Your Honor, at this time I would like to offer Exhibit -- State Water Contractor Exhibit L into evidence.

THE COURT: Any objection?

MR. WALL: No objection.

THE COURT: Exhibit L is received in evidence.

(Defendants' Exhibit SWC L was received.)

BY MR. WILKINSON:

Q. Dr. Hanson, were you here when Dr. Tina Swanson testified?

A. Yes, I was.

Q. And did you hear Dr. Swanson's testimony regarding the reliability of your population abundance estimates?

A. Yes, I did.

Q. Did you hear Dr. Swanson say that you do not have confidence intervals with your estimate, but Dr. Bennett does?

A. I do remember that testimony.

Q. Is there a reason why you did not include confidence intervals in your estimates of the order of magnitude

abundance of delta smelt?
A. Yes. When I produced these estimates, what I was looking at is the order of magnitude estimate for individual surveys conducted, for example, during the 20 millimeter survey within the 2007 period. When Dr. Bennett did his estimates, he used the same approach that I used. But he calculated the independent estimates for each survey. But because Dr. Bennett was more interested in looking at the comparison of the estimates of population abundance over time, he then combined all of those surveys within a year, calculated the estimate for the year and the associated confidence intervals.

So when Dr. Bennett was presenting his information in his publication in 2005, he presented an estimate for one population estimate plus its confidence intervals for a year for each individual survey and then compared those over time. That wasn't the approach nor the purpose of my estimates.
Q. To your recollection, Dr. Hanson, did Dr. Bennett include any confidence intervals for any of the population abundance estimates that he developed using data from a single survey?
A. Dr. Bennett in his 2005 report does not present any results from a single survey.
Q. Do you -- Dr. Hanson, do you believe your estimates of the order of magnitude of delta smelt population abundance are based on the best scientific data?
A. I believe they are based on the best scientific data.

That's certainly not to imply that they can't be improved and refined as we've talked previously. But I think they are based on the best available data and I think they do provide a reasonable context for evaluating how we should proceed with various operational decisions during the interim period.

Q. Earlier, Dr. Hanson, you described the factors you used in making your evaluation to Fish & Wildlife Service action matrix --

THE COURT: Before you ask that question, let me ask a question.

MR. WILKINSON: Yes, sir.

THE COURT: How do you then explain the difference between the opinions you've just expressed and the opinions Dr. Swanson expresses about the effect of project operations on the delta smelt?

THE WITNESS: I don't think Dr. Swanson and I disagree substantially that project operations contribute to the cumulative impacts that have occurred on delta smelt, through both direct entrainment and salvage at the export facilities as well as their effects on hydrodynamic conditions within the estuary.

I think the difference, Your Honor, is that I was focusing on a very short time period associated with the interim remedy period. 12 to 18 months.

THE COURT: 12 to 18 months.

THE WITNESS: I was not concerned, nor did I include in my analysis any kind of a trend over time to be able to suggest that smelt are doing better or worse.

THE COURT: Understood. But if dry conditions continue and the projects operate, in effect you're taking -- or you have the Court take your opinion to -- and as I've heard it, there isn't any jeopardizing effect of the operations of the projects. And so there doesn't need to be any remedy, there doesn't need to be any adjustment or any kind of addressing of what is happening as a result of exports, the direct salvage and entrainment.

THE WITNESS: Okay. No, Your Honor, that's not my opinion.

THE COURT: It isn't? Well, then you need to express your opinion on that subject so I can clearly understand it.

THE WITNESS: My opinion on that subject is that the delta smelt require protection during this interim period. That protection can best be afforded through modifications of export operations at both the SWP and CVP.

That within the context of the Fish & Wildlife Service matrix, they have the ability to modify those export operations over the range from zero reverse flow in Old and Middle River up to minus 4,000 cfs.

And my opinion, Your Honor, is that if they exercise their judgment appropriately and the projects are managed

within that range, which means that if delta smelt are at risk of salvage, we should be operating near the low end, the zero end of that range. Under those circumstances, I think these approaches do provide a level of protection for delta smelt that will allow them to get through the interim period.

If you were to ask me could they simply close their blinders and operate at minus 4,000 or minus 6,000 throughout this period and avoid jeopardy, my answer would be no.

THE COURT: Perhaps the way it has been done.

THE WITNESS: The way it has been done in the past, I believe, has contributed to impacts to the population and to their habitat that are trying to be addressed during this critical period in the delta smelt population through these measures.

BY MR. WILKINSON:

Q. So Dr. Hanson --

THE COURT: And you can not answer this question, but you're an observer. I want to ask the operator directly. But what is -- from your observation, what is the reason that measures have not been taken to attempt to avoid the jeopardy of the species and to prevent the depravation of the habitat? Can you offer, without speculating, any professional opinion as to why the operators have been unable to either modify operations or to address the problem of the decline of the smelt?

THE WITNESS: I think, Your Honor, that the operations of the projects to date has been a balancing between competing needs of fishery protection, not only for delta smelt, but for other species, and water supply deliveries and reliability.

In the past, when balancing those competing interests, I think the fact that delta smelt were at higher levels of abundance than they occur today, that they had a geographic distribution that appeared to be more robust than it does today. I think in many of those instances, the balancing then said we have adequate levels of protection and we can weigh our decisions with respect to operations in meeting our other requirements for water supply deliveries and reliability.

I think what's changed, Your Honor, is that the delta smelt population has now declined to a level where that balance between those competing interests is weighted differently than it has in the past.

THE COURT: And you don't think that -- let's just take the last three years, that the 2003 to 2006 -- through 2006 period, that the conditions were clear enough, in terms of their critical nature, that action would have been called for?

THE WITNESS: No, I think actions were called for, Your Honor, during that time period. And as evidenced by the

operations that occurred this past year --

THE COURT: This was because the case was in court.

THE WITNESS: Well, I think it was in part that, but I think it's also in part that there's been -- from my perspective only, and my opinion only, I think there's been a growing sensitivity towards the condition of delta smelt. I think there's been a growing sensitivity that we need to provide higher levels of protection than have occurred in the past. And I think that has influenced decision makers with respect to how they approach these issues.

THE COURT: Thank you. You may continue.

MR. WILKINSON: Thank you, Your Honor.

(Defendants' Exhibit SWC M was marked for identification.)

BY MR. WILKINSON:

Q. Dr. Hanson, I am going to hand you an exhibit that has been marked for identification as State Water Contractors Exhibit M.

Do you recognize that document?

A. Yes, I do.

Q. Would you tell us what it is, please?

A. What it is is a brief overview of the three tiered approach that I proposed in my July declaration representing some modifications and refinements to the approach that had been proposed by the Fish & Wildlife Service.

Q. Is this a document that emerged from your analysis of the Fish & Wildlife Service matrix?
A. Yes, it did.
Q. Can you tell us then what this document shows, please?
A. What it shows is that we have proposed a three tier approach to addressing the interim actions associated with SWP and CVP export operations. The time period that this would be in effect extends from December 1st through June 30th. The tier one actions are designed to maintain hydrodynamic conditions within specific portions of the estuary that would be more favorable, we feel, to moving delta smelt and keeping delta smelt further downstream in an area away from the influence of the SWP and CVP exports. And hence a reduction in their vulnerability to export related losses.

The second tier would be triggered if we find evidence that delta smelt are geographically in the area where they would have increased vulnerability. It's a refinement to the matrix that the Fish & Wildlife Service put forward. But contains the same basic principals, it's based on the same basic hydrodynamic concerns about Old and Middle River flows, but has some refinements.

And tier three is, in essence, the ultimate level of protection. And that's in the event that all else fails and we find that there is an unacceptable level of take of delta smelt at the SWP or CVP export facilities, that there be an

immediate curtailment of their operation until such time as we can reconsult, look at the data and make decisions as to whether or not that curtailment needs to continue or could be evaded.

Q. Dr. Hanson, I'd like to focus first on your tier one measures. What are those supposed to do? How do they work and what do they consist of? And if it helps to use the map, please do so.

A. Please. Our tier one measure is really aimed at providing a net positive downstream flow, sometimes referred to as Q west, in the lower San Joaquin River in the vicinity of the Jersey Point. But it also has hydrodynamic influences on the water movement into Three Mile Slough from the Sacramento River.

And if I can approach the map, I'll -- one of the things that we have observed in the past is that in those years when we have wet hydrologic conditions and we have increased flow of water passing downstream from the tributaries through the Delta, we tend to have lower risk of delta smelt being entrained at the SWP and CVP export facilities.

And part of the physical process that we think is in play here is that when we have a net positive flow in this lower part of the Delta, that provides the transport mechanism for moving planktonic larval delta smelt further downstream

into Suisun Bay and away from the influence of the pumps.

The second part of our physical process occurs during that December, January, February time period. Some of the results of analyses done by David Fullerton from the Metropolitan Water District and others has shown an apparent correlation or prediction between the occurrence of elevated turbidity within portions of the estuary and the movement of sub-adult pre-spawning adult delta smelt into the interior Delta where they would be more vulnerable to being lost as a result of export operations.

And so to the extent that we can provide more of a net positive flow, we can reduce hopefully the insurgence of elevated turbidity water, say, from the Sacramento River through Three Mile Slough. We can reduce the possible incursion of higher turbidity water in the lower San Joaquin River in the vicinity of Sherman Island.

And specifically during the spring period, when the larval smelt are being transported, we can provide greater transport mechanisms to bring those larval fish, in this example, from Cache Slough down the Sacramento River, avoid, to the extent possible, having them come into Three Mile Slough and move those larvae down here into the higher productive more shallow areas where they would be not only having better habitat, the low salinity X2 located in this area, but they would also be further to the west and have

reduced vulnerability to the effects of the export operations.

So the fundamental principle of our tier one is to create the hydrodynamic conditions that are conducive to moving the fish further away from the pumps, reducing the risk that they will be influenced directly by SWP and CVP export operations, and therefore prevent the kinds of episodic take that has occurred in the past.

THE COURT: And is the water turbid because it's in the reverse flow stage?

THE WITNESS: No. That's part of it, Your Honor. But part of it, too, is that, for example, if we have sub-adult delta smelt positioned here in the lower Sacramento River at, say, Station 706, and during that January or February or March time period, there's a substantial storm in the Sacramento River watershed, we get a lot of storm water runoff and that results in a short-term increase in turbidity.

If that turbid water from the Sacramento River then comes down and passes into Three Mile Slough, some of those delta smelt we feel may actually cue on that, move into that area and then subsequently move into the area of increased vulnerability.

BY MR. WILKINSON:

Q. The smelt respond positively to turbidity increases; is that correct?

A. What we've seen are -- and this is really attributed to

the work that Dave Fullerton has done. Is that the smelt seem to follow the turbidity within the estuary. And that's based on looking at the distributional patterns of delta smelt, looking at turbidity events and looking at how the fish respond to those events.

But it's corroborated by an interesting piece of evidence from the delta smelt root stock program and the hatchery effort. And that's that delta smelt that are held in purely clear water don't appear to feed very well. The delta smelt that appear to feed the best and do the best are delta smelt that occur in slightly turbid water. And so if we have increased turbidity, there may be a mechanism that's helping us explain why there's a change in their geographic distribution.

Q. Your measure one or your tier one measure, I should say, Dr. Hanson, commences December 1; is that right?

A. That's correct.

Q. That's about a month earlier than the initial actions under the Fish & Wildlife Service matrix. Why do you have the December 1 start date?

A. I extended it to December 1 based on some discussions that I had with Dave Fullerton, who said that some of the evidence that he was reviewing showed that some of these delta smelt movement events could occur during the winter prior to December 25th. And we felt that by moving it back to December

1st, it would be more protective in that regard.

Q. Do you recall the testimony of Dr. Swanson that your proposal to maintain a net positive downstream flow doesn't correspond with any environmental variable?

A. I do remember that testimony.

Q. Do you agree with that?

A. I agree with Dr. Swanson that we have not tried to put forward any kind of a statistical relationship between the magnitude of reverse flows in the lower San Joaquin and salvage at the export at facilities or any type of an analysis like that.

We approach this from a different perspective. We approach this not from the standpoint of looking for statistical relationship, but rather looking at the physical processes and the hydrodynamics that may influence the geographic distribution of delta smelt at different lifestages.

And so it's not surprising to me that we don't have statistical correlations. We've looked at particle tracking modeling. We've looked at the information from Dave Fullerton's investigations. We've tried to identify the underlying physical factors that would provide benefit to the delta smelt.

THE COURT: And if the smelt, then, move and have the ability to be affected by the flows that are in, I'm going to

call it the Delta system, why are you doing nothing from September to December where Dr. Swanson thinks that that's a crucial time for, in effect, I think facilitating the growth and protection of the young smelt?

THE WITNESS: Well, Your Honor, we have seen that during that September through December period, that in the past the majority of sub-adult delta smelt have been residing in the lower Sacramento River near Decker Island. It appears, for whatever reason, and there are investigations underway why that habitat seems to be preferred. Whether it be the hydrodynamics of the area based on the relative balance of tidal influence versus Sacramento River flow. Maybe it's food availability.

But we haven't seen any evidence from those investigations that there would be a substantial improvement in delta smelt habitat during the fall if we manipulated salinity regimes to a specific X2 location, for example, at Kilometer 80. We've looked at the information that Dr. Swanson cited, some of the Gurein analyses that were done by the Contra Costa Water District, as well as the Feyrer analyses.

We've considered that information in terms of, you know, how comfortable we and the authors are with using that as the basis for a management action. And we don't discount that at all, Your Honor, as something that should receive

further investigation and scrutiny as we go forward.

THE COURT: But you don't think it's necessary?

THE WITNESS: But right now, I don't think it's necessary.

THE COURT: Because?

THE WITNESS: Because two things. We do have a lot of habitat in this area of the Delta that are -- is occupied right now by delta smelt. And we haven't seen any indication that that habitat area is limiting in terms of its volume, especially at these lower population levels. As well as some of the analyses that Feyrer has put forward that we'll discuss further.

THE COURT: And the second reason?

THE WITNESS: Pardon me?

THE COURT: Two reasons, I thought.

THE WITNESS: Oh, no, those are -- that's the primary reason.

THE COURT: All right. You may continue.

BY MR. WILKINSON:

Q. Dr. Hanson, you mentioned that you would use Particle Tracking Model as part of your evaluation; is that right?

A. That is correct.

Q. Were Particle Tracking Model studies performed under your direction and control as part of the formulation of your tier one measure?

A. Yes, they were. We had the advantage of having some really good hydrodynamic modeling capability available to us as a resource. And so in investigating the various proposals that were being put forward, we used not only the CALSIM II model to look at the system at a gross level and how it responds in different water year types and under different conditions, but we also had the ability to use the more refined DSM II model and the Particle Tracking Model as additional tools to look at these hydrodynamic conditions.

Q. Is the Particle Tracking Model used by fishery scientists working in the Delta?

A. It is.

Q. And when you used it for your purposes, what did it show?

A. Well, what it showed is that if you maintain an appropriate level of positive net flow coming through the lower San Joaquin River -- and that's the area here near Sherman Island, Station 804, and the associated hydrodynamic effects.

THE COURT: That's no negative flow?

THE WITNESS: That's no negative flow at that location, Your Honor.

THE COURT: So it's minimum of zero.

THE WITNESS: It would be a minimum of zero in terms of providing -- what occurs, Your Honor, is that that location, the tidal influence moves back and forth. So you're

not always moving downstream. But on a net basis, you don't want the water to move upstream. It will move upstream on the flood tide and downstream on the --

THE COURT: So you have to push water downstream to achieve that?

THE WITNESS: You would. And in pushing water downstream to achieve that, our hope and what the Particle Tracking Model shows is that you're also moving these particles further to the west and outside of the zone of influence.

BY MR. WILKINSON:

Q. Did you hear Dr. Swanson's testimony, Dr. Hanson, that the Particle Tracking Model cannot be used for delta smelt larvae?

A. I did hear that and --

Q. Do you agree?

A. I disagree with Dr. Swanson. I think that the Particle Tracking Model can be used for looking at the movement of planktonic particles representing larval delta smelt as well as representing some of the other constituents like turbidity.

And I think that in Dr. Swanson's testimony, my feeling is that she and I agree that -- and I don't want to speak for Dr. Swanson. But the Particle Tracking Model is best suited for looking at things like turbidity, for residence time, for larval fish distribution.

Where the Particle Tracking Model becomes to be more

uncertain is whether or not it accurately reflects the movement of juvenile and adult delta smelt that have more volitional behavior.

And many of the hydrodynamic modelers are in the process right now of modifying the Particle Tracking Model to be able to instill in the particles themselves the ability to regulate neutral positive and negative buoyancy to try and do a better job of dealing with some of the behavioral elements that we've talked about.

THE COURT: What's the relationship between the Particle Tracking Model and turbidity? Just the manner in which water causes the particles to react?

THE WITNESS: It is, Your Honor. That --

THE COURT: That reveals something of significance?

THE WITNESS: The particles that create the turbidity are typically very fine colloidal clays and fine material. And they would move, we think, very much the way a neutrally bouyant particle would move. The larger sediments certainly drop to the bottom and would not be represented by this. But for turbidity, it serves, I think, as a useful tool.

Again, it needs to be used in balance. You can't say it's absolutely going to be like this. It's simply a tool that provides a better indicator.

THE COURT: But it has a limited span of usefulness to the size of the fish?

THE WITNESS: It does. As the size of the fish get larger, they become more volitional, they are selecting habitat. They no longer meet the assumption of being a neutrally bouyant particle.

THE COURT: Would that be in July?

THE WITNESS: That would be starting in June and July and continuing through the remainder of the fall and winter.

THE COURT: So that's when you would not be using the Particle Tracking Model?

THE WITNESS: You would use the Particle Tracking Model during those time periods, but limiting your analysis to looking at two things. One is how do the flows in the Delta change between the baseline and under your proposed condition. Because that change in hydrodynamics would influence habitat conditions, we think, for delta smelt.

And the second is, as we've talked already, it's appropriate to be able to use that during that wintertime period for looking at turbidity events and where you would expect these turbidity particles to be distributed.

THE COURT: Thank you. You may proceed.

MR. WILKINSON: Thank you, Your Honor.

Q. Dr. Hanson, would you describe for us your tier two action and describe for us when it would it commence, what would trigger your tier two action and what it consists of?

A. Yes. And let me backtrack a little bit because it's

important to put tier two into context with tier one. Tier one is a preventative action. It's designed to provide the best hydrodynamic conditions that we think would benefit delta smelt.

We've talked already about using the Particle Tracking Model and we talked about the fact that there's some uncertainty associated with that action, particularly of whether the Particle Tracking Model accurately reflects the movement of juvenile or sub-adult or adult delta smelt.

And so recognizing that uncertainty, particularly beginning in the wintertime period, we felt it appropriate to have a second layer of protection and that second layer of protection is the implementation of tier two.

Q. So in other words, if your tier one measure doesn't achieve the results that you hope for, tier two would kick in at that point?

A. It would. The purpose of tier one, as we've talked, is to keep delta smelt out of harm's way in terms of their geographic distribution. If we see evidence that it's not achieving that objective and that we do have delta smelt that are now moving into an area of greater risk, then tier two would be triggered.

Q. And what does tier two consist of?

A. Tier two consists of a modification of the action matrix put forward by the US Fish & Wildlife Service. It's

specifically designed to regulate reverse flows in Old and Middle River. We did make some modifications in terms of the range of those operations. But fundamentally, it's based on the same principles as put forward in the agency proposal.

Q. So you agree that there is a relationship then between salvage and reverse flows in Old and Middle River?

A. I have looked at a variety of different data sets. I've looked at salvage data. I've looked at hydrodynamic data. And it's my firm believe that there is a relationship there between the magnitude of reverse flows and the vulnerability of delta smelt to salvage.

Q. Was one of the things that you looked at in developing your tier two measure, Dr. Hanson, the work that Pete Smith, Dr. Pete Smith of the US Geological Survey had done?

A. I did review the results of the regression analyses developed by Dr. Smith.

Q. Were you aware, at any time, that there was a re-analysis of that data that Dr. Smith had used to develop his relationship that was underway at the Department of Water Resources?

A. I was. Dr. Smith presented his original relationships in a CALFED workshop and it gained great notoriety and interest among the scientific community working on these issues. It shed new light on an approach and some modeling and statistical results that we all found intriguing and wanted to

look into more.

Jerry Johns at the Department of Water Resources, my understanding, asked Sheila Greene, another staff member at DWR, to try and replicate the results of Dr. Smith's original analysis, and to also carry those analyses further in terms of looking at the underlying relationship between Old and Middle River flows and salvage of delta smelt during the winter period.

Q. Is Sheila Greene a biologist?

A. Sheila Greene is, I believe, a biologist. But she primarily deals with the compilation and analysis of hydrodynamic and biological data. Sheila has served on a number of committees with me, including the NOAA Salmonic Fish Recovery Team.

THE COURT: And is Dr. Hanson intending to discuss the physical --

THE WITNESS: Yes.

THE COURT: -- quantity of what it's going to take to do this, to implement the tiers?

MR. WILKINSON: Yes. We will explain how the tiers were developed.

THE COURT: You're doing that now.

MR. WILKINSON: Yes.

THE COURT: I'm talking about what it's going to it take to effectuate them.

MR. WILKINSON: In terms of water or --

THE COURT: Yes. And anything else that is required.

MR. WILKINSON: I believe Dr. Hanson has an idea of the impact in terms of water supplies relating to his measures. Our thought was that those would be questions we would ask of John Leahigh, who is a hydrologist for the Department of Water Resources.

THE COURT: All right. Well, I'm -- my question is: Are we going to, at some point before Friday, put side by side the three proposed actions and exactly what it's going to take to implement them?

MR. WILKINSON: Yes, Your Honor, I believe we are. I believe, again, that would be through Mr. Leahigh from DWR.

THE COURT: All right. Let's take the noon recess at this time. We'll stand in recess until 1:15.

(Lunch recess.)

THE COURT: Good afternoon, ladies and gentlemen. Please be seated. Going back on the record in NRDC versus Kempthorne. We're going to continue the testimony of Dr. Hanson. Mr. Wilkinson.

MR. WILKINSON: Thank you, Your Honor.

Q. Dr. Hanson, before we broke for lunch, we were beginning to talk about the work that DWR had done and I'm going to ask you a couple of questions about that. But before we do, I want to make sure that we had offered into evidence State

Water Contractors Exhibit M, which is your chart showing your tier one, tier two and tier three matrix.

THE COURT: Is it in evidence?

THE CLERK: It's not in evidence.

THE COURT: Are you offering it?

MR. WILKINSON: I am.

THE COURT: Any objection?

MR. WALL: No objection.

THE COURT: Exhibit M is received in evidence.

(Defendants' Exhibit SWC M was received.)

BY MR. WILKINSON:

Q. Dr. Hanson, the DWR, I think we call it re-analysis of data. And you were indicating before the break that it was Sheila Greene at DWR who had done that analysis. Is it your recollection that the Sheila Greene re-analysis disclosed some concerns about the Pete Smith work?

A. Yes, it did.

Q. And what were those concerns?

A. I had an opportunity to meet with Sheila to talk about her analysis of some of the reverse flow versus salvage data. And several of the things that we talked about -- one has come up already in this proceedings, and that was the way the data were treated when reverse flows in Old and Middle River were positive.

The second thing that she and I talked about were the

time intervals for averaging Old and Middle River flows as well as averaging the delta smelt salvage for use in looking at these two different relationships.

Q. Can you elaborate a little bit about the second concern. I think we've had testimony previously about the zero point problem; is that --

A. That's correct.

Q. What's about the second problem?

A. The second problem has to do with a choice with whether you analyze the data averaging over the January through February period, as Dr. Smith did, or whether or not you segregate your analysis separately by some other time period. And in the re-analysis that Sheila Greene did, she separated it based on calendar months. So she presented a result for January and a separate analysis for February.

Q. Dr. Hanson, I have marked a graph as State Water Contractors Exhibit N and I'd like to hand that to you.

(Defendants' Exhibit SWC N was marked for identification.)

BY MR. WILKINSON:

Q. Have you seen that document before?

A. Yes, I have.

Q. Can you tell us what it is?

A. This is one of the two graphics that Sheila Greene prepared based on her re-analysis. This shows the average

January Old and Middle River flows between 1993 and 2006 versus the sum of January adult delta smelt salvage between January 1993 and 2006. It's curvilinear regression. Sheila also prepared a similar analysis using the data from February.

Q. Is this the same data that appeared in the Smith graph that we discussed a couple of days ago?

A. This is basically the same type -- it's the same data, yes, just analyzed in a different way.

Q. Would you explain, please, how you used this graph developed by Ms. Green in connection with the development of your tier two measure?

A. Well, what we were looking for is what would be the relationship between Old and Middle River flows, reverse flows, and the risk or magnitude of salvage of delta smelt during this wintertime period. And Dr. Smith's analysis showed a linear regression as presented by Dr. Swanson.

The analysis that was done by Sheila Greene showed, in essence, a stepped function with a threshold where there's very little difference in delta smelt salvage at both positive reverse flows in Old and Middle River and as reverse flows become more negative, as evidenced by the 1999, 1998, 1994 and 2001 data points.

What I used this for was to try and identify that hydrodynamic threshold above which delta smelt salvage increases markedly. And based on this relationship, what I

concluded was that when reverse flows exceed minus 6,000 cfs, which is one tick to the left of the minus 5,000 number, that from that point on the salvage of delta smelt increases markedly with increasing magnitude of reverse flow.

Q. Why did you use Ms. Green's graphical presentation of the data instead of Dr. Pete Smith's?

A. Well, I considered a couple of things. One is I considered the statistical results of the two different analyses. In this case, Sheila Greene's re-analysis had a very high R-squared and was, you know, statistically significant. Dr. Smith's linear regression was also statistically significant, but had a slightly lower R-squared. I considered the issue that we've talked about already is how the data are portrayed for the range of reverse flow conditions that were included in the analysis.

I considered how the data would reflect the inherent variability that occurs in Old and Middle River flows and delta smelt salvage during the wintertime period and whether or not those relationships were taken into account.

And after I sort of evaluated the statistical underpinning of these two different approaches, I was still unclear as to, you know, the final decision about which of the two I would suggest using.

And what I wanted to find is any time you look at a statistical relationship like this, I think it's important

that you also evaluate and consider the underlying physical processes that influence that relationship.

And I know relatively little about the details of the hydrodynamic and tidal conditions occurring in this part of the estuary. And I had an occasion at one of the workshops to meet with Dr. Gartrel from the Contra Costa Water District and I discussed the two analyses with Dr. Gartrell and asked him his opinion. He's done a lot of work on salinity distribution and tidal hydrodynamics in this part of the estuary, what he felt what might be the underpinning physical process that would influence the shape of a curve such as that derived by Ms. Greene.

And what Dr. Gartrell told me was that as the reverse -- the magnitude of reverse flows become greater in Old and Middle River, it has a progressively greater influence on the relative magnitude of the ebb tide movement within the area. And that as you start moving up to higher and higher reverse flows, you get to a point where the influence of the state and federal water projects overwhelms the magnitude of the ebb flow within these areas.

And in essence, you have then, under those high export rates, a unidirectional pathway of transport that moves fish and other material directly from Old River downstream, should say upstream, into the export facilities in somewhat of a ratcheting effect.

Q. Did Dr. Gartrell share with you the flow at which that overcoming of the ebb tide influence would occur?
A. We talked about the shape of Sheila Greene's analysis and Dr. Gartrell didn't present any real detailed results of hydrodynamic analysis, but it was our discussion that somewhere around 6,000 was the flow, negative flow in Old and Middle River where we would overcome that ebb condition.

And that varies based on flow in the San Joaquin River and the magnitude of tidal flows and a variety of other factors. But at least it gave me a little bit better understanding of what might be occurring there and why the salvage would increase so markedly as reverse flows increase.
Q. You mentioned the R-squared that is shown on State Water Contractor Exhibit N for identification. What is that number?
A. The number on State Water Contractor Exhibit Number N is 0.885 or about 89 percent of the variability is explained by the relationship.
Q. Is that -- in the field that you work in, Dr. Hanson, is that considered a goal R-squared, high R-squared or low R-squared?
A. This would be considered a high R-squared for virtually all of the biological investigations that we've done.
Q. Do you recall what the R-squared was in Dr. Smith's graph of the data?
A. I believe the R-squared on the figure that Dr. Swanson

showed was about 0.61.

Q. Do you share Dr. Swanson's concern that Ms. Greene split the data in to two different months, January and February, rather than analyzing it as one graph over the same period?

A. I share part of the concern that Dr. Swanson expressed. And that's, you know, she had noted that if you have a salvage event that encompassed the two months, but was split between just an artificial calendar date, that you could be misinterpreting the results of these relationships.

But I also am concerned about the variability that's inherent in some of these data. Old and Middle River flows vary substantially over a period of time. And delta smelt salvage also varies substantially over a period of time. Partly in response to hydrodynamic conditions such as Old and Middle River flow, but also partly in response to other environmental conditions in our geographic distribution.

And so as I started to look at that, one of the things that I examined was what kind of variability we have inherent in some of this data and would that suggest that a shorter time period, rather than two months, going to one month, would be a more appropriate way of looking at the data.

In some cases, we might actually adjust the time period that we look at based on the distribution of salvage. We might go down to a two-week time period. There are a variety of judgments that get made.

MR. WILKINSON: Your Honor, I'd like to offer Exhibit N into evidence.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: Exhibit N is received in evidence.

(Defendants' Exhibit SWC N was received.)

BY MR. WILKINSON:

Q. Dr. Hanson, I would like to show you an exhibit that was previously admitted into evidence as plaintiffs' Exhibit 3.

Do you recall seeing that exhibit over the preceding days?

A. Yes, I have.

Q. And is that the Pete Smith graph that we've been referring to?

A. Yes. This is Figure 8 from Dr. Swanson's declaration and this is the Pete Smith linear regression of combined Old and Middle River flows and combined SWP and CVP salvage during the January and February time period.

MR. WILKINSON: Your Honor, do you have a copy of that exhibit? I have a couple questions.

THE COURT: The whole exhibit? This is one figure from it.

MR. WILKINSON: This is one exhibit taken from Dr. Swanson's declaration.

THE COURT: I have the Swanson declarations. I'm not

sure that I have all the exhibits to them. I have --

MR. WILKINSON: I think it's actually from page 12 of Dr. Swanson's declaration.

THE COURT: Well, there are two declarations. And the first is dated -- it doesn't have any -- well, it does have. July 23rd, 2007 of Dr. Swanson. And then --

MR. LEE: Your Honor, it's from the July 23rd declaration of Dr. Swanson. That would be on page 12 --

MR. WILKINSON: Thank you, Mr. Lee.

MR. LEE: -- of her July 23rd declaration, document 421.

THE COURT: All right. I'm on page 12. Yes, I see these figures.

MR. WILKINSON: You recognize that figure. We talked about it quite a bit.

Q. Dr. Hanson, do you recall the discussion that occurred with Ms. Goude about the data point for 1996 that appears in Dr. Smith's graph?

A. Yes, I do.

Q. Have you done any work to further investigate the conditions that existed over the two-month period that were used by Dr. Smith in developing the data point that he shows for 1996 in that graph?

A. Yes, I did.

Q. And can you tell us what you did.

A. What I did was we compiled records of the daily Old and Middle River flows during the January through February time period in 1996.

The data point for 1996 shows, on Exhibit Number 3, a moderately high delta smelt salvage at a reverse flow that looks to be about minus 3800 cfs. And so we've been investigating what the data were that went into this calculation and what underpinnings actually affect that data point.

(Defendants' Exhibit SWC O was marked for identification.)

BY MR. WILKINSON:

Q. Dr. Hanson, I'd like to show you an exhibit that has been marked as State Water Contractors Exhibit O for identification.

Have you seen that exhibit before?

A. Yes, I have.

Q. Can you tell us what it is, please.

A. What it is, it's a figure that shows the daily Old and Middle River flows during the period from January 1 through the end of February, 1996 with a series of histograms. The histograms that point down reflect negative reverse flows. The histograms that point up reflect positive flows in Old and Middle River.

Q. And did you reach any conclusions as a result of the

preparation of this document?

A. What I concluded was that because of the high variability inherent in the Old and Middle River flows during this period in 1996, that when you average over all of these individual data points, by coming up and saying that the average January through February Old and Middle River flow was minus 3800 cfs, you're obscuring the reverse flows in the early part of the period that went down to minus 8,000 cfs by including, in your calculation, substantially lower reverse flows and towards the, you know, end of February actually, positive reverse flows.

When we went back and actually looked at the salvage of delta smelt, what was occurring is that the salvage that was reported in the figure by Dr. Smith occurred during the period when the reverse flows were in the minus 8,000 range. But because of the averaging that was used that resulted in the data point on this graph, what it shows is substantially higher salvage because of the numbers of fish that were salvaged at the minus 8 ,000 level. Corresponding to an average reverse flow over the two month period of minus 3800 cfs or so.

Q. Do you have an opinion as to whether the data point for 1996 on Dr. Smith's graph, which is plaintiffs' Exhibit 3, Figure 8, accurately represents the conditions that actually occurred during that year in the months of January and

February?
A. I think it accurately reflects the average. But I think it's misleading in terms of the interpretation of the relationship. And a better approach to this would have been to have separated the period when the higher reverse flows were occurring, say in January, and presented that set of reverse flow versus salvage estimates separately from the data reported later in that time period.

MR. WILKINSON: Your Honor, I would like to offer State Water Contractors Exhibit O into evidence at this time.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: Exhibit O is received in evidence.

(Defendants' Exhibit SWC O was received.)

BY MR. WILKINSON:
Q. Dr. Hanson, your tier two proposal involves a range of flows that runs from negative 6,000 cfs to negative 1,000 cfs as the lower end of your range; is that right?
A. That is correct.
Q. Can you tell me how you developed the lower end of your range; that is, to say the negative 1,000 end?
A. When I was reviewing the matrix put forward by the Fish & Wildlife Service, the lower end of their range for Old and Middle River flow was zero cfs.

But I work for a variety of different entities in the

Delta, one of which is the Contra Costa Water District and I'm knowledgeable about their diversions from Old River, at their Old River diversion site.

I'm also knowledgeable about the number of other diversions that occur within Old and Middle River, a whole variety of smaller siphons and pump augmented diversions that occur for a variety of purposes.

And I became concerned that if we put forward a proposal that stipulated zero reverse flow in Old and Middle River, that even if the state and federal water projects were completely curtailed, there would still be the opportunity for reverse flows caused by these other sources of diversion from the area.

And so simply recognizing that physical reality, I suggested in my refinements to the matrix that rather than zero reverse flow, it be expanded to minus 1,000 reflecting the influence of these other diversion points.

I also felt that it was inappropriate if we retained the zero reverse flow, that the state and federal water projects would be required to mitigate for the effects of other diverters on the hydrodynamic conditions occurring on Old and Middle River. And I had concerns about how they would actually accomplish that.

Q. How do you think they would accomplish that, Dr. Hanson, if, for example, pumping were completely shut off and there

were still reverse flows in Old and Middle River, what is your expectation of how the projects would mitigate that?

A. My expectation for how they would mitigate that would be through increased releases from reservoir storage on the San Joaquin, principally New Melones Reservoir.

Q. In those circumstances, those releases would be made not to mitigate project effects; is that correct?

A. To the extent that the SWP and CVP are curtailed, it would not be a project related impact, it would be associated with other activities.

Q. Do you have any proposed triggers for your tier two action?

A. The tier two triggers -- since I started with the Fish & Wildlife Service matrix, I felt that many of the triggers that were embodied in the service matrix would also be applicable for triggering tier two.

They would be such things as changes in the distribution of delta smelt within the estuary as reflected in results of the 20 millimeter delta smelt survey or the Summer Townet Survey; it would be triggered in response to changes in delta smelt occurring in the fish salvage facilities at the SWP and CVP. And it could be triggered based on other actions, like an increase in turbidity or a change in hydrodynamic conditions that were consistent with the notion that delta smelt may be moving from areas of low risk into

areas of increased vulnerability in risk to export effects.
Q. In your declaration, Dr. Hanson, of July 23rd, you also describe a 500,000 acre foot water increment to be used for your tier two measures; is that right?
A. Yes, I did.
Q. What was the source of that suggestion?
A. The source of that suggestion, and again, came from the earlier declarations submitted in this proceeding by the US Fish & Wildlife Service.

In that particular instance, it was from the declaration of Steve Thompson.
Q. And do you recall what Dr. Thompson was proposing?
A. What he --
Q. Mr. Thompson. I think I --
A. Yeah, it's Mr. Thompson. What he was proposing, as I understood it, was that there would be some allocation of water, in this case 500,000 acre feet, that would be devoted to implementation of the actions embodied in the matrix.

My understanding is that that was not to be considered to be a cap or an ultimate constraint on the implementation, but rather was to be a milestone where, after that allocation had been expanded, there would be a re-analysis of the performance of the actions, how well they're working to achieve their objectives, whether delta smelt continue to be at risk of significant impacts. And the

decision would be made at that time as to whether or not additional resources should be allocated for this purpose.

Q. So you use that 500,000 acre foot increment in your tier two measure as kind of a mid course correction rather than a cap?

A. It was not intended to be a cap. It was intended to be a point where there was a given milestone that the various parties working on this issue could reconvene, could evaluate the program and could make adjustments if necessary. But it wasn't ever intended to be a constraint or a cap on that activity.

Q. I'd like to turn your attention, Dr. Hanson, to your tier three measure. Would you tell us what that is and how it would work.

A. Tier three, at least in my mind, was kind of the ultimate level of protection. And what it includes is an immediate reduction in SWP and CVP export operations in the event that we do have an increased level of delta smelt salvage or risk of entrainment.

Q. What would be involved in this curtailment you described?

A. What would be involved is if we had evidence that delta smelt were experiencing a greater risk of entrainment mortality than we originally had expected -- for example, that might be evidenced by an increase in the numbers of delta smelt showing up in the salvage -- that would be tied then to

a triggering event that, in my mind, would be based on these order of magnitude of population levels of delta smelt at the time.

And if that trigger event is exceeded, then there would be an immediate curtailment of exports for a period of four days. And the period of four days would then allow the biologists and the operators to re-evaluate what's going on in the Delta, look at the data that's been collected, possibly collect additional data. Make a decision at the end of that period as to whether or not the evidence suggests that delta smelt have no longer the risk of entrainment or make the conclusion that delta smelt continue to remain in the area of vulnerability and the curtailment should be extended.

Q. In your declaration, Dr. Hanson, you said that the implementation of your tier three measure would depend upon a showing of a dramatic increase, your words, in delta smelt salvage. How would you propose that that determination be made?

A. Well, what I intended by the concept of a dramatic increase is that let's hypothetically assume that we're going through a season and no delta smelt have been collected at the export facilities. And then all of a sudden one delta smelt is collected. In my mind, that wouldn't be the kind of event that would trigger this type of an action.

But rather, if we use the order of magnitude

population approach, and through consultation with the appropriate agencies, the Fish & Wildlife Service, the Department of Fish & Game, we could agree upon some trigger that is reflected by the expanded salvage that would be protective of delta smelt, but would also trigger that there really is an issue here that needs immediate attention, then that would be the type of event that would trigger this action.

Q. Do you recall Dr. Swanson's concern that waiting until a dramatic increase in salvage occurs is like shutting the barn door after the horse is stolen?

A. I do remember that.

Q. Do you agree with that comment?

A. I do. And I agree with it in the sense that our tier one and tier two are explicitly intended to prevent that kind of an occurrence. We'd like to avoid the occasion where delta smelt are showing up in the salvage. But that doesn't completely preclude the chance that those kind of events could occur.

And under that extreme event, we wanted an action that was quick to implement and would protect the smelt and would allow an opportunity for folks to further evaluate the next step of actions.

Q. Dr. Hanson, do you believe that a process of consultation of the sort we've described regarding pumping curtailment or

pumping increases is preferable to a fixed take limit?
A. I do for the reason that -- I don't know how best to say this. In the past, when we've established pre-determined fixed take limits, from my perspective, we've almost always been wrong. And partly because we've established a numeric level that is largely independent of what's happening to the population of smelt in any given year.

It seems to me that it's more appropriate that you have triggers that are based on your expectation of the population level and are responsive to what's occurring within a year as the population increases or decreases.

And let me just give you an example. If we had pre-determined that a trigger of 10,000 delta smelt would be necessary to trigger this action three event, and our order of magnitude estimates determined that there's about 100,000 delta smelt in the population, that trigger would not be adequately protective at that low population level. We'd want it to be more responsive and to be adjusted in accordance with what's going on within the population.
Q. Using your example, what would you anticipate would occur under your proposed tiering actions in terms of dealing with allow the take and triggering various actions that you have described?
A. Well, what I envisioned is that, depending on the order of the Court and how this proceeds, that there would be occasion,

between now and December, that the resource agencies would reconvene, we would review the available information on the current status of the delta smelt population and triggers would be debated and would be established that would, in view of the Fish & Wildlife Service and the other agencies, be responsive to the conditions that are occurring.

And that those would then not only be put into place, but they would be periodically revisited and refined as necessary as we go through the interim period as new information from the Fish & Game surveys becomes available.

Q. Dr. Hanson, it has been suggested that your proposed modifications to the matrix amount to business as usual. Do you recall that?

A. I do recall that.

Q. Do you agree?

A. I don't. I don't think any of the three proposals could be ever characterized as business as usual. All of the proposals include additional constraints and requirements for export project operations, whether it be through maintenance of a positive flow in the lower San Joaquin River, whether it be through maintenance of Old and Middle River flows within a given range or whether it be the immediate curtailment of export operations.

None of those are considered to be business as usual. And I think that's reflected in the fact that all three of

these proposals have very large water supply impacts exceeding a million acre feet in many of the model runs that we've looked at. So I can't see where any of those things could be characterized as business as usual during the interim period.

Q. Dr. Hanson, before we move off of that particular subject, do you recall any estimates of the water supply impact of these measures?

A. You know, I didn't pay a lot of attention to the water supply impact issue. But in the course of looking at the various proposals and the refinements, we certainly exercised the CALSIM II model to look at the water supply impacts for the various proposals on the table. And we use some of those results in the modifications that I've proposed in the actions embodied in this proposal. My recollection is that for many of these actions, the incremental impact was in the hundreds of thousands of acre feet.

Q. Another of your suggested measures, Dr. Hanson, involves the possible construction of a temporary physical intertie. Do you recall that?

A. I do recall that.

Q. Would you explain what you have in mind and how that would operate?

A. Can I approach the map?

Q. Sure.

Is that all right, Your Honor?

THE COURT: You may approach.

THE WITNESS: Well, as you can see from the map, the State Water Project and the Central Valley Project export facilities are located in relatively close proximity to one another. And what we've seen, as we looked at the salvage data from previous years, is that there are a number of occasions where the salvage of delta smelt is substantially different between the State Water Project and the Central Valley Project despite their being closely located, you know, in that section of Old and Middle River.

What we wanted to do is to see if there was an opportunity, through some kind of a temporary physical structure, that we could increase the operational flexibility that would allow preferential diversion operations from that intake that had the lowest risk of entraining delta smelt.

And one of the constraints then is if you were to curtail SWP exports and preferentially operate the CVP diversion, would there be a way to move water from the distribution system of one project to the next to meet the downstream demands for human health and safety and to meet other water supply requirements? Currently we don't have that kind of a physical facility in this region of the system.

But you can see, since the two projects parallel each other and come close together geographically, it didn't seem to me that it would be that difficult, from an engineering

standpoint, to either put in pumps and a pipe or put in some kind of a temporary canal that would allow water to be redistributed from one intake side to the distribution network of the other facilities. And thereby provide opportunities to reduce water supply impacts while also increasing the level of protection of delta smelt through preferential diversion operations.

BY MR. WILKINSON:

Q. Has the concept of preferential pumping at one plant or the other been raised by anyone else, to your knowledge?

A. It has. This is an old concept that's been, you know, discussed as part of the Bay-Delta proceedings for a number of years. It was actually called the Joint Point Proposal that was included in the State Water Resources Control Board D 1641. It was a little different concept than what I'm proposing here, but the idea of preferential operation of diversion locations in response to changes in fish density has been around for a long time.

Q. Are any of your tier one, tier two or tier three measures contingent upon the construction of an intertie?

A. No, an intertie would provide additional operational flexibility. I think it's a good idea. But there's certainly other obstacles in terms of environmental documentation, of permitting and construction. None of the tier one, tier two or tier three actions are dependent upon this. It would

simply be an augmentation to the flexibility of the operations.

Q. Dr. Hanson, why don't you go ahead and resume your seat.

In the course of your analysis, did you make any evaluation of whether operation of the State Water Project and Central Valley Project, in accordance with the modifications you've suggested through your tier one, tier two and tier three measures will avoid jeopardy to the delta smelt during the period prior to the issuance of a new Biological Opinion?

A. I did. And as I mentioned in terms of my analysis of the Fish & Wildlife Service proposal, we considered what the modeling was telling us about changes in hydrodynamic conditions in response to these types of actions. We were considering how these types of actions could be responsive to changes in the geographic distribution of delta smelt and, correspondingly, their risk of adverse impacts associated with water project operations. We were cognizant of the short period of the interim remedies extending from 12 to 18 months.

And I took a lot of comfort in the fact that within our range, if the conditions warrant and the delta smelt are at risk, there are the opportunities to exercise extreme constraints on water project operations that would provide a higher level of protection for delta smelt.

It simply provides more flexibility in how you can make those choices, depending upon the level of risk that the

delta smelt is under. Given those various constraints and the opportunities to provide a range of levels in response to the delta smelt distribution and its risk, I felt that this would be protective and would avoid jeopardy during the short period.

Q. Did you undertake an evaluation of whether operation of the state project and federal project in accordance with the modifications you've suggested would avoid adverse impacts to critical habitat?

A. We did. We considered looking at the modeling if there would be an effect on the X2 location during the February through May period. Also in the event that we have tier one, that would provide better hydrodynamic conditions in the estuary than have occurred under many of the previous years. If tier two were to be invoked, then there would be further improvements in the hydrodynamics in Old and Middle River compared to some of the base conditions.

So I felt that through those various actions, there would be not only the level of protection for delta smelt, but from a hydrodynamic perspective, it would also contribute to improved habitat conditions, not only for delta smelt, but for other resident and migratory fish within the estuary.

Q. In light of the recent catch data indicated by survey five of the Summer Townet Survey, have you changed your opinions with regard to either jeopardy or adverse modification?

A. I haven't changed my opinions with regard to the performance of the program. What I have changed is my opinions with respect to the kinds of monitoring and the sensitivity of the triggers that would be necessary under these lower new population levels.

And I've also changed my opinion when -- I thought there was, for example, in excess of a million delta smelt in the population. My expectation at that time was that we had a higher degree of flexibility and would be able to exercise our operations more towards the upper end of the range of operations. Under the lower levels of population that appear to be present in the system now, I've changed that opinion. And I think that it's more likely, in order to provide the level of protection, that we would exercise operations at the lower end of that range.

But that decision wouldn't be pre-determined. It would be based on the conditions, the hydrodynamic conditions and the geographic distribution of smelt and their risk at the time those decisions were to be made.

Q. And is it your belief that the modifications to the matrix that you've proposed would provide sufficient, if you will, flexibility to make the changes you've described?

A. Within the tier two, for example, we could go anywhere from minus 1,000 to minus 6,000. There isn't anything that locks you in to one particular part of that range or another.

So the way I view it is that you've got large flexibility in exercising your judgment as to where that level of protection should be given the level of risk.

Q. You mentioned that your opinions had changed with regard to the monitoring that might be necessary and also the triggers. Would you elaborate on that, please?

A. That as the order of magnitude estimate of population abundance goes down, I think the triggers that we would use from moving from one tier to the next need to become more sensitive and need to be lowered so that we're making those actions earlier and in response to the occurrence of fewer delta smelt than we would have made had the population levels been higher.

Q. Have you discussed, Dr. Hanson, your proposed modifications to the Fish & Wildlife Service action matrix with anyone at the State of California or with Fish & Wildlife?

A. I have. I had an occasion to meet with Jerry Johns and others during the preparation of declarations, to review the draft matrix that was being developed at that time. We provided to the Department of Water Resources some additional thoughts and ideas that we were thinking about in terms of modifications to those elements of the matrix.

We subsequently had an occasion to have a meeting with the Fish & Wildlife Service, the Department of Fish &

Game, the Bureau of Reclamation and DWR, where we presented to them the outline of our three tiered approach. We discussed the underpinning philosophy behind our approach and what we were trying to accomplish. And that was all prior to submittal of my July declaration.

The purpose of that meeting was several fold. We weren't asking for their approval or endorsement of our proposal. We were using it as an opportunity, among colleagues, to, first of all, avoid surprises so that they knew what we were thinking and what we were likely to propose. It also gave us an opportunity to solicit their feedback and insight into areas that they thought were -- you know, needed further refinement or areas that should be further, you know, discussed and deliberated.

Q. Did the agencies provide you with any response?

A. They did in the course of the meeting. We had a good discussion about, you know, the particle tracking modeling and, in fact, Dave Fullerton made a presentation to the group while some of us were away, showing them the results of the particle tracking modeling and some of the foundation for our tier one activities. We had a good dialogue about the idea of monitoring and triggers and how some of that could fit together.

Subsequently -- but there was no agreement at that time in the meeting. Subsequently, the Department of Water

Resources, through the declaration of Jerry Johns in early August, did endorse one of our proposed actions. And that was the modification of the Old and Middle River flows in the matrix to extend to a minus 6,000 cfs.

Q. That was the upper end of the range that was proposed as part of your tier two modification?

A. It was.

Q. Was there any other response, Dr. Hanson?

A. I think the other response that we had -- and it's the kind of response that we have had consistently throughout, you know, the years of working on these things, was a desire to continue the dialogue, to continue working together, to look at these kind of actions.

For example, we had some feedback that, you know, this idea of maintaining a positive net westerly flow had merit, but that there was additional information and additional analyses, additional particle tracking that would be beneficial to further evaluate and assess that particular action.

And what we agreed was that that was true. That further discussion throughout this process and continuing well beyond these proceedings would be a valuable thing to continue to do.

Q. Thank you. Dr. Hanson, are you familiar with the interim actions proposed by Dr. Swanson?

A. I am.
Q. Is it your understanding that Dr. Swanson proposes to limit flows in Old and Middle River to a target of not more than 3500 cubic feet per second over the period December 25 through February?
A. Correct.
Q. Is that her action number four?
A. I believe so, yes.
Q. What's your understanding of the purpose of that action?
A. The purpose of that action is to provide increased levels of protection for pre-spawning sub-adult delta smelt during that wintertime period prior to spawning.
Q. Are you aware of any estimate of the impact of implementing her action number four, Dr. Swanson's action number four, on the project exports?
A. I had seen some preliminary estimates that suggested that that would be in the order of hundreds of thousands of acre feet.
Q. What's your understanding, Dr. Hanson, of the basis for Dr. Swanson's action number four?
A. Well, as Dr. Swanson presented in her declaration and subsequently in her testimony, the primary source of information that she was using for that particular action were the regression analyses developed by Dr. Smith that show the relationship, the linear relationship between Old and Middle

River flows during January and February and the number of delta smelt salvaged during that time period.

Q. Dr. Hanson, we've seen the regression graph that was part of Dr. Swanson's declaration. I'd like to hand you a document that's been marked as State Water Contractors Exhibit P.

(Defendants' Exhibit SWC P was marked for identification.)

BY MR. WILKINSON:

Q. Have you seen that document before?

A. Yes, I have.

Q. Can you tell me what it is?

A. What it is is a PowerPoint presentation that was presented at the 2006 Environmental Water Account workshop on November 28, 2006 by Pete Smith.

Q. If you turn to the -- well, before that, strike that question.

Can you tell me where you obtained this document, Dr. Hanson, and when?

A. I obtained this when I was preparing my August declaration. I was away from my office and I wanted to look at the information that Dr. Swanson had included in her analysis on the relationship from Pete Smith. And so I simply went to the website and I pulled off this presentation to the EWA conference for that relationship.

Q. If we look at the second page to the regression or

regressions in this case, they appear to be somewhat different than the graph that was provided by Dr. Swanson in her declaration. Could you describe what the differences are?
A. There are two primary differences. One is that this figure has, on the upper panel, the relationship between delta smelt salvage and combined Old and Middle River flows for the January through February period. And on the lower panel, similar graph that shows the relationship between delta smelt salvage and SWP and CVP export rates during that time period.
The other difference is that this one has a large "draft - subject to revision" stamped across it.
Q. Is there also a difference in the R-squared value shown in the upper graph?
A. There is. In the graph that Dr. Swanson includes in her declaration, the R-squared is reported as 0.61. In this regression, it's reported as 0.55.
Q. Do you have any understanding of the reason for the change in the R-squared?
A. I don't. Other than the possibility that Dr. Smith, you know, re-analyzed it or -- I simply have no idea.
Q. And again, was it your testimony, Dr. Hanson, there have been changes within the past month?
A. I did.
Q. To your knowledge, has the work undertaken by Dr. Smith been published or peer reviewed?

A. To my knowledge, it has not been either published or peer reviewed.

MR. WILKINSON: Your Honor, I would like at this time to offer State Water Contractors Exhibit P into evidence.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: Exhibit P is received in evidence.

(Defendants' Exhibit SWC P was received.)

BY MR. WILKINSON:

Q. Dr. Hanson, are you also familiar with Dr. Swanson's fall salinity measure number ten?

A. I am.

Q. What's your understanding of the purpose of that proposed measure?

A. My understanding is that her proposed action number ten, which includes maintenance of the X2 or the 2 part per thousand isohaline at Kilometer 80 would occur during the fall period extending from September through December for the purposes of improving delta smelt habitat within the central portion of the Delta.

Q. What is your understanding of the basis for Dr. Swanson's proposed action ten?

A. My understanding, there have been two relatively recent analyses that have looked at this relationship between delta smelt habitat and fall salinity. One of those was a

statistical analysis presented by Gurein from the Contra Costa Water District. And the second was an analysis, a statistical analysis of water quality effects related to environmental quality for delta smelt during the fall published by Fred Feyrer and Matt Nobriga and Ted Sommer.

Q. Do the Gurein and Feyrer analyses demonstrate causal relationship or cause and effect relationship between fall salinity and delta smelt abundance?

A. No. What they reported are statistical relationships and it's difficult to tell whether those are causal relationships or simply correlations.

Q. What is the difference in your understanding between a causal relationship and a statistical correlation?

A. Causal relationship is one in which one variables drives the response of your second variable. A correlation is where two variables might be related independently to a third variable. And therefore are not directly linked, but are linked through some intermediary factor.

Q. Do statistical correlations provide or identify any underlying relationships?

A. Statistical correlations may identify underlying relationships. They're frequently used as the basis for hypothesis testing and for additional data collection. They're used for examining the underlying physical processes that may be driving the specific response of a given, in this

case, delta smelt to some environmental condition. So they're used for a variety of purposes.

Q. Do they provide the mechanism?

A. They don't provide the mechanism.

Q. Dr. Hanson, I'd like to show you a document that has been previously marked for identification as State Water Contractor Exhibit E. Do you recognize that document?

Do you recognize that document?

A. Yes, I do.

Q. Could you tell us what it is?

A. This is a review of the 2005 Environmental Water Account Workshop prepared by James Anderson from the University of Washington. It's dated January 2006.

Q. Have you seen SWC Exhibit E previously?

A. I had seen it previously.

Q. It appears to relate to an EWA Workshop. Do you know what those are?

A. Yes, I do.

Q. What are they?

A. The Environmental Water Account is a program that has been established through the CALFED program. It's designed to have an allocation of water that can be used for environmental enhancement purposes. And as part of that process, a number of questions arose about the performance of water allocations for different uses and the resulting biological response that

was achieved through those allocations.

And so as part of that annual review process, an EWA Workshop is convened where a variety of investigators come together. They're both investigators working on the Bay-Delta Estuary, conducting analyses, looking at various factors, but it also includes independent scientists from outside the area that are brought together to share ideas, to share results of analyses and to provide guidance to the program as to where further refinements or additional emphasis should be placed in the future.

Q. Did you obtain a copy of Dr. Anderson's paper yourself?

A. Yes, I did.

Q. How did you do that?

A. I obtained it by going on the website for the CALFED EWA program and downloading it.

Q. Did you have an opportunity, Dr. Hanson, to examine the copy of the paper that I've handed to you?

A. I did.

Q. Did you compare that copy with the copy that you obtained from the EWA website?

A. I did.

Q. Are they the same?

A. They are.

Q. Do you review the papers that are issued by the EWA Independent Science Review Panel following the workshops?

A. There is so much material that's produced currently as part of our investigations of fisheries and habitat conditions in the system that it's important for scientists to be aware of what's going on and what are the new developments and the new insights. It's just virtually impossible to actually review in detail all of the various documents that are being produced.

And so part of my work is to be aware of these things. I attended this workshop. I was aware that, you know, this was underway. But I simply don't review and detail all of these various documents.

Q. Did you consider Dr. Anderson's paper, the one you have in front of you, in developing your opinion about statistical correlations?

A. I did. And Dr. Anderson serves on the National Marine Fisheries Service Central Valley Salmonid Recovery Team and he and I and Dr. Swanson and others have discussed similar kinds of analyses in the past.

MR. WILKINSON: Thank you. Your Honor, at this time I'm going to offer state water contract Exhibit E into evidence.

THE COURT: Any objection?

MR. WALL: No objection, Your Honor.

THE COURT: State Water Contract Exhibit E is received in evidence.

(Defendants' Exhibit SWC E was received.)

BY MR. WILKINSON:

Q. Dr. Hanson, the Gurein analysis that you referred to strike that. What is the Gurein analysis that you referred to?

A. The Gurein analysis was a statistical analysis that was designed to investigate the potential relationships between fall salinity as measured at Jersey Point and the subsequent abundance of delta smelt.

Q. Did Gurein use the most recent data available in setting up his analysis?

A. It's a she.

Q. I'm sorry.

A. And she used the most available information at the time that she had prepared her analysis, which was several years ago.

Q. Did her analysis include the three most recent years of data?

A. It did not.

Q. Have you examined the results, if those three most recent years of data are added to the Gurein analysis?

A. I have. Dave Fullerton from the Metropolitan Water District has been working on, you know, re-analyzing those relationships. And one of the most powerful tools that we have for evaluating these kind of statistical relationships is

to determine whether or not the previous relationship accurately predicts future events.

And so one of the most powerful tests that you can apply is to use the previous relationship to see whether or not it predicts the relationships in more recent years that were not included in the original statistics. And that's what Dave Fullerton did.

And what it shows is that the more recent data do not conform to the earlier predictions.

(Defendants' Exhibit SWC Q was marked for identification.)

BY MR. WILKINSON:

Q. Dr. Hanson, I'm going to hand you a document marked State Water Contractors Exhibit Q for identification.

Have you seen that document before?

A. Yes, I have.

Q. Can you tell us what it is, please?

A. This is the declaration of David Fullerton in these proceedings.

Q. And that declaration was filed on or about August 13th, 2007; is that right? If you can look at page ten, Dr. Hanson, you'll see a date on there.

A. Thank you. Yes, it was August 9th.

Q. And is that the analysis by Mr. Fullerton that you were describing?

A. Yes. I'd been having discussions with Mr. Fullerton for quite some time, as well as with Dr. Gartrell and others about these analyses.

Q. And Dr. Hanson, did you rely on the analysis shown in State Water Contractor Exhibit Q in formulating your opinions about the Gurein analysis relied upon by Dr. Swanson?

A. In part I did.

MR. WILKINSON: Your Honor, I'm going to move Exhibit Q into evidence.

MR. WALL: Your Honor, we're going to object to that on several different grounds. This is a non-testifying expert. Exhibit Q has not been redacted. We understood that redacted versions would be provided to us. We have not had an opportunity to review the version Mr. Wilkinson gave us this morning and would reserve our right to make objections on that basis.

In addition, there are certain attachments to this that were not placed in evidence during the written evidentiary phase of this proceeding. They were not submitted to the Court and we will need a chance to look at them and see what they are.

MR. WILKINSON: Your Honor, this declaration is one of the declarations that we did provide to the plaintiffs' counsel this morning. And it is one of the declarations we intend to offer into evidence in this proceeding. It may be

that we should simply mark it at this time and then when Mr. Fullerton is available for cross-examination, we can move it at that time.

THE COURT: I think that would be fairer.

MR. WILKINSON: Okay.

THE COURT: Let us mark -- it is marked SWC Q for identification.

As to the objection that it is hearsay, it is hearsay relied on by an expert, which is permitted. However, that reliance doesn't make the underlying concept admissible. And since the plaintiffs haven't had a chance to review or to ascertain the complete exhibit, its contents, we will reserve rulings both on the ground of improper opinion or other content and as to the agreement that you were going to redact parts of this.

MR. WILKINSON: Actually, we did provide a copy and we did not redact any of the material in that declaration. So what we gave the plaintiffs this morning was, in effect, a redacted copy but no redactions were made.

THE COURT: All right.

MR. WILKINSON: We thought the full declaration was appropriate. So --

THE COURT: You gave the plaintiffs all the exhibits?

MR. WILKINSON: Yes, we did.

THE COURT: All right. What time did you give it to

them this morning?

MR. WILKINSON: Oh, I think it was probably about 8:45. So I'm happy to just simply mark it at this time.

THE COURT: Yes.

MR. WILKINSON: And we'll move it on Friday.

THE COURT: That's the way we'll leave it. You can move its introduction and I can rule on whatever objections are raised at that time.

MR. WILKINSON: Could I have just a moment, Your Honor?

THE COURT: Yes.

BY MR. WILKINSON:

Q. Dr. Hanson, I'm going to give you a document which has been previously admitted into evidence as plaintiffs' Exhibit 5.

Do you recognize that article?

A. Yes, I do.

Q. Can you tell us what that is, please?

A. This is the article dated 2007 by Fred Feyrer, Matt Nobriga and Ted Sommer titled "Multidecadal trends for three declining fish species: Habitat patterns and mechanisms in the San Francisco Estuary, California, USA."

Q. Have you had an opportunity to review that article, Dr. Hanson?

A. Yes, I have.

Q. From that review, do you recall whether the authors of the article viewed their correlation of salinity and EQ, or environmental quality, to be the basis for directing water supply management actions?
A. No. I believe that they have a statement in their discussion that says how these results would be used for making management decisions is still uncertain.
Q. Do you recall whether the authors of this article believe they had all the data that they needed to make their statistical correlation effective for species management?
MR. WALL: Objection. I don't think there's a basis established for the witness to testify --
THE COURT: Sustained. Lay the foundation.
BY MR. WILKINSON:
Q. Dr. Hanson, if you would turn to page 732 of the article. Above the word "Acknowledgments." Would you read the last sentence that appears above that heading?
A. Starting "Moreover"?
Q. Yes.
A. "Moreover, for the water quality data to be most effective for species management, additional information is needed to better define the mechanisms for the effects of water quality variables on aquatic organisms."
Q. Do you agree with that statement?
A. Yes, I do.

Q. Do you recall Feyrer in the article indicated that there could be other causes of declines in delta smelt abundance?
A. They do discuss other potential causes of decline in delta smelt.
Q. Do you agree that there are other potential causes of the decline in smelt abundance other than the state and federal projects?
A. I do believe that there are cumulative impacts from a wide variety of different sources of mortality and factors affecting habitat quality and availability that include the state and federal water projects, but also include a wide variety of other factors, such as toxics and pollutants, the effect of exotic introduced species on the trophic dynamics of the estuary, changes in nutrient phytoplankton and zooplankton production. Predation mortality. Exposure to other unscreened diversions within the Delta. There are a variety of factors that influence delta smelt.
Q. Do you recall whether the authors of the Feyrer article conducted any analysis of whether salinity is related to the presence or absence of delta smelt?
A. As I mentioned, the Feyrer analysis utilized the data collected from the Department of Fish & Game Fall Midwater Trawl Surveys. And as part of those surveys, each of those samples, the department also records the salinity, the water temperature, the water depth and the electrical conductivity

are a measure of salinity. So yes, salinity was included as one of their habitat or water quality parameters.

Q. Dr. Hanson, I'd like to hand you a document marked as State Water Contractors Exhibit R for identification.

(Defendants' Exhibit SWC R was marked for identification.)

BY MR. WILKINSON:

Q. Have you seen that before?

A. Yes, I have. This is table one taken from the Feyrer article.

Q. What is the R-squared shown by Table 1 of Feyrer with regard to specific conductance?

A. The R-squared value is reported in the parentheses. And for delta smelt, the R-squared value for the row titled specific conductance is 18.6.

Q. What does an R-squared value of 18.6 mean to you?

A. That means that the relationship that has been put forward for the presence of delta smelt as a function of salinity is relatively weak. That it explains only about 18 percent or 19 percent of the variation in that particular parameter.

Q. And in this case specific conductance is a term of more salinity; correct?

A. Specific conductance is a term for salinity.

MR. WILKINSON: Your Honor, I'd like to move Exhibit R for identification into evidence.

THE COURT: Any objection?

MR. WALL: None.

THE COURT: Exhibit R is received in evidence.

(Defendants' Exhibit SWC R was received.)

BY MR. WILKINSON:

Q. Now, is it your understanding, Dr. Hanson, that Feyrer does reference the concept of EQ in his paper?

A. They do develop the concept of EQ based on their three measurements of water quality parameters.

Q. And those were the measurements of salinity, turbidity and temperature?

A. They were the measures of salinity, temperature and the Secchi disk.

Q. Secchi disk.

A. Which is a measure of transparency of the water.

Q. Thank you for the correction. Does that definition of EQ that you just provided, as it appears in Feyrer, include all of the factors that could affect habitat quality?

A. No. Fish respond to a variety of factors, including water quality parameters such as those that are described here. But they also respond to other factors, such as water velocity or turbulence, presence of overhead cover, availability of prey, presence of predation or other predators. So a variety of factors go into the determination of habitat quality.

Q. What does Feyrer conclude about EQ with regard to delta

smelt?
A. What he concludes in this paper is that over the entire Delta, there has been a decline in the index of environmental quality for delta smelt. And I believe he concludes that that decline in the environmental quality has been significant.
Q. Was that finding of a decline in habitat quality or EQ consistent throughout the estuary?
A. No, it wasn't.
Q. Was there any area of the estuary Feyrer concluded that EQ had actually increased over time?
A. Feyrer ran separate regression analyses between his index of environmental quality over time for the individual sampling stations where the fall midwater trawl is conducted. And those are roughly the same stations that we show on our Exhibit H in the green dots.

And what he found in doing that analysis is that there was one station near the confluence between the Sacramento and San Joaquin Rivers where his regression analysis showed a statistically significant positive relationship between environmental quality over time.
Q. If you would approach the map. Could you show us on the map where that confluence station is?
A. I don't remember which specific station he was looking at. But the confluence between the Sacramento and San Joaquin River is located in this general area about Station 801. 520,

513 located in station grids A4 and A5.
Q. And approximately how close is that to Kilometer 80?
A. Kilometer 80 is opposite Broad Slough and Collinsville. So it's within just a number of kilometers. A relatively few kilometers upstream from Kilometer 80.
Q. Dr. Hanson, why don't you resume your seat. I'd like to hand you a document that has been marked for identification as State Water Contractor Exhibit S.
(Defendants' Exhibit SWC S was marked for identification.)
BY MR. WILKINSON:
Q. Have you seen that Exhibit before, Dr. Hanson?
A. Yes, I have. This is Figure 6 from the Feyrer article.
Q. Can you tell us what Figure 6 describes?
A. What Figure 6 presents are the results of his regression analyses of environmental quality over time for individual stations for delta smelt.
Q. And is it the case that Mr. Feyrer did regressions for each of the stations for which smelt -- from which smelt were collected?
A. He did.
Q. And is Figure 6 an indication of what he found by doing those regressions?
A. This presents the overall results of those regressions from each of the individual stations included in his analysis.

Q. Can you tell us what Figure 6 shows, Dr. Hanson?
A. Well, what Figure 6 shows is a map of the Delta and Suisun Bay. It has a series of dots on the map reflecting the fall midwater trawl sampling sites. Some of those dots are solid circles and some of those dots are open circles.
Q. What do the solid circles represent?
A. The solid circles reflect a statistically significant regression between environmental quality over time showing that environmental quality at those stations has declined over time.
Q. And what do the open circles indicate?
A. The open circles indicate that there was no statistically significant relationship between environmental quality over time.
Q. Can you tell us, looking at Figure 6, Dr. Hanson, where Kilometer 80 would be on this figure?
A. Kilometer 80 would be upstream of the Sacramento and San Joaquin River confluence, roughly above the dash between the range of values of minus 0.003199 and minus 0.0.
Q. So directly above that dash would be the area where Kilometer 80 would be?
A. Roughly so, yes.
Q. And is Kilometer 80 surrounded by closed circles or open circles?
A. It's surrounded by open circles.

Q. And again, what is the significance of that?
A. The open circles were regressions from the Feyrer analysis that did not show a statistically significant relationship between environmental quality over time.
MR. WILKINSON: Your Honor, I'd like to move State Water Contractor Exhibit S into evidence.
THE COURT: Any objection?
MR. WALL: No objection, Your Honor.
THE COURT: Exhibit S is received in evidence.
(Defendants' Exhibit SWC S was received.)
BY MR. WILKINSON:
Q. Dr. Hanson, if the state and federal projects are not required to meet the terms of Dr. Swanson's proposed action ten, are there any other requirements on the projects that would affect salinity at Kilometer 80 in your opinion?
A. There are several other factors. The water projects comply with upstream release requirements as outlined in FERC, requirements as outlined in biological opinions for the protection of upstream habitat for salmonids.
There are also water quality standards within the Delta. As part of D 1641, there's a water quality standard year round to protect water quality from salinity intrusion at the Contra Costa Water District Pumping Plant Number One. That criteria is the maintenance of water quality with a salinity not to exceed 250 milligrams per liter year round.

There are also municipal and agricultural water quality standards that are applicable in the Delta at different times of the year to protect in-Delta agriculture as well as municipal and industrial uses. And as part of D 1641, there are also outflow requirements. And those are intended to provide for fishery habitat.

Q. Dr. Hanson, have you made a determination of what the expected salinity would be at Kilometer 80 this fall if Dr. Swanson's action number 10 is not implemented?

A. I was asked to make that determination. And the way I approached it was two-fold. One, as I mentioned, Dr. Greg Gartrell from the Contra Costa Water District has been complying and analyzing extensive salinity information from this region of the Delta. And from Dr. Gartrel's perspective, his interest is that water quality, primarily salinity at the Contra Costa Pumping Plant Number One, which is --

Q. Can you point out where that is on the map?

A. It's located in Section A5 immediately upstream of Station 802 on this map.

Q. Thank you.

A. So as a result of their interest in salinity intrusion at Rock Slough as well as into the Old River area, they've compiled extensive databases and information on salinity within this area.

The second thing that is available are the results of

the DSM II salinity modeling and they can predict salinity distribution within various locations of the Delta within different operating and hydrologic conditions.

Using the results of the information available from Dr. Gartrell as well as the results from the DSM2 modeling, I estimated that salinity in the fall in this area would likely be in the range from about 3 to 4.5 parts per thousand.

Q. Are salinities of 3 to 4.5 parts per thousand within the range of salinity tolerance of the delta smelt?

A. Based on the information that's available and the testimony from Dr. Moyle, yes, they are.

Q. Are you aware of any study that has attempted to calculate the change in abundance of delta smelt that would occur if fall salinities at Kilometer 80 are 3 to 4.5 parts per thousand rather than 2 parts per thousand?

A. I'm not aware of any analysis of that.

Q. Do you have opinion, Dr. Hanson, as to whether there is currently sufficient habitat for sub-adult delta smelt in the area of Kilometer 80?

A. There is habitat that falls within the appropriate salinity range throughout the central region of the Delta. As I've mentioned in the past, frequently sub-adult delta smelt are found concentrated in the lower Sacramento River in the vicinity of Decker Island, basically about Station 706 on Exhibit H.

And these areas have supported large populations of delta smelt in the past. Appear to have suitable habitat in the fall to support those populations. And although we have not done a specific analysis of this, it appears to me that based on the low populations of sub-adult delta smelt that we anticipate to occur in the system this coming fall, it doesn't appear to me that habitat, the physical volume of habitat, would be a limiting factor affecting delta smelt this fall.

Q. Is it also your understanding, Dr. Hanson, that action ten in Dr. Swanson's matrix is intended to address food availability issues related to the Asian clam Corbula?

A. That's one of the underlying hypotheses that has been put forward recently is that variable salinity regimes may have benefit in altering or reducing the abundance or distribution of some of the benthic foraging, such as the overbite clam.

Q. Does Dr. Swanson cite any particular source for her proposed use of X2 to control the clam?

A. I believe that she cites the work of Dr. Jan Thompson from USGS.

Q. Are you familiar with the work that has been performed by Dr. Jan Thompson regarding the clam?

A. I am. The most recent presentation I've seen was at the CALFED Variable Salinity Workshop.

Q. Based upon your attendance and understanding from that workshop, is it your opinion, Dr. Hanson, that Jan Thompson's

work supports Dr. Swanson's proposal to use project water to increase food availability by controlling the salt water clam?
A. No, I think the work that Dr. Thompson put forward basically showed that there's a high degree of uncertainty as to how the brackish water clam Corbula would respond to variation of salinity within this range and magnitude. It also depend on how long that salinity would be held.

Another question that arises is we have two clams that have invaded the estuary that are significant benthic filter feeders. We have the brackish water clam Corbula, which primarily inhabits the area in Suisun Bay and encroaching into the Delta. But we also have the fresh water Asian clam Corbicula, which inhabits the fresh water portions of the upstream tributary rivers and Delta. And there's a dynamic balance in terms of the salinity regimes and the geographic distribution between those species as it relates to salinity conditions occurring within the Delta.

(Defendants' Exhibit SWC T was marked for identification.)

BY MR. WILKINSON:
Q. Dr. Hanson, I would like to show you an Exhibit marked T for identification. State Water Contractor Exhibit T. Have you seen that before?
A. Yes, I have.
Q. Would you tell us what it is, please?

A. This is a portion of a PowerPoint presentation that Dr. Jan Thompson made to the CALFED Variable Salinity Workshop.
Q. And did you attend that presentation?
A. Yes, I did.
Q. Would you show us, Dr. Hanson, what these four slides of Dr. Jan Thompson show?
A. The first slide is just the title slide from a PowerPoint presentation titled "Clams - where, how and can we limit the damage."

The second slide, which is marked State Water Contractor Exhibit T-B shows the range of salinity tolerance between Corbula and Corbicula. Corbula is shown in the orange bar, Corbicula is shown in the blue bar. The top two rows show the range for the adult lifestage. The two bottom bars show the range for the larval or recruitment stage.

And what it shows is that Corbula extends over salinity range basically from approximately fresh water to full strength sea water; where Corbicula extends over a range of salinities from about zero to ten parts per thousand in the adult stage. There is a difference in recruitment. Corbula is much more tolerant in the larval stage for higher levels of salinity than is Corbicula.

The third slide shows Corbicula densities measured in number per square meter. In this case, during a May 2003 survey, showing that they're widely distributed throughout the

central Delta and extending downstream at the confluence between the Sacramento and San Joaquin River systems.

And the fourth figure is, in essence, a conceptual model that Dr. Thompson put forward, sort of showing how variable salinity or how the change in salinity distribution would potentially affect one or both of these clam species.

The idea being that if we had fresher water conditions further downstream in the Delta, even if they were able to reduce the abundance of the brackish water Corbula, that that habitat may be inhabited or colonized by the Corbicula.

Similarly, if we had more saline water intruding up into the Delta, that area may then preferentially be inhabited by the brackish water Corbula, pushing the fresher water Corbicula further upstream.

So there's a change in the species composition of these two clams geographically, but not necessarily a change in their effect on the estuary or their filter feeding.

Q. Dr. Hanson, do both Corbula and Corbicula have about the same ability to filter food from the water column?

A. I don't know the specific filter rates for the two species. They're roughly the same size. They're both filter feeding organisms, filtering from the water column and removing nutrients, organic carbon, phytoplankton and zooplankton, so I would assume that they would be similar.

Q. Do you believe Dr. Thompson's work supports Dr. Swanson's proposal to release water or reduce exports to maintain X2 at Kilometer 80?

A. I think the work of Dr. Thompson simply shows that there's a high degree of uncertainty as to the response of the benthic organisms that would occur in response to variable salinity conditions such as those that have been proposed. And I think there's a high degree of uncertainty as to what the biological implications of that would be in terms of an increase in nutrients or food availability for other species like delta smelt.

(Defendants' Exhibit SWC U was marked for identification.)

BY MR. WILKINSON:

Q. Dr. Hanson, I would like to show you a document that has been marked as State Water Contractors Exhibit U for identification.

Can you tell us what that document is?

A. I had mentioned the CALFED Science Program workshop titled defining a variable Delta to promote estuary and fish habitat that was the subject of the presentations by Dr. Thompson and others.

As part of the summary of that workshop, the CALFED staff, in addition to some of the participants, prepared a report summarizing their findings and conclusions from that

workshop. And what we have is a report, it's dated July 27, 2007. It was prepared for Dr. Healey, who is the CALFED lead scientist. And it was prepared by Matt Nobriga, a staff member of the CALFED program, with input from many of the participants.

Q. Is Matt Nobriga also one of the authors of the Feyrer paper?

A. He is a co-author of the Feyrer paper.

Q. Dr. Hanson, I'd like to turn your attention to page ten of Exhibit U for identification. And I'd like to read to you a couple of the sentences that appear in the large paragraph in roughly the middle of the page.

"All of the presenters agreed that a focus simply on salinity variability is inappropriate; that habitat variability had to include a broad range of attributes."

And then at the bottom of the paragraph, the last two sentences, "It is also unknown if extending the freshwater period to kill overbite clams would allow Asiatic freshwater clams to establish higher populations in Suisun Bay. Thus, the dynamics of clam - phytoplankton interactions under different salinity regimes are not currently predictable. Therefore, the food web responses of fishes feeding on clams or competing with them for food are likewise not currently predictable."

Do you agree with those statements?

A. I do agree with those statements and I do agree that that was the general finding from this workshop.

MR. WILKINSON: Your Honor, I would like to offer into evidence both State Water Contractor Exhibit T and State Water Contractor Exhibit U for identification.

THE COURT: Any objection?

MR. WALL: Yes, Your Honor, we'd object on the ground that both documents are hearsay.

THE COURT: All right. As to Exhibit T, the Court is going to sustain the objection in part. It will be received not for its truth, it will be received for information that was relied on by the expert in expressing opinions.

As to Exhibit number U, this is another multiple hearsay report containing opinions of third parties. It is information relied on by the expert to corroborate findings or opinions.

I will sustain the objection to the underlying opinions and not received the document for the truth, but will receive it as information that the expert has relied on in reaching his opinions. And since there is no further foundation offered for it, that's as far as my rulings go.

(Defendants' Exhibit SWC T and U were received.)

MR. WILKINSON: Thank you, Your Honor.

Q. Dr. Hanson, do you have an opinion about the possible impact of Dr. Swanson's action number ten on other species?

A. Yes, I do.
Q. And I'll hand you an exhibit that we will mark as State Water Contractor Exhibit V as in Victor for identification.
(Defendants' Exhibit SWC V was marked for identification.)
BY MR. WILKINSON:
Q. Have you seen that document before, Dr. Hanson?
A. Yes, I have.
Q. Tell us what it is, please.
A. What it is is a summary of three reservoirs on the Sacramento River watershed, including Shasta Reservoir, Oroville Reservoir and Folsom Reservoir. The next column is the reported maximum storage capacity in millions of acre feet for each of those three reservoirs.
The third column is the storage in millions of acre feet reported by the USBR and DWR as of August 26th, 2007.
The final column is, in essence, a threshold for concern regarding cold water pool management within upstream reservoirs.
Q. Dr. Hanson, did you prepare SWC Exhibit V?
A. Yes, I did.
Q. What was the purpose of preparing that?
A. The purpose of that was that by managing salinity conditions within the Delta during the period from September through December, there are functionally two main ways to

accomplish that. One would be to release water from upstream reservoirs to provide greater fresh water outflow and therefore move the salinity isohaline further to the west around Kilometer 80.

The second would be to reduce SWP or CVP exports to allow greater Delta outflow to occur and also achieve that salinity redistribution.

One of the concerns that the various scientists have in dealing with central valley fishery issues are concerns with respect to cold water pool depletion and exposure of salmonids residing in upstream tributaries on the main stem Sacramento River, the Feather River, the American River, as they experience elevated water temperatures, particularly during the summer and early fall months.

Q. How did you determine the cold water pool level at Shasta and Oroville?

A. I searched the web for information on what had been reported as the storage thresholds for various cold water pool management strategies. For example, the 1.9 million acre feet for Shasta Reservoir was one of the storage thresholds that was identified by the National Marine Fisheries Service for the protection of winter run Chinook salmon that spawn in the main stem of Sacramento River downstream of Shasta Reservoir.

On the Feather River, Oroville Storage, the cold water pool management has been a key issue of concern and

discussion and analysis as part of the FERC hydro relicensing proceedings. There are fall-run Chinook salmon, spring-run Chinook salmon and central valley steelhead that reside in the Feather River downstream of Oroville Dam. So cold water pool management has been a key issue in these upstream reservoirs as it has on the American River, primarily focusing on steelhead and fall-run Chinook salmon.

Q. Dr. Hanson, when is the cold water, in your understanding, in these pools needed for salmon and steelhead?

A. Well, cold water is an important attribute to the physical habitat required for salmon, both as adult holding habitat during the upstream spawning migration, during spawning and egg incubation and during juvenile rearing.

In our portion of the central valley, those temperature conditions occur throughout the spring, the summer and the early fall. Prior to the time that atmospheric temperatures decline to the point where we have nighttime cooling and other conditions that make temperature less of an issue.

On many of the river systems, such as the mainstem Sacramento River downstream of Shasta Reservoir, one of the primary areas of concern is during that August, September and October time period. That's a period when winter run Chinook salmon that have been listed as endangered under both the California and Federal Endangered Species Act are spawning and

their eggs are incubating in the mainstem Sacramento River.

The eggs are the most temperature sensitive of the lifestages for Chinook salmon. And there are concerns about the effects of elevated water temperature on hatching success of those winter run Chinook salmon. On the Feather River and the American River, for example, we have spring -- well, on the Feather River, we have spring-run Chinook salmon that have been over holding since the spring through the summer.

They spawn in the Feather River in September and October. Water temperatures during that time period are also a critical issue in terms of the survival of those incubating eggs. For fall run Chinook salmon on the Sacramento, the Feather and the American River, the pre-spawning adults migrate upstream in September -- well, actually from August through about October.

Exposure of those pre-spawning adults to elevated water temperatures has been identified as one of the factors contributing to both pre-spawn mortality as well as reduced viability of fall run Chinook salmon eggs.

Q. Do you recall testimony, Dr. Hanson, that meeting Dr. Swanson's proposed action ten by additional upstream reservoir releases, instead of doing it that way, we could simply reduce exports?

A. I do remember that testimony.

Q. Do you have an opinion of the effect of reducing exports

to meet action ten?

MR. WALL: Objection if he's asking for water supply opinion. This witness isn't qualified.

MR. WILKINSON: Actually I'm not.

THE COURT: All right. The objection is overruled on counsel's representation that this is going to be biological related opinion.

BY MR. WILKINSON:

Q. Dr. Hanson, with that understanding, would you please go ahead and answer my question?

A. Yes. The water diverted from the Delta during the fall period serves a variety of purposes. One of the purposes is to provide water supplies to refuges and wildlife areas within the San Joaquin River Valley. There are a variety of refuge habitats that receive water supplies from the CVP and the SWP facilities. And so depending on the magnitude and the allocations, there are potential effects of reduced exports on other wildlife issues.

Q. Dr. Hanson, I'd like to finally turn your attention to Dr. Swanson's actions number five and number seven. Do you recall those?

A. Yes, I do.

Q. What is your understanding of the purpose of those actions?

A. The purpose of those actions, as I understand it, is to

provide an increased level of protection for larval and early juvenile lifestages of delta smelt. Those lifestages occur within the estuary during the late winter through the late spring, early summertime period.

And one of the hypotheses that has been put forward is that those larval delta smelt and early juvenile lifestages, which are largely planktonic, are vulnerable to entrainment at the SWP and CVP export facilities where there's high mortality.

Q. What is your understanding of the flow limitations that Dr. Swanson would propose to implement in her actions number five and number seven?

A. My understanding is that Dr. Swanson has proposed a flow level not to exceed -- well, a target flow level of 1500 cfs reverse flow in Old and Middle River throughout that spring and summer period, early summer period.

Q. Is it your understanding that the purpose of these -- providing these flows is to attempt to extend, pardon me, the VAMP conditions to a period of time both before and after the VAMP period of April 15th to May 15th?

A. I think they're intended to provide an extension of the export component of the VAMP program during those periods.

Q. And you were one of the authors of the VAMP program; is that correct?

A. I was. With Bruce Herbold from EPA.

Q. Dr. Hanson --

THE COURT: You say "the export component," you mean reduction in exports?

THE WITNESS: No. The VAMP program has multiple components. It includes reduced exports during a 31-day period in spring, typically extending from April 1st through May 15th. But it also includes the installation of the Head of Old River Barrier and it includes increases in the releases of water from San Joaquin River tributaries for the purpose of managing the flow level in the San Joaquin River Vernalis.

So the VAMP program in total has both export related factors as well as San Joaquin River flow related factors. And Dr. Swanson's proposal only addresses the export component of the VAMP program.

THE COURT: But the other components are in an attempt to increase flows --

THE WITNESS: They are an attempt.

THE COURT: -- at Vernalis. And the export component is to reduce exports --

THE WITNESS: Correct.

THE COURT: -- during the same period.

THE WITNESS: Exactly.

THE COURT: You may proceed.

BY MR. WILKINSON:

Q. Dr. Hanson, does the VAMP target Old and Middle River

flows?
A. It does not. It targets export rates at the SWP and CVP.
Q. Does the VAMP target exports at negative 1500 cfs?
A. No. The VAMP has a range of target export rates that range from 1500 cfs to about 3500 cfs.
Q. Do you --
THE COURT: Negative or positive?
THE WITNESS: These are export rates, so these are water being withdrawn from the Delta and passed through the export facilities.
THE COURT: Thank you.
BY MR. WILKINSON:
Q. Would that have an impact on Old and Middle River flows?
A. It would. There's an association, although not necessarily a direct linkage between the export rate and Old and Middle River flows.
Q. Dr. Hanson, is it your understanding that Dr. Swanson's proposed actions five and seven replicate VAMP conditions?
A. They replicate just one element. The 1500 cfs export rate. They don't reflect the range of exports that we have in VAMP nor do they address the issue of San Joaquin River flows.
Q. Is it your understanding that Dr. Swanson's actions five and seven are based on the work by Dr. Bennett?
A. That is my understanding.
Q. Is Dr. Bennett's work publicly available?

A. To my understanding it is not.
Q. Do you know what Old and Middle River flow conditions Dr. Bennett examined to develop his theory about larval smelt survival?
A. I don't. I haven't had an opportunity to talk to Dr. Bennett about that. In the absence of a written report, it's hard to tell.
Q. Do you know what years Dr. Bennett examined as part of his analysis and research?
A. I don't know specifically.
Q. Is any of that information publicly available?
A. It has been presented at some of these workshops, but other than that, it's not publicly available.
Q. Has it been published?
A. No, it has not.
Q. Has it been peer reviewed?
A. Not to my knowledge.
Q. Is there anything in your tier two proposal, Dr. Hanson, that would preclude operating the projects to a negative 1500 cfs in Old and Middle River if Dr. Bennett's work does become publicly available and scientists like yourself become confident that the relationship Dr. Bennett has suggested is correct?
A. No, there's nothing to preclude that. Our range encompasses that range that's been proposed.

Q. Is there anything in the Fish & Wildlife Service action matrix that would preclude operating to a target of negative 1500 cfs in Old and Middle River under those same conditions?
A. There is nothing that would preclude that. Their range also encompasses that.
Q. Dr. Hanson, in your opinion, would the proposed matrix put forward by the plaintiffs be sufficient to avoid jeopardy to the delta smelt during the interim period before Biological Opinion is issued?
A. Yes, it would.
Q. In your opinion, would their proposed matrix be sufficient to avoid adverse modification of critical habitat during that interim period?
A. I believe it would.
Q. In your opinion, Dr. Hanson, would the delta smelt action matrix proposed by the Fish & Wildlife Service be sufficient to avoid jeopardy to the delta smelt during the interim period before a Biological Opinion is adopted?
A. Given the range of opportunities to modify export operations in response to the risk of delta smelt, I believe that it would.
Q. In your opinion, Dr. Hanson, would the Fish & Wildlife Service action matrix be sufficient during this interim period to avoid adverse modification of critical habitat for the smelt?

A. Given the short period of this interim action and the fact that it would contribute to reduced reverse flows, I believe that it would contribute to habitat improvement.

Q. And by --

THE COURT: And the basis for that answer is that you don't think, depending upon what none of us know, what the conditions are going to be, as far as the availability of water climatologically in the -- what will be the '08 water year starting in October, October 1st through September 30th, '08, which will definitely be the period covered at the minimum by these actions. You don't think there's any possibility that the species can go extinct given the current conditions?

THE WITNESS: No, that's --

THE COURT: If these measures are not implemented.

THE WITNESS: No. That's not my conclusion, Your Honor.

THE COURT: What is your conclusion?

THE WITNESS: My conclusion is that the scope of these proceedings has really been focused just on addressing a fairly narrow range of operations and actions related directly to the SWP and CVP export operations that are intended to avoid that being the cause for the delta smelt to go extinct.

There are a variety of other factors that are independent of that for which we have no control that could

supercede this and could result in the delta smelt going extinct independent of what operations are at the projects.

THE COURT: That I believe I understand. My question is specifically focused on the actions that are proposed. We have at least three alternatives. And they're complimentary or cumulative because they seem to increase the levels of protection. And I know that that's debated and it's not agreed by the parties. And so given those measures being implemented, it's still your opinion that the species could be extinct?

THE WITNESS: Unfortunately, that is --

THE COURT: Even if they're all given.

THE WITNESS: Unfortunately that is my opinion, sir.

THE COURT: And you don't have any present proposal that would necessarily, in the worst case, prevent the extinction of the species?

THE WITNESS: I do not.

THE COURT: All right.

MR. WILKINSON: That's all I have.

THE COURT: All right. We're going to take --

MR. WILKINSON: One final exhibit.

THE COURT: The afternoon recess -- beg your pardon?

MR. WILKINSON: I'm sorry, Your Honor, there's one final exhibit. I believe it was State Water Contractors Exhibit V. I would offer that in evidence at this time.

THE COURT: Any objection?

MR. WALL: Yes, Your Honor. The only testimony we have is that the last column there was based on an internet search. I believe it's hearsay. We wouldn't object to the extent that it shows what the witness considered in forming his opinions, but for the truth of the matter, we object.

THE COURT: All right. I will sustain the objection in part. I'm going to admit the exhibit to show information. The witness has described the sources. I'm not sure that we have the complete foundation for the sources and therefore I will not admit the data for its truth, but it will be considered because it was relied on by Dr. Hanson in formulating his opinions.

MR. WILKINSON: Thank you, Your Honor.

THE COURT: All right. We will now -- so that is admitted in part subject to my stated limitation.

(Defendants' Exhibit SWC V was received.)

THE COURT: We will stand in recess until 3:20.

(Recess.)

THE COURT: We're on the record in NRDC versus Kempthorne. Please be seated. Mr. Wall, you may proceed.

MR. WALL: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. WALL:

Q. Good afternoon, Dr. Hanson.

A. Good afternoon, Mr. Wall.
Q. Dr. Hanson, just before we broke, you were testifying regarding your view of whether project operations at the export facilities would cause critical -- adverse modification of critical habitat; correct?
A. Correct.
Q. And you testified in your view that if any of the three remedial proposals you described were implemented, the export facilities would not cause jeopardy during the next 12 to 18 months; correct?
A. Depending on how they're operated, correct.
Q. And you testified that you did not look at whether other factors would cause jeopardy during that period; correct?
A. I'm only concerned that other factors would contribute to mortality and potential jeopardy, but we didn't do any kind of an analysis of their incremental contribution, no.
Q. So you didn't look at the incremental contribution of any factors other than the projects' export facilities; correct?
A. We did not.
Q. Dr. Hanson, the projects have impacts on delta smelt through the operations of their dams and reservoirs; correct?
A. Indirectly through changes in hydrodynamics and water quality downstream throughout the estuary, yes.
Q. And those dams and reservoirs would hold fresh water from the Delta; correct?

A. Correct.
Q. Dr. Hanson, there's been a lot of discussion about population estimates. Your population estimate of 1.8 million delta smelt presented in your July declaration was projected from the results of the 20 millimeter survey conducted between July 2nd and July 9; correct?
A. Correct.
Q. That was survey nine of the 20 millimeter survey?
A. That was survey nine.
Q. Did you use the catch only from survey nine or the cumulative catch through survey nine to calculate your results?
A. Our results were calculated on survey nine densities alone, not the cumulative over time.
Q. Dr. Hanson, how many delta smelt were caught during the survey nine of the 20 millimeter survey?
A. I don't remember explicitly.
Q. Dr. Hanson, do you have in front of you Dr. Swanson's declaration of August 13? I believe this would be the plaintiffs' Exhibit Number 4 in evidence.
A. Yes, I do.
Q. Could I ask you to please turn to page 11 of that declaration.
A. I have page 11.
Q. Page 11, Dr. Hanson.

A. Yes.
Q. And do you see Table 1.
A. Yes, I do.
Q. And is that a table that shows the number of delta smelt caught by different surveys over different years?
A. It does. For surveys five, six, seven, eight and nine.
Q. And that's the cumulative total through each survey; correct?
A. Correct.
Q. Looking at this table, could you tell me the number of delta smelt that were caught during the survey nine of this year?
A. I believe -- well, without doing the math, it would be 137 minus 98.
Q. And that would be 39 delta smelt?
A. 39 delta smelt.
Q. So Dr. Hanson, you calculated a total population abundance of delta smelt of 1.8 million fish based on a survey that caught 39 fish; is that correct, Dr. Hanson?
A. That is correct.
Q. That's quite an extrapolation; wouldn't you say?
MR. WILKINSON: Argumentative.
MR. LEE: Argumentative.
THE COURT: It is in part. This is an expert. I suspect he can handle it. The objection is overruled. You

may answer.

THE WITNESS: It is a large expansion.

BY MR. WALL:

Q. Do you have any idea what the ratio is between 39 and 1.8 million?

A. I don't.

Q. Dr. Hanson, you made certain assumptions in preparing your population estimates; correct?

A. Correct.

Q. And one of those assumptions was that the density of delta smelt in the water column, both vertically and laterally, was consistent within a given region; correct?

A. Correct.

Q. So for example, if we were to look at the map that is in front of you, which I believe is Exhibit H, State Water Contractors Exhibit H.

A. Correct.

Q. It shows a region A4?

A. It does show a region A4.

Q. And a region A3 and so on.

A. Correct.

Q. And so you assumed that within each one of those regions, the density of delta smelt was consistent; correct?

A. Correct.

Q. Dr. Hanson, you obtained the delta smelt --

THE COURT: Excuse me.

MR. WALL: I'm sorry.

THE COURT: You know that that isn't accurate?

THE WITNESS: We do know that that isn't accurate, Your Honor.

THE COURT: And to what extent is there a difference between actual and assumed?

THE WITNESS: That difference, Your Honor, is not well defined, but it could be relatively large. We could have stations within a region that there are no delta smelt collected and a large number of delta smelt collected at just one sampling site within a region. And that would affect our density calculation.

THE COURT: So your confidence factor could be more than 50 percent?

THE WITNESS: I would expect that it would be, yes, sir.

THE COURT: You may continue.

BY MR. WALL:

Q. Dr. Hanson, you have not calculated confidence factors; correct?

A. For my estimates, I did not calculate confidence intervals.

Q. Dr. Hanson, if you could look at the map to which we just referred and focus particularly on region A4. And let me see

if I can find a copy of this to put on the Elmo for everyone else.

THE COURT: There was one on there. I don't know what happened to it. Do you have it, Mr. Wilkinson?

MR. WILKINSON: I have it, yes.

THE COURT: All right.

MR. WILKINSON: Do you need a copy, Your Honor?

THE COURT: Can you give that to Mr. Wall?

Thank you, Mr. Buckley. If we have one that's a stand alone, let's just put it on there. Thank you.

MR. WALL: Thank you very much.

Q. Dr. Hanson, if I could direct your attention to region A4. It includes the following sampling stations, does it not, 610, 704, 705, 706, 707, 711 and 812.

A. Correct.

MR. WALL: Your Honor, may I approach?

THE COURT: You may.

(Plaintiffs' Exhibit 15 was marked for identification.)

BY MR. WALL:

Q. Dr. Hanson, I'm showing you a document that has been marked for identification as plaintiffs' Exhibit 15.

Do you recognize this document? And it has two sides.

A. Yes, I do recognize this document.

Q. Could you tell us what it is?
A. This is a portrayal of the reporting that's presented on the California Department of Fish & Game web page. It allows you to go in and query various surveys. In this case, the delta smelt survey nine for 2007. It allows you to present several depictions of those survey results.

On the front page of the example is the map of what we frequently call the dot plot with size of the circles surrounding a given sampling station being proportional to the density of fish as expressed in fish per 10,000 cubic meters.

And on the reverse side are the results by station. The station number, surface temperature, surface electrical conductivity, number of tows and the average CPUE.

Q. And this is the data for which you relied on in calculating your population estimate?
A. These are the data that we used.
Q. Now, let's -- if I could ask you, Dr. Hanson, to go ahead -- and do you have a pen there?
A. I don't.
Q. Would it be -- may I approach?

THE COURT: You may.

MR. WALL: Your Honor, I move to have Plaintiffs' 15 admitted into evidence.

MR. WILKINSON: Objection, Your Honor, it's hearsay.

THE COURT: This --

MR. WALL: Your Honor -- I'm sorry.

THE COURT: This is a Department of Fish & Game prepared study that was relied on by the expert, accessed by a website. And finish the foundation for the website, if you would, please, and then I'll rule on the objection.

BY MR. WALL:

Q. Dr. Hanson, you obtained this from a Department of Fish & Game website; correct?

A. I didn't obtain this. But we do access this website.

Q. And you accessed that website in preparing your population estimate?

A. Yes, I did.

Q. And that's the website that's listed at the top of the first page?

A. I believe it is, yes.

Q. And to your knowledge, this is accurate representation of California Department of Fish & Game's survey data for the 20 millimeter survey?

A. To my knowledge it is, yes.

MR. WALL: Your Honor, does that lay an adequate foundation? If it does, I'd like --

THE COURT: Yes, unless there's an objection as to foundation.

MR. WILKINSON: No, Your Honor.

THE COURT: The Court overrules the objection under

Federal Rule of Evidence 803 subsection (a). This is a public record, report, statement or data compilation in any form of a public office or agency which set forth matters observed pursuant to duty imposed by law as to which matters there was a duty to report.

(Plaintiffs' Exhibit 15 was received.)

THE COURT: You may proceed.

BY MR. WALL:

Q. Dr. Hanson, I'm going to read for you the -- actually, let me ask you a question first. On the second page, there's a column that says "Average CPUE." Do you see that?

A. It's CPUE. Catch per unit effort.

Q. And that's a measure of delta smelt density. Right?

A. That's correct.

Q. Dr. Hanson, I'm going to walk through with you -- and I'd like you to read along with me and make sure I get this right. The catch per unit effort figures for each of the sampling stations in region A4. The first was station 610 and that had a catch per unit effort of zero; correct?

A. Correct.

Q. That means no delta smelt were caught; correct?

A. That is correct.

Q. And the next was station 704. And that had a catch per unit effort of zero as well; correct?

A. Correct.

Q. And the next is 705 and that had a catch per unit effort of zero?
A. Correct.
Q. And the next is 706 and there we see a catch per unit effort of 31.59; correct?
A. Correct.
Q. Then we go on to 706 and -- sorry, 707, and we see a catch per unit effort of 3.87; correct?
A. Correct.
Q. And 711, the catch per unit effort was zero?
A. Yes.
Q. And 812, the catch per unit effort was zero; correct?
A. Correct.
Q. Now I'm going to -- I've written those numbers on a copy of State Water Contractors H, which I'm going to put on the Elmo, and just tell me if that we're looking at is accurate and states the numbers I just read.
A. Yes, it does.
Q. Now, if we took the average of -- there are seven sampling stations in region A4; correct?
A. Correct.
Q. And if we took the average of those, it would be a bit more than five, the catch per unit effort; correct?
A. I haven't done the average here, but that looks to be about right, yes.

Q. Let me represent to you and ask you to assume that the average catch per unit effort of the seven sampling stations is 5.06. You assumed that this was the density of delta smelt throughout the entirety of the water contained within region A4; correct?

A. That is correct.

Q. Even at the stations at which no delta smelt were caught; correct?

A. Across the entire region, yes.

Q. Now, if you could turn your attention back to the map. Am I correct that stations 704, 705, 706, 707 and 711 are all on the Sacramento River?

A. Those are on the Sacramento River.

Q. And station 812, also in region A4, is on the San Joaquin River?

A. That is correct.

Q. And station 16 is on the Montezuma Slough.

A. 606?

Q. I'm sorry. 610, I believe.

A. 610 is on Montezuma Slough.

Q. So if I understand this correctly, Dr. Hanson, and correct me if I'm wrong, you averaged the density of delta smelt across these three waterways, the San Joaquin River, the Sacramento River and the Montezuma Slough and assumed that that average density applied to all three waterways to the

extent they go in region A4; correct?
A. To the extent they were in region A4, we did, yes.
Q. Dr. Hanson, there's no biological basis for assuming that the density of delta smelt on the Sacramento River was the same as the density of the delta smelt on the San Joaquin River during this time period; is that correct?
A. There's no biological basis. Delta smelt are distributed throughout this area of the estuary, but biologically, I don't think there's a reason to believe that they would be on -- you know, differential on one or the other.
Q. In fact, if we could just turn back to Plaintiffs' 15, the first page. Does that map indicate to you that there's a much stronger abundance of delta smelt on the Sacramento River than on the San Joaquin River?
A. And that's -- it has been a consistent pattern in recent years, yes.
Q. But you assumed that the average across these three waterways, to the extent that they are both in this region, apply in all three waterways?
A. In this particular example, I did, yes.
Q. Dr. Hanson, you testified that you had discussed your regions with other scientists; correct?
A. I had.
Q. Including Dr. Moyle.
A. Including Dr. Moyle.

Q. And did you say Dr. Bennett?
A. Dr. Wim Kimmerer.
Q. Dr. Wim Kimmerer. And those scientists suggested there might be a better way to draw these regions; correct?
A. They did at the time, yes.
Q. But you did not follow up on their advice and draw new regions; correct?
A. For this purpose, I did not.
Q. Now, when you testified that you had not calculated confidence intervals for your population estimates, that means you didn't calculate the possible range of error in your estimates; correct?
A. That is correct.
Q. And if I understood you correctly, that's because you believe you didn't need to calculate confidence intervals; correct?
A. What I was preparing were point estimates of the standing stock. I did not calculate confidence intervals for those. And there were several sources of potential bias and error that I had no information on how to calculate confidence intervals around.
Q. You're aware that Dr. Bennett calculated confidence intervals for his population estimates; correct?
A. I am aware of that.
Q. And you said he had done it because he had compared

populations of delta smelt through time. Correct?
A. He used his data differently than I did. He calculated a population estimate for a given sampling type for all of the surveys that were contained within that, as I understand it.
Q. Your understanding is he calculated -- it was appropriate for him to calculate a confidence interval because he calculated the delta smelt population through time; correct?
A. He was using his estimates to compare population estimates through time. And given that type of a comparison, Dr. Bennett felt that confidence intervals were appropriate to include.
Q. Now, Dr. Hanson, you used your population estimates to make a comparison; did you not?
MR. WILKINSON: Ambiguous.
THE COURT: Do you understand the question?
THE WITNESS: I think I do. I made a comparison only --
THE COURT: Let me rule on the objection.
THE WITNESS: Oh, sorry.
THE COURT: Overruled. You may answer.
THE WITNESS: I made a comparison not of the population trends, but of the change in my estimate of the population from one survey to the next within 2007.
BY MR. WALL:
Q. Well, Dr. Hanson, you compared your population estimate to

salvage counts at the pumps; did you not?
A. That we did, yes.
Q. And in making that comparison, it would have been important to know how far off your population estimates might be; correct?
A. That would have been one additional piece of information, yes.
Q. Today, Dr. Hanson, you described your population estimates as an order of magnitude estimate; correct?
A. Correct.
Q. You didn't call it an order of magnitude estimate in any of your declarations in this case; did you?
A. No, I just presented the results of those calculations.
Q. And you have not presented any calculations showing that your population estimates are accurate within an order of magnitude; correct?
A. I have not, other than in our earlier discussions with Dr. Bennett going back to the late 1990s. At that point in time, our population estimates using this approach were within the same order of magnitude as had been done by other investigators.

And similarly, when I compared these estimates to population estimates for 2007 that had been prepared by Dr. Sitts as well as Dr. Miller, they were roughly within the same order of magnitude in those comparisons as well.

Q. And all those investigators, according to you, used essentially the same methodology?
A. They did use very similar methods.
Q. So if the methodology was flawed, it wouldn't be surprising if you came up with similar results; correct?
A. That is true.
Q. Now, go back to my question. You have not presented any calculations showing that your population estimates were accurate within an order of magnitude; correct?
A. I have not.
Q. Now, order of magnitude is a factor of ten; correct?
A. That is correct.
Q. So an order of magnitude of 100,000 population would be a range somewhere between 10,000 and a million; correct?
A. That would be plus or minus one order of magnitude.
Q. So 10,001 would be within an order of magnitude of 100,000; correct?
A. Yes.
Q. And you believe today that your population estimates are correct within an order of magnitude?
A. I think they are, at least in my estimation, they provide information on that order of resolution, yes.
Q. And you believe that order of resolution is appropriate to serve as a guide to whether Old and Middle River flows should be set at minus 2,000 cfs or minus 4,000 cfs; correct?

A. That they would be one of the pieces of information that would be taken into consideration in making that kind of a risk assessment.
Q. In particular, you believe that your population estimates are appropriate to use as a backstop to evaluate which end of the action matrix range is most appropriate; correct?
MR. LEE: Objection. Vague.
THE COURT: Do you understand the question?
THE WITNESS: I do.
THE COURT: Overruled. You may answer.
THE WITNESS: I do feel that they would be useful as context for deciding what level of protection, what level of risk we're experiencing.
BY MR. WALL:
Q. Dr. Hanson, there has been some debate among scientists over population estimates for delta smelt; correct?
A. Absolutely.
Q. And you mentioned that you participated in those debates; correct?
A. I have.
Q. Now, "debate" does not mean agreement; correct?
A. "Debate" does not mean agreement.
Q. You mentioned that Dr. Wim Kimmerer had engaged in a population estimate for a striped bass; is that correct?
A. That is correct.

Q. And you claim that your methodology was similar to his; correct?
A. That when we've been discussing this, we've been considering the various methods that are available. Dr. Kimmerer uses a slightly different and sometimes radically different methods than we have.
Q. And his -- he's applied his methodology to striped bass; correct?
A. He did.
Q. Now, one of the assumptions you have to make in your population calculations is the uniformity of the density of delta smelt. In other words, the uniformity of distribution of delta smelt; correct?
A. Correct.
Q. Isn't it true that striped bass are distributed much more uniformly than delta smelt?
A. There certainly is -- to my recollection, there is evidence to suggest that they are more broadly distributed and probably more uniformly distributed, yes.
Q. You also mentioned that one of the participants in this debate about population estimation methodologies was Dr. Bruce Herbold; correct?
A. Correct.
Q. Dr. Herbold is a biologist in the employ of the US Environmental Protection Agency; correct?

A. That is correct.
Q. And he's a very well respected delta smelt expert; correct?
A. Bruce has been -- Dr. Herbold has been working on delta smelt issues for a number of years and he is regarded.
Q. Now, he's a member of the Delta Smelt Working Group; correct?
A. Yes, he is.
MR. WALL: May I approach, Your Honor?
THE COURT: You may.
(Plaintiffs' Exhibit 16 was marked for identification.)
BY MR. WALL:
Q. Dr. Hanson, I have handed you what has been marked as plaintiffs' Exhibit 16 for identification. Do you recognize this document?
A. Yes, I do.
Q. It's an article by Dr. Bruce Herbold; correct?
A. It is.
Q. And the title is "Why We Don't Do Population Estimates for Delta Smelt"; correct?
A. That is correct.
Q. If I could ask you to turn to the conclusion of this document. And I'm going to read along and you tell me if I have read this correctly. "Population estimates with immense

but unknown uncertainties about their averages and reliability are of no practical application. They give a false sense of confidence in our knowledge of the animal. Abundance indices tend to remind us of how little we know."

Did I read that correctly?

A. You did read that correctly.

Q. You disagree with that statement; correct?

A. I disagree in part with that statement. And I think the difference is that population estimates for delta smelt, you know, we're looking more towards trying to identify tools that can be used to give us a better perspective on the delta smelt population in terms of its abundance, in terms of its risk.

And I participated in the discussions with Dr. Herbold during this period, when we were debating about making population estimates. We recognize the uncertainties and the inherent limitations in the data. But there has been a pressure to try and provide some insight in to how large a population of delta smelt we have and is how great is their risk.

And the approach that we've used, despite its assumptions, has been an effort to try and provide some of that context. In that regard, I disagree with Mr. Herbold.

The second thing is that we have efforts underway, I've talked to Dr. Chotkowski, we've talked with the Fish & Wildlife Service about ways that we can better improve our

understanding of the population abundance, how we can improve our estimation procedures and provide better confidence and better reliability in these estimates. And I think we should continue to move forward with those efforts.

Q. Dr. Hanson, these potential improvements you're discussing with Fish & Wildlife Service are not reflected in your calculation of population estimates; correct?

A. Unfortunately they are not.

Q. Dr. Hanson, you also mentioned that Dr. Bennett had been a participant in this debate about population estimates; correct?

A. Correct.

Q. And you've stated that he produced a population estimate that is comparable to yours; correct?

A. Dr. Bennett used methods comparable to mine, yes. His population estimates were higher than mine.

Q. Dr. Bennett's 2005 monograph provides the only population estimate for delta smelt that has been published in a peer review journal; correct?

A. That is correct.

Q. And Dr. Bennett stated in his monograph that the assumptions on which his population estimate were based were invalid; correct?

A. Well, we know that many of the assumptions are not true. And Dr. Bennett, as did I, acknowledges that. How we move

forward from there to improve those assumptions is part of the future. But yes, he did say we know that our assumption about uniformity of density and size selectivity of the gears is not true.

Q. You haven't improved on Dr. Bennett's assumptions; correct?

A. We have not.

Q. You did use a different set of regions than Dr. Bennett in estimating population; correct?

A. We did.

Q. And for example, your region combined parts of three different waterways into region A4; correct?

A. Correct.

Q. Do you know if Dr. Bennett did that?

A. I don't know specifically the regions that Dr. Bennett used.

Q. Dr. Bennett estimated that in 1994, the population of delta smelt was approximately 86,203 give or take; correct?

A. Yes.

Q. And the "give or take" that Dr. Bennett estimated was plus or minus roughly 86,000 fish; correct?

A. Roughly 100 percent, yes.

Q. So his confidence interval was a population in 1994, somewhere between zero delta smelt and perhaps 170,000 delta smelt; correct?

A. Correct.
Q. At the time Dr. Bennett made his estimate for 1994 delta smelt population, that year, 1994, had the lowest fall midwater trawl index on record; correct?
A. To that date, yes.
Q. And in 1994, the fall midwater trawl index was 102; correct?
A. I believe so, yes.
Q. 2005, the same index was just 26; correct?
A. Yes.
Q. And in 2006, that index was 41; correct?
A. I believe so, yes.
Q. So this change in the fall midwater trawl index from 102, when Dr. Bennett calculated population of about 86,000 delta smelt give or take, to a population -- or a trawl index of 26 or 41 in the last couple of years, would suggest that the population of delta smelt has fallen in the intervening 13 years; correct?
A. In my estimation, I don't think there's any question about that.
Q. And so if Dr. Bennett's methodology were applied today to the new indices, one would expect that he would calculate a lower population than he calculated for 1994; correct?
A. Correct.
Q. Dr. Hanson, you take some comfort from the fact that Dr.

Bennett found a significant correlation between population estimates and the Summer Townet Survey and fall mid water trawl survey indices; correct?

MR. LEE: Objection, vague.

MR. WILKINSON: Mischaracterizes the testimony and is argumentative.

THE COURT: It appears to be a compound question. It has two subjects. Which do you want him to answer? Can you break it down?

MR. WALL: Why don't I withdraw the question and start over, Your Honor.

THE COURT: Thank you.

BY MR. WALL:

Q. Dr. Hanson, you testified that in relying on your population estimate, you took some comfort from certain of the findings of Dr. Bennett; correct?

A. Correct.

Q. And one of those findings from which you took comfort was that there was a significant correlation between his population estimates through time and changes in the Summer Townet Survey indices through time; correct?

A. That was one of the factors I looked at. He also had similar correlations between the 20 millimeter delta smelt abundance, the townet survey and then between the fall midwater trawl abundance and the fall surveys.

Q. Dr. Hanson, those indices are calculated based on underlying catch data from the relevant survey; correct?
A. They are. Both the population estimate and the indices use the same fundamental data.
Q. Right. So the fundamental data that you're talking about there is the number of delta smelt caught in one of these surveys; correct?
A. Correct. And the corresponding densities that would calculate from that catch.
Q. So the number of delta smelt caught would be expected to correlate to an index based on the number of delta smelt caught; correct?
A. Correct.
Q. And you would also expect the number of delta smelt caught in these surveys to correlate with the population estimate based on the number of delta smelt caught; correct?
A. Correct. That was one of the things that Dr. Bennett was testing.
Q. So it's predictable that when an index and a population estimate are based on the same underlying data, that the index and the population estimate are correlated; correct?
A. The fact that they were correlated here reflects, to a large extent, that underlying population estimate, the densities. So yes. Had it not proven to be true that they are as highly correlated as Dr. Bennett found, that would have

been the subject of further debate and discussion. But the fact that they are correlated, since you have the same fundamental data driving both, is not particularly surprising.

Q. And it doesn't particularly establish that the population estimate is accurate; does it?

A. It does not. It just simply says that it responds the way you would expect it to respond.

Q. Dr. Hanson, could I ask you to look at State Water Contractors Exhibit I. It says "Exhibit 4" on it and it has a graph of estimated delta smelt population based on surveys 4 through 9 from the 20 millimeter survey 2007.

A. Thank you. That helped.

Q. Do you recall Mr. Wilkinson asking you whether this graph -- whether you intended this graph to present a trend in-Delta smelt abundance through time?

A. Yes, I do.

Q. And your answer was -- well, your answer is that you did not intend it to -- for that purpose; correct?

A. We intended it not to be a depiction of the trend in-Delta smelt abundance through time as reflected by various survey years. It does reflect a trend in time within the 2007 period of the 20 millimeter surveys.

Q. Does it reflect an increase in abundance in-Delta smelt during that time period?

A. It reflects an increase in our estimate of abundance based

on these surveys.
Q. So is it fair to say, Dr. Hanson, that your estimate of abundance of delta smelt increased from something under 50,000 in the period June 4th through June 9th to something over -- around 1.8 million in the period July 7th through -- or July 2nd through July 7th?
A. Given the estimates and the data that we used, that was the change in our estimates between those two periods, yes.
THE COURT: And you have the opinion that that's an annual phenomena, that's the way the population in effect progresses during the year?
THE WITNESS: Well, we know, Your Honor, that delta smelt spawn during the late winter, early spring. And so what you would expect is to have those eggs hatching progressively over the period say in March and into early April. With those larvae then becoming part of the planktonic population in the spring. This reflects, I think, a couple of different factors that are not separable. One is the change in the population abundance itself as these larvae become, you know, hatching and coming into the Delta.
The second, and the compounding factor is that during this time period, the larvae are growing and therefore there's a change in the efficiency of the net that we're using.
THE COURT: And until they become, in effect, detectable by size, they're not counted?

THE WITNESS: They are not counted.
BY MR. WALL:
Q. But you wouldn't use this graph to suggest that there had been a sudden increase in abundance of delta smelt; would you?
A. All we can say is that there was a sudden increase in our population estimate. We don't know whether that reflects a change in the real abundance of delta smelt, a change in the selectivity of the net for reporting the occurrence of delta smelt. Very likely a combination of factors.
But we wouldn't use this information to suggest that the delta smelt population as reflected in the 2007 data is higher, lower, in a positive trend or not when compared to previous years.
Q. Dr. Hanson, do you have in front of you, or could you find, please, State Water Contractor Exhibit F. I believe it's your declaration of July 23rd in this case.
A. Yes.
Q. If I could ask you to turn to page four, paragraph 11. And read along with me. I'm going to read your declaration of July 23rd. And tell me if I read this accurately. "The receipt of the most recent" -- sorry, does the Court --
THE COURT: Page and line?
MR. WALL: This is page 4 of State Water Contractor F. Paragraph 11 at the bottom of the page.
THE COURT: Thank you. Proceed.

BY MR. WALL:

Q. Tell me if I read this declaration of yours accurately. "The receipt of the most recent mid-June through early July 20 millimeter survey data has substantially increased the estimate of the current population of delta smelt. A population estimate based on pre-June/July data would have been extremely low (see Exhibit 4) and would have increased the vulnerability of the delta smelt to significant impacts associated with various sources of mortality. With the increase in-Delta smelt abundance observed during late June and early July, it appears that the 2007 delta smelt population has higher abundance than earlier expected. This suggests that with higher population abundance, the 2007 delta smelt cohort will be more resistant and resilient to various factors affecting population dynamics, and that through the implementation of various protective measures to reduce and avoid significant mortality during the remainder of the summer, fall and winter, an increased abundance of adult delta smelt would be expected in the spawning populations during the winter and early spring in 2008."

Did I read that correctly?

A. Yes, you did.

Q. Now, could I ask you to look at State Water Contractor -- oh, I'm sorry, there's just one more part in that. If we could -- let's see -- look at your August

declaration, which I believe is State Water Contractor Exhibit G. If I can direct your -- do you have that in front of you, Dr. Hanson?

A. Yes, I do.

Q. Actually, let me -- I apologize for this, but I'm going to have you look at a different exhibit first. It was State Water Contractor J. It says "Exhibit 8" on it and has "survey and date" on it. "Estimated population."

Now, do you have that in front of you?

A. I do.

Q. Do you recall Mr. Wilkinson asking you some questions about this?

A. Yes, I do.

Q. And Mr. Wilkinson -- is it -- did you intend this -- if I could ask you to focus in particular on the last survey result for the 20 millimeter survey, which shows a population of 1.8 million.

A. Yes.

Q. And then the next bar there in a different color is for the Summer Townet Survey.

A. That is correct.

Q. And you testified that you were not intending to suggest that the difference between those two figures represented simply mortality of the delta smelt; correct?

A. Correct. There's several factors that could account for

that difference.
Q. Those population estimates were based on surveys that were one week apart; correct?
A. That is correct.
Q. And you would never have suggested that had all been caused by mortality; correct?
A. I don't believe it was caused by mortality in total.
Q. Now, if I could turn your attention back to your August 13th declaration, which is State Water Contractor G, and ask you to turn to page 16.

And if you see there, there's a question printed in bold face that says "Court question number 6: Best current estimate of the entire delta smelt population abundance." Do you see that?
A. Yes, I do.
Q. I'm just going to read that paragraph and ask you to read along and let me know if I read it correctly.

"As discussed above the best available population abundance estimates for juvenile delta smelt are those derived from the surveys eight and nine of the CDFG 20 millimeter delta smelt surveys, and the first three 2007 Summer Townet Surveys. The early, juvenile delta smelt population abundance estimate that I developed using density data from the survey nine CDFG 20 millimeter survey was approximately 1.8 million delta smelt. The population estimate that I developed based

upon the latest CDFG Summer Townet Survey conducted between July 9 and 14th, 2007 was 680,000 juvenile delta smelt. Results of the 2007 delta smelt population estimates calculated from the CDFG 20 millimeter surveys and Summer Townet Survey three are shown in Exhibit 8."

That's State Water Contractor J; correct?

A. That is correct.

Q. Continuing, "As discussed above, the decline in-Delta smelt abundance during the summer is not unexpected given the mortality that occurs during the early lifestages of the species such as delta smelt." Is that correct?

A. That is correct.

Q. Now, you wouldn't -- let me withdraw that.

You would not use your own population estimates to decide whether to delist the delta smelt; correct?

A. Absolutely not.

Q. The question of whether to delist is a question of whether the population of delta smelt has recovered; correct?

A. That is correct.

Q. So you would not use your population estimates to decide whether the population has recovered; correct?

A. No. And I don't believe these estimates come anywhere near suggesting that it has.

Q. You wouldn't use them to determine whether a particular project affected the Delta smelt's prospects for recovery;

correct?
A. I would use them to evaluate the potential magnitude of an impact of a project, in this particular instance over a short period of time. If we had started this year with a very low delta smelt population, let's assume 100,000 fish or less, that would have changed my opinion about the prospects of delta smelt surviving through the year, potential magnitude of various impacts. And those would have all had a bearing on a decision about the prospects for recovery.
Q. Dr. Hanson, Dr. Bennett's population estimate allowed that population of delta smelt in 1994 might have been as low as zero; correct?
A. Could have been. The fact that it was driven by survey data that showed it was not zero suggests that it was higher than that.
Q. But we don't know the lower bound of the population estimate for delta smelt; correct?
A. We do not.
Q. And your population estimate doesn't give you any confidence that the population is or was 1.8 million fish in July; correct?
A. That was simply the estimate that we derived.
Q. And you don't actually have any confidence that it was 100,000 fish then; do you?
A. From a mathematical and statistical perspective, no.

Q. But you would compare those uncertain population estimates to salvage in determining whether export operations posed a risk of jeopardy or adverse modification to the delta smelt; correct?
A. I would use those as one of the factors in that decision. In the absence of that, you have no context for determining whether 100 or 500 delta smelt in the salvage is a large percentage of the potential population or a very small percentage.
Q. Would you say that relying on a population estimate that -- for which you've not calculated confidence intervals gives a false sense of confidence?
A. As scientists, we're all concerned that the information that we're presenting could be used, in some cases, in inappropriate ways. And the fact that individuals could use this information to develop a false sense of confidence, I think, is a fear and a risk.
Q. And, in fact, you have used this information to compare uncertain population estimates to known underestimates of project take of delta smelt; correct?
A. I have. To provide a context for that.
Q. Dr. Hanson, you've prepared a remedy proposal in this case; correct?
A. Correct.
Q. Your tier one remedy proposal is to provide net westerly

flows on the San Joaquin River through the winter and spring; correct?

A. That is correct.

Q. Now, this approach hasn't been field tested to determine whether it will effectively reduce delta smelt entrainment; correct?

A. It has not been tested.

Q. You have hypothesized that the geographic distribution of delta smelt would primarily occur in the lower San Joaquin River, Suisun Bay, if net westerly flows were maintained in the lower San Joaquin River during the winter and spring; correct?

A. I have hypothesized, not that they would be in the lower San Joaquin River, but rather that they would be in the lower Sacramento River and Suisun Bay.

Q. Let me rephrase the question then.

You have hypothesized that the geographic distribution of delta smelt would primarily occur in the lower Sacramento Bay and Suisun Bay if net westerly flows were maintained in the lower San Joaquin River during winter and spring?

A. That is correct.

Q. But that hypothesis has not been tested; correct?

A. That hypothesis has not been field tested.

Q. Now, the purpose of your tier one proposal would be to

protect various lifestages of delta smelt; correct?
A. Correct.
Q. Those lifestages would include sub-adults?
A. Yes.
Q. And adults?
A. Yes.
Q. And larval?
A. Yes.
Q. And early juvenile delta smelt?
A. Correct.
Q. And the only modeling to which you point in support of this tier one proposal is Particle Tracking Model; correct?
A. That is correct.
Q. Now, am I correct that particle tracking modeling looks at what would happen to a neutrally bouyant particle that is just let loose in the stream of water?
A. That is correct.
Q. And the modeling that you used, the particle tracking modeling that you relied on in developing your tier one proposal, was conducted only for the months of December and January; correct?
A. No. The particle tracking modeling that was done was conducted from December through June.
Q. Dr. Hanson, the particle tracking modeling that you relied on was conducted by or under the supervision of somebody named

Armin Munevar; correct?
A. Armin produced some of the results. Allison Dvorak produced some of the results. Paul Hutton from the Metropolitan Water District also was producing results on the Particle Tracking Model.
Q. Let me direct your attention to your July 23rd declaration. State Water Contractor Exhibit F at page 8. If I could ask you to look at line 6 on. I'm just going to read from your declaration, let me know if I read this accurately. "The Particle Tracking Model is considered by" -- I'm sorry. I have the wrong lines there. Lines four through six.
"The Particle Tracking Model simulates the water transport of neutrally bouyant particles through the Delta. The technical details of the model are beyond my expertise but are described in the accompanying declaration of Armin Munevar." Correct?
A. That is correct.
Q. And that's the modeling you relied on in developing your tier one proposal; correct?
A. We used the Particle Tracking Model. The way the Particle Tracking Model works is that you can select various locations within the Delta for particle insertion. You can also select various time periods for particle insertion.
And the structure of the analyses that I had laid out with Armin had five different locations where particles were

inserted at, I believe, four different monthly time periods.
Q. Dr. Hanson, the modeling on which you relied is the modeling that's set out in the declaration of Armin Munevar; correct?
MR. WILKINSON: Asked and answered. He explained there's several people whose modeling he relied on.
THE COURT: This is a stand alone question. He has confirmed that Mr. Munevar was one of the people who worked on this. Do you need to go over that again?
MR. WALL: Well, Your Honor, I'm just trying to understand if there was modeling that is not described in the declaration of Armin Munevar.
THE COURT: Why don't you ask that directly.
BY MR. WALL:
Q. Mr. Hanson --
THE COURT: The objection is sustained.
BY MR. WALL:
Q. -- the modeling that you relied on is described in the declaration of Armin Munevar; correct?
A. The -- and I haven't gone through Armin's declaration in detail. The model description and the protocols and assumptions, I believe, were laid out in that declaration. We relied on a whole series of iterations of the Particle Tracking Model. And so I'm not sure which specific results are presented in that declaration.

Q. The declaration of yours, from which we've been reading, is dated July 23rd; correct?
A. Correct.
MR. WALL: Your Honor, may I approach?
THE COURT: You may.
(Plaintiffs' Exhibit 17 was marked for identification.)
BY MR. WALL:
Q. Now, Dr. Hanson, the technical details of this particle tracking method are beyond your expertise; correct?
A. That is true.
Q. Could you -- I've handed you what has been marked as plaintiffs' Exhibit 16 for identification. Could you tell us what that is?
A. This is the declaration of Armin Munevar in these proceedings.
MR. WILKINSON: Excuse me, I don't think the exhibit number is correct. I have as Exhibit 16 the paper by Bruce Herbold.
THE COURT: I have it as plaintiffs' 17.
MR. WALL: I'm sorry, Your Honor. We'll refer to it as Plaintiffs' 17.
THE COURT: Thank you.
BY MR. WALL:
Q. This is the declaration of Armin Munevar; correct?

A. That is correct.
Q. It's the declaration described in your own declaration of July 23rd; correct?
A. That is -- describes how this modeling was done.
Q. And the date of this declaration of Armin Munevar is July 20th, 2007?
A. That is correct.
Q. If I could ask you to turn to paragraph five. And I'm just going to read the first sentence of paragraph five. And let me know if I've got it correct.

"CH2M HILL staff ran two DSM2 model simulations for the historical period of December 2001 through January 2002 to evaluate the effects of proposed operational changes."

Did I get that correct?
A. You did.
Q. The modeling they used as the basis for your tier one proposals was conducted for only a single hydrologic year; correct?
A. Correct.
Q. And only for two months during that year; correct?
A. Based on the information presented in paragraph five, that is true.
Q. That modeling was not conducted under a range of hydrologic conditions; correct?
A. The modeling reported by Armin here doesn't appear to be,

no.
Q. If I could ask you to turn to page four of this exhibit, Plaintiffs' 17. And I'm going to read you the second to the last paragraph. It's right after paragraph nine. Particularly I'm going to read the last sentence of that paragraph. Let me know if I got it correct.
"However, this operation and the associated export reductions were not evaluated for a wider range of hydrologic conditions or different particle insertion locations." Correct?
A. That is correct.
Q. Now, the particle tracking modeling on which you relied in developing your tier one proposal assumed that the Delta cross-channel gates were open; correct?
A. We assumed that the Delta cross-channel gates would be open until February 1. And the Delta cross-channel gates would then be closed from February 1 through May 20th.
Q. Well, Dr. Hanson, there was no modeling for February 1 through May 20th; correct?
A. Not reported in Armin's declaration, no.
Q. And you relied on this modeling to propose your tier one approach for the entirety of the winter and spring; correct?
A. This was one of the pieces of information that we used, yes.
THE COURT: Tell you what we're going to do. We're

going to take ten minutes now on the hour for the reporter since it's getting so late in the day and we'll go one-half hour more after we come back at 25 minutes to five. So we're in recess until 25 minutes of five.

(Recess.)

THE COURT: Please be seated. We're back on the record in NRDC versus Kempthorne. Resuming Dr. Hanson's testimony. Mr. Wall.

MR. WALL: Thank you, Your Honor.

Q. Dr. Hanson, your tier one proposal was designed to protect sub-adult and adult juvenile smelt?

A. It is intended to provide conditions that would be more conducively built to keeping sub-adult and adult delta smelt away from the area of risk.

Q. Particle tracking modeling does not reliably predict the movement of sub-adult or adult delta smelt; does it?

A. Particle tracking modeling does not reliably provide information on the movement of sub-adult or adult delta smelt that have volitional behavior. One of the things, though, that we found through the work of Dave Fullerton is that there appears to be an association between sub-adult and adult delta smelt and turbidity and the Particle Tracking Model can be used to look at the potential effects of hydrologic conditions on turbidity in terms of the movement of material from, say, the Sacramento River into the interior Delta.

Q. Dr. Hanson, increasing flows on the San Joaquin River would tend to increase turbidity on the San Joaquin River; correct?
A. To the extent that they're driven by storm water runoff, that is true. To the extent they're driven by reservoir releases, less true.
Q. But still true?
A. But still true.
Q. And the San Joaquin River is more turbid than the San Joaquin River; correct?
A. San Joaquin River is typically more turbid than the Sacramento River.
Q. And delta smelt prefer a more turbid environment; correct?
A. That is what's starting to show up from some of these analyses.
Q. So increasing flows on the San Joaquin River would make that a more preferable environment for the delta smelt; correct?
A. There is a potential for that, yes.
Q. They tend to attract delta smelt towards the San Joaquin River; correct?
A. There is a potential for that, yes.
Q. Getting back to -- that would be in the zone of influence of the pumps; correct?
A. That would be in the area of the lower San Joaquin River

near the confluence with Old and Middle Rivers and that would be within the area of the zone of influence.

Q. Getting back to the particle tracking method and its use with respect to sub-adult and adult smelt. Let me direct your attention to State Water Contractor Exhibit F. Or it's your July 23rd declaration.

A. All right.

Q. Let me ask you to turn to page eight. I'm going to read you a couple of sentences and I'd like if you could just read along with me and let me know if I get them correct.

"The Particle Tracking Model is considered by biologists and other experts in the field to be a reliable method for predicting and analyzing the movement and fate of delta smelt larvae in the Delta under different hydrologic conditions."

Got that right so far?

A. Yes.

Q. "Results of these particle tracking modeling exercise indicate that, by maintaining a positive net westerly flow of water within the lower San Joaquin River through regulation of combination of flow through the Delta cross-channel, San Joaquin River flow, and SWP and CVP exports during the period extending from approximately December 1 through June 30th, the vulnerability of sub-adult, adult, larval, and early juvenile lifestages of delta smelt to project exports effects can be

substantially reduced or eliminated." Correct?
A. That is correct.
Q. So it's your opinion that this Particle Tracking Modeling on which you relied is sufficient to determine that net westerly flows on the San Joaquin River, lower part of the San Joaquin River would protect sub-adult and adult delta smelt.
A. To the extent that through my discussions with Dave Fullerton and others, it appeared that by providing these positive flows, we would be reducing the likelihood that sub-adult and adult delta smelt may be moving into that zone of influence, that was part of the rationale that we used for evaluating those wintertime actions.
Q. Dr. Hanson, sub-adult and adult delta smelt are engaging in a volitional movement upstream; correct?
A. They are moving upstream at that time of their life history.
Q. Against the current; correct?
A. They are moving upstream against the current.
Q. And they prefer more turbid environments; correct?
A. Well, not necessarily. I mean, if that were to be the case -- I mean, they do -- there's a turbidity relationship here, but for example, today we have greater concentration of sub-adult delta smelt in the lower Sacramento River near Decker Island. Whether that is in response to food accumulation in this area or a combination of turbidity and

other factors, I don't think we really understand.
Q. But all other things equal, the delta smelt would prefer a more turbid environment; correct?
MR. WILKINSON: Asked and answered.
THE WITNESS: The data we have suggests that all other things being equal, they prefer a more turbid environment.
BY MR. WALL:
Q. And increasing flows on the lower San Joaquin River would make that a more turbid environment; correct?
A. There would be a potential for that, but whether or not that would occur and how delta smelt would respond to that I think is still one of the issues of concern. That's one of the reasons we implemented tier two.
Q. Dr. Hanson, your proposal to attempt to protect delta smelt through net westerly flows on the lower San Joaquin River has not been endorsed by any state or federal agency; correct?
A. Correct.
Q. It was not recommended by the Delta Smelt Working Group?
A. Not to my knowledge.
Q. It's not been recommended by the Fish & Wildlife Service?
A. It was not included in their matrix, no.
Q. You were here for Ms. Goude's testimony?
A. I was.

Q. And you understand that she testified that there was no demonstrated connection between net westerly flows on the San Joaquin River and delta smelt survival or abundance?
A. I remember Dr. -- or Ms. Goude making that declaration, yes.
Q. And your tier one proposal has not been recommended by the California Department of Fish & Game?
A. They have not.
Q. And Jerry Johns with the Department of Water Resources, he's a biologist there; correct?
A. He is.
Q. And he has testified through his declaration -- have you read his declaration?
A. I have read only portions of his first declaration. I have not read his second.
Q. You recall that -- you had conversations with Mr. Johns about your tier one proposal; correct?
A. Yes, I did.
Q. And you understand that it's his opinion that tier one, your tier one proposal is too experimental to recommend it as part of any interim remedy proceeding in this case?
A. Mr. Johns and I had that discussion and Mr. Johns expressed that opinion. We talked about the need for additional analyses and that there was some additional information that he had requested and would like to see, such

as the results of the Particle Tracking Model. But yes, that is a fair reflection of the discussion I had with Mr. Johns.

Q. To your knowledge, Mr. Johns' view that your tier one proposal is too experimental to be implemented at this time hasn't changed; has it?

A. I don't believe I have any information to suggest that that has changed, no.

Q. Let me turn to your tier two proposal. Do I understand correctly that your tier two proposal would target Old and Middle River flows that were negative between minus 1,000 cfs and minus 6,000 cfs?

A. That is correct.

Q. So the ceiling on negative flows would be minus 6,000 cfs; correct?

A. Correct.

Q. And under your proposal, within that range the Fish & Wildlife Service would have discretion to set the particular flows; is that correct?

A. That is my understanding.

Q. Your proposal doesn't set out any specific criteria for setting the flows within that range; correct?

A. It does not.

Q. So the Fish & Wildlife Service could set the flows at minus 6,000 cfs under a variety of different conditions; correct?

A. That is correct. And one of the things that we intended was to potentially have an opportunity to sit down with the Fish & Wildlife Service and Fish & Game and discuss the triggers and how those would be developed and how they would be implemented. But it would be the service's decision.

Q. But those details are not set out in your proposal?

A. Those details are not set out in the proposal.

Q. Now, the purpose of this ceiling on negative flows under your proposal is to prevent or reduce entrainment of delta smelt by the CVP and SWP export facilities; correct?

A. Correct.

Q. And entrainment depends in part on the magnitude of negative flows on the Old and Middle River; correct?

A. It depends on a variety of things. The magnitude of flow on Old and Middle River is certainly one of the important -- as is the geographic distribution of delta smelt, other hydrologic influences within the Delta, but yes, Old and Middle River flows are an important factor.

Q. And focusing on a second factor you just mentioned, the geographic distribution of delta smelt. Would it be fair to say that entrainment by the export facilities depends in part on when delta smelt are passing through the zone of influence of the export facilities?

A. Yes, it does.

Q. And in most years, the delta smelt salvage at these

facilities occurs as one continuous event; correct?
A. Well, there is variability --
MR. WILKINSON: Objection.
MR. LEE: Objection on vagueness grounds.
THE COURT: Do you understand the question?
THE WITNESS: I believe that I do.
THE COURT: Overruled. You may answer.
THE WITNESS: There is variability in the occurrence of delta smelt within the salvage. But there are general seasonal periods when delta smelt salvage is typically the highest.
BY MR. WALL:
Q. And there's one period in the winter when salvage tends to be high; correct?
A. There is one period in the winter generally and there's one period in the spring.
Q. And in most years, winter salvage of delta smelt occurs as one continuous event; correct?
MR. LEE: Objection, Your Honor, the term "one continuous event" is not defined.
THE COURT: Do you understand the question?
THE WITNESS: Not completely.
THE COURT: All right. The objection is sustained. You may rephrase.
BY MR. WALL:

Q. Dr. Hanson, do you have in front of you a copy of Dr. Swanson's declaration of August 13th, 2007? This would be Plaintiffs' Exhibit 4 in evidence.
A. Yes, I do.
Q. I'd like to ask you to turn to the exhibits of that declaration. If you go towards the back, you'll see that they're numbered up to page 135. Do you see that?
A. I do see that.
Q. And if I could ask you to turn to page 81.
A. Delta Smelt Working Group Conference Call Minutes, November 28?
Q. Yeah, November 28, 2005.
A. Yes.
Q. This is page 81 of 135 of the exhibits, Your Honor.
THE COURT: I have it.
BY MR. WALL:
Q. If I could ask you to look at the last paragraph on that page and look at the second sentence. I'm going to read that and let me know if I read it correctly. "In most years, winter salvage occurs as one continuous event spread over time." Did I get that right?
A. Yes, you did.
Q. You understand what that means?
A. What I interpret that to mean is that there would be a uniform distribution, basically you have the same number of

delta smelt showing up in the salvage each day during the winter period.

Q. So you have a time period during the winter when delta smelt were passing through the zone of influence of the pumps and salvage occurred as a result of that passage; correct?

A. That would be one biological pathway that this could occur, yes.

Q. So the timing of this winter salvage event would depend on when delta smelt were in the area of the pumps; correct?

A. That is correct.

Q. And sometimes that might occur in January?

A. That could occur in January or in February.

Q. Or March?

A. Could be in March.

Q. Or even late December?

A. Sometimes, yes.

Q. Or it could be spread across more than one month; correct?

A. Could be spread across more than one month, yes.

Q. Dr. Hanson, could I ask you to look at State Water Contractors Exhibit O, which is the graph that says "Old and Middle River flow." It's a bar graph.

A. I have it.

Q. Mr. Wilkinson asked you some questions about that; correct?

A. Yes, he did.

Q. This is a bar graph that shows flows on the Old and Middle River in 1996; correct?
A. In January and February of 1996, yes.
Q. And he asked you some questions about this relative to the salvage of the delta smelt in those two months. Correct?
A. Yes, he did.
Q. And in particular, he asked you about a data point on Dr. Peter Smith's relationship that showed a high salvage at a flow of, what was it, about 4,000 cfs.
A. 4,000, 3900 minus cfs, yes.
Q. You indicated that that data point might have been misrepresentative because it reflected both January and February; correct?
A. That was one of my concerns, yes.
Q. And the average flow in January and February would be much lower than the -- or much less negative than the negative flow in January alone; correct?
A. That is correct.
Q. Now, what would you consider a high level of take of delta smelt for one of these months?
A. During that time period, we have adults that are moving upstream. Take in the hundreds would certainly, I think, be high. Take in the thousands would be very high.
Q. Dr. Hanson, if you were to approximate the average flow for the month of February on State Water Contract Exhibit O,

what would you say that was?
A. I would say it would be close to zero, maybe slightly negative.
Q. But during a portion of that month, it was negative; correct?
A. During a portion of that time, it was approaching or slightly exceeding negative 2,000.
Q. And based on your understanding of negative flows on the Old and Middle River, one would not expect to have high levels of salvage at those flows; correct?
A. We would typically not expect to have high levels of salvage at those flows.
Q. Now, Dr. Hanson, your declaration includes a flow relationship that was developed by DWR for the months of January and February; correct?
A. Correct.
Q. And your declaration only attaches the flow relationship for January; correct?
A. Correct. I used both January and February, but we attached January.
Q. And you were only asked today in this courtroom about January; correct?
A. I was.
MR. WALL: May I approach, Your Honor?
THE COURT: You may.

(Plaintiffs' Exhibit 18 was marked for identification.)

BY MR. WALL:

Q. Dr. Hanson, I have handed you what's been marked for identification as plaintiffs' Exhibit 18. This is the declaration of Jerry Johns filed on July 9th, 2007; correct?

A. Correct.

Q. If I could ask you to turn to Exhibit B.

THE COURT: Does it have a page designation?

MR. WALL: Up at the top, Your Honor, it would be page 12 of 21, I believe.

THE COURT: The Exhibit that I have is 22 pages long and page 12 of 22 has no reference to an exhibit.

MR. WALL: I'm sorry, Your Honor, do you have the declaration of Jerry Johns filed 7-9-2007?

THE COURT: I do. It's marked Exhibit 18 for identification. It consists of, looking at the document 399-2 and it purports to have 21 of 21 pages.

MR. WALL: Your Honor, I'm directing the witness' attention to page 12 of 21.

THE COURT: Yes. I'm there.

BY MR. WALL:

Q. Dr. Hanson, this is the exhibit which you attached to your declaration; correct?

A. This is the exhibit, yes.

Q. And it shows a flow versus salvage relationship for January in certain years; correct?
A. It does, yes.
Q. Let me ask you to turn to Exhibit C, which is the next page of Mr. Johns declaration.
Now, this represents the DWR analysis for February. Negative flows on the Old and Middle River versus delta smelt salvage; correct?
A. Correct.
Q. And could you tell us approximately what the level of salvage was in 1996? In February.
A. In February, the salvage looks to be about 1300 or so, 1400 delta smelt at a combined Old and Middle River flow of just above zero, slightly positive.
Q. Now, referring back to State Water Contractors Exhibit O, which is on the Elmo. Those 13 or 1400 delta smelt would have been taken during a time period in which you said the average negative flows during the period of negative flows was about minus 2,000 cfs; correct?
A. Roughly so, yes.
Q. So at a negative flow of about minus 2,000 cfs for a part of the month, we saw a salvage of about 1300 or 1400 delta smelt; correct?
A. Based on the 1996 data for February, that's what it was reported, yes.

Q. And that salvage count is an underestimate of the total take due to entrainment at the state and federal water project export facilities; correct?

A. That salvage estimate would occur during the February time period when delta smelt are sub-adults. So some of the issues about underreporting fish less than 20 millimeters would not apply at this time period. There is predation mortality that I feel occurs within the forebay. There are louver efficiency issues, most of which have not really been very well documented for delta smelt.

So I would say that there are certainly opportunities for this to be an underestimate. How much, we don't know.

Q. And that underestimated 1300, 1400 delta smelt is somewhat in excess of the hundreds of delta smelt that you said would represent a high level of salvage; correct?

A. That would be, you know, certainly in the realm of being in the higher range. Not so much for 1996, but certainly under the current population levels, that would be, in my estimation, a very high level of salvage.

Q. Dr. Hanson, if I could turn your attention back to Exhibit C. Actually if I could ask you to look at Exhibit -- this is Plaintiffs' 18, the Johns declaration, Exhibit D, which is at page 12 of 21 of plaintiffs' 18.

A. Yes.

Q. And you testified earlier today that the R-squared value

was quite high, it was .88 or so for that exhibit; correct?
A. For the January analysis, that's true.
Q. And you said that was higher than the R-squared value reported by Dr. Smith of about .64; correct?
A. I believe Dr. Smith's January/February combined linear R-squared was .61.
Q. Dr. Hanson, the R-squared value for February, the table that -- or the exhibit that you did not previously provide to the Court, has a value of .299; correct?
A. Roughly .3, yes.
Q. If I could ask you to look at Exhibit D of Plaintiffs' 18, page 12 of 21. If you could look at January, 2000. Is it correct that it shows an average negative flow of about minus 7400 cfs?
MR. WILKINSON: Excuse me, Mr. Wall. I'm not sure. You're looking at page 12 of?
MR. WALL: 12 of 21 of plaintiffs' 18. It says at the top. This is Exhibit B, this is the figure that --
MR. WILKINSON: I've got it. Thank you.
THE COURT: These are average January, but I'm not seeing days on the scale. It looks like we have flow and cfs on the X axis and we have delta smelt salvage on the Y axis. Is there a way to find a date on this exhibit?
MR. WALL: The -- Your Honor, the small circles have a number in them.

THE COURT: I see. Those are dates?
BY MR. WALL:
Q. Dr. Hanson, is it your understanding that the numbers in the small circle is the year?
A. It is the year.
THE COURT: Thank you.
BY MR. WALL:
Q. Am I correct that the salvage reflected in this for January 2000 was about 800 delta smelt?
A. That's not how I would read the graph. I would read the graph as saying for January of 2002, the reverse flow was about negative 8,000 cfs. And the number of delta smelt salvaged was about 5200.
Q. I'm sorry, if I could ask you to look at 2000.
THE COURT: 2000 is down there, it's -- if you go over on the X axis in increments of thousands, count over about almost 3,000.
THE WITNESS: Yes.
THE COURT: In terms of the salvage, it looks like it's less than a thousand.
THE WITNESS: It would be less than a thousand. And it would be a reverse flow somewhere in the order of about 74, 7500 cfs negative reverse flow.
BY MR. WALL:
Q. And your explanation for this data point is that flows of

negative 7400 cfs are not particularly harmful to delta smelt?
A. No. This would be above the range where we would start to see an increase in-Delta smelt salvage as reverse flows become more negative.
Q. Do you know if that salvage of, say, 800 delta smelt during that month was spread out through the entirety of the month?
A. I don't know.
Q. So you don't have any understanding of whether delta smelt were just beginning to migrate into the area where they might be entrained during late January?
A. I don't know.
(Plaintiffs' Exhibit 19 was marked for identification.)
MR. WALL: Your Honor, may I approach?
THE COURT: You may.
BY MR. WALL:
Q. Dr. Hanson, if I could direct your attention to what has been marked as Plaintiffs' Exhibit 19. I assume you've never seen this document before?
A. I have not.
Q. Do you have an understanding of what it represents?
A. In general I do, yes.
Q. Could you describe your understanding.
A. What these graphs show are a frequency of occurrence of

delta smelt as a function of the date during the wintertime period extending from December through March shown on the X axis, the delta smelt take, the number of fish per day, on the Y axis for periods from December 1999 through March 2000, a separate graph for December 2000 through March 2001 and a third graph for December 2001 through March 2002.

And then what appears underneath each of those monthly designations, I'm assuming, is the average monthly reverse flow in Old and Middle River during that time period.

Q. I'm going to ask you to assume that this figure is an accurate representation of what you've just described.

MR. LEE: Your Honor, I'm going to object to consideration of this document. We've had no foundation laid as to what public records or sources it's been derived from. No idea whether it's reliable.

THE COURT: Well, the witness recognizes it generally. But it does seem to need more foundation. Sustained.

MR. WALL: Your Honor, I am asking him to assume that it is accurate. I will, during rebuttal testimony --

THE COURT: All right. You want to connect it up.

MR. WALL: -- in about three minutes.

THE COURT: Can you do that, Dr. Hanson? Just make the --

THE WITNESS: Yes, Your Honor.

THE COURT: -- assumptions that the data here you can refer to and interpret.

THE WITNESS: I can make that assumption.

MR. WALL: I will represent to the Court, as an officer of the Court, that if we have three minutes of rebuttal testimony, we'll be able to lay an adequate foundation for this.

THE COURT: All right. Thank you.

BY MR. WALL:

Q. Dr. Hanson, is it fair to say that the salvage event for winter 2000 began to really take off in late January of that year?

A. In that year, yes.

Q. So just looking -- averaging take against negative flow for January of 2000 might misrepresent the relationship between flow and salvage for that month; correct?

A. I believe so, yes.

Q. It would have split the salvage event between two months; correct?

A. It would have. It would have primarily put the salvage event into February.

Q. And it would have suggested that, if you looked only at January, flows of minus 7300 or 7391 cfs on Old and Middle River weren't likely to cause that significant a take event; correct?

A. Well, when you look at the 2,000 data by itself, you could draw that conclusion. But when you look at the relationship overall as reported in Exhibit B of Mr. Johns' declaration, it suggests that there's a dramatic increase after you pass about minus 6,000 cfs. Independent of what any one given year may show. But you could draw that conclusion from this, yes.

Q. Might that dramatic increase of above 6,000 cfs negative flow have something to do with the levels of negative flow at the time when delta smelt are passing through the zone of influence of the pumps?

A. Those two things co-occurring would certainly be a major factor affecting the vulnerability of delta smelt. You need to have the environmental conditions, in this example the negative flow in Old and Middle River, coincident with the time period that delta smelt are vulnerable and in the area of potential influence.

THE COURT: All right. We've reached the time that we had promised the reporter we weren't going to go past. So let me ask the parties a rhetorical question.

We are approaching the time where we're going to conclude this hearing and I don't think there's any question parties should not be surprised to learn that there is going to be a remedy that is going to be imposed by the Court. I do not know whether the parties are interested in communicating with each other and seeing if you can come up with something

you can all be proud of in terms of what is going to be lawful and appropriate to address the issues that are before the Court until the BiOp is reissued.

That I'm going to leave to you. But if you want any predictability and any certainty and hope to have any control over what may be pronounced, that is the only way that you'll be able to do that.

So I'm going to leave it to you. I don't know how entrenched the parties are and how firm your positions are. But if you leave it to me, I will do it. As you know, I've done it in every case that I've had to decide before. And so -- but that may not be what any of you want.

Is there anything further before we recess?

MR. LEE: Your Honor, I would like to know from Mr. Wall how much more he has of cross so we can prepare.

THE COURT: Yes.

MR. WALL: Your Honor, I'd be able to give a more accurate estimate the first thing tomorrow morning when we resume and I look over my notes.

THE COURT: All right.

MR. WALL: I do need to complete tier two and tier three of Dr. Hanson's proposal.

THE COURT: Yes. And I can tell you this. Again, I'm not prejudging anything, but it seems to me that Dr. Hanson has been very helpful in, quite frankly, acknowledging

the limitations on the studies that have been done. There are limitations in everybody's studies. There's great uncertainty.

But there is one universal principle in this case that cannot be contested by anybody and that is that no matter how you evaluate it, no matter how you parse it, whatever he's done with the numbers, the species is in a critical condition, it's got to be addressed and the only question that there is is how it's going to be addressed.

So if anybody is thinking that there's not going to be a remedy, that you've shown that there's such uncertainty that something is not going to happen, you need to have a reality check now because that's where we are in this case. Every expert has told us the same thing.

And I respect and thank Dr. Hanson for his candor today. It is appreciated. And I want to say that to all the experts. All the experts have been unusually helpful and I think honest and forthright in their testimony.

Anything else, Mr. Wall?

MR. WALL: I just need to collect my papers and move away.

THE COURT: Yes, you may do that. Plaintiffs' 16 through 19, while there was some foundation issues with some of them -- there have been objections -- which are going to be connected up. Had you moved any of those into evidence, Mr.

Wall?

MR. WALL: Your Honor --

THE COURT: Excuse me. Can everybody start at 8:30?

MS. POOLE: Yes, Your Honor.

MR. MAYSONETT: Yes, Your Honor.

THE COURT: All right. We're going to start at 8:30 a.m.

MR. WILKINSON: What time, Your Honor?

THE COURT: 8:30 a.m.

MR. WILKINSON: Thank you.

MR. WALL: Your Honor, we would like to move number 16 into evidence.

MR. LEE: Your Honor, we would object to number 16 in evidence. The State of California would. We would think that the foundation has not been laid. That Mr. Herbold's is a learned treatise and even if it is a learned treatise, under Rule 803 subsection 18, if admitted the statement may be read into evidence but may not be received as an exhibit. This is the apparent newsletter authored by Mr. Herbold entitled "Why we don't do population estimates for delta smelt."

MR. WILKINSON: There's also a --

THE COURT: He said that --

MR. WILKINSON: I'm sorry, Your Honor.

THE COURT: Let me say, if I understand it, is this a group that operates under the auspices of either the federal

or the state agency here? Either endorsed, supported or sponsored by in any way and do they regularly, in the ordinary course of their business and activities, utilize and rely on the information that's produced in these working groups or study groups, whatever they're called?

MR. WILKINSON: I don't know the answer to that, Your Honor. But certainly as to the witness --

THE COURT: But does Mr. Lee? You're not a governmental representative here, wouldn't expect you to.

MR. LEE: I'd have to consult with my client to see if the IEP would fall into those categories.

THE COURT: If it does, then essentially it's reliable hearsay information that the expert has referred to and is able to testify about as he had. It's also being used for impeaching effect. And so I will let you confirm that. We'll take it up first thing in the morning.

MR. LEE: Your Honor, but under subsection 18, it may be read into evidence, but may not be received as exhibits. And I believe he's read it into evidence. But we're now at the point whether the document should be received an exhibit, and we would submit under 803 subsection 18 that it cannot be.

THE COURT: We'll let Mr. Wall respond.

MR. WALL: Your Honor, we're not seeking to have this admitted solely as a learned treatise. There are two other bases for this. This is, as you'll see from the website

printed at the top of the page, it's printed off of the IEP State of California website. This is a state funded program and it's published on their website.

The other basis is that Dr. Hanson has relied on and cited to this document in his August 13th, 2007 declaration. And specifically listed in his bibliography and cited as one of the factors that one would consider in looking at the lack of reliability for these estimates.

THE COURT: If any witness relies on and refers to a document, no matter what it is, in formulating testimony and preparing opinions, even though there may be technical objections to it, it is admissible in evidence.

And so based on the representation of Mr. Wall -- and I believe that my recollection is that Dr. Hanson did say that those studies were ones that he looked at, that he had considered and some of it he found useful and some of it not useful.

THE WITNESS: That is correct, Your Honor. And I did cite Dr. Herbold's --

THE COURT: Yes, you did.

MR. WILKINSON: Your Honor, is it being admitted for the truth of the matter asserted or simply that this is --

THE COURT: No. It is being admitted as a state sponsored study that the expert witness referred to -- referred to and essentially relied on that which he found

useful, other information that he didn't find useful and therefore it is admitted as part of the basis of the opinion that he expressed to explain it.

MR. WILKINSON: Thank you.

THE COURT: So 16 is received in evidence under those conditions.

(Plaintiffs' Exhibit 16 was received.)

MR. WALL: Thank you, Your Honor. We would also ask that plaintiffs' 18, Exhibits B and C be admitted into evidence. Plaintiffs' 18 is the declaration of Jerry Johns. And we're not asking that the entirety of it be admitted, but Exhibits B and C are these figures that show relationship between negative flow and salvage. And the witness indicated that he has relied on and considered those in preparing his testimony.

THE COURT: All right. Those are tantamount to party admissions if they're used for that purpose, so I don't see any -- we may not need the whole declaration. If you want to redact or just put in those parts that you think are germane. Or do you want the whole declaration?

MR. WALL: I just want Exhibits B and C.

THE COURT: All right.

MR. WALL: Not the exhibit.

THE COURT: That would be the most I think expedient. Mr. Lee, do you agree?

MR. LEE: If plaintiffs want to have B & C admitted, we of course have no objection to that.

THE COURT: All right. That will be admitted as Exhibit 18. And we'll make it 18 in this case, 18.B and 18.C and then put a decimal after the letter for however many pages the sub-exhibits have. So it would be 18.B.1 in seriatim.

MR. WILKINSON: Your Honor, I guess the concern I have with just the -- those two exhibits coming in and not the declaration is that the declaration actually relies on those and describes those exhibits. So there is some interpretation.

THE COURT: Well, under Federal Rule of Evidence 103, the rule of completeness, if you want the declaration, you can move it in.

MR. WILKINSON: I'll move it in.

THE COURT: Any objection?

MR. WALL: Your Honor, he is -- has not been called to testify and our understanding is --

THE COURT: You have the right to cross-examine on anything in the declaration.

MR. WALL: Yeah, on that basis I would withdraw the motion to introduce Exhibit B and C.

THE COURT: All right. I will reverse my ruling and I will not receive Exhibit 18.B and C in evidence. Do you withdraw your motion, Mr. Wilkinson or do you want the --

MR. WILKINSON: If Mr. Wall is withdrawing his exhibit --

THE COURT: All right. Exhibit 18 remains marked for identification.

MR. WALL: Thank you, Your Honor.

MR. WILKINSON: That's fine, Your Honor.

THE COURT: Hope you can keep track of that, Ms. Courtroom deputy.

THE CLERK: I think I did.

THE COURT: Anything further?

MR. WALL: Nothing further, Your Honor.

THE COURT: All right. We are in recess until 8:30 a.m.

MR. MAYSONETT: Your Honor, I have one further question.

Your Honor, Ms. Goude, our witness, has somehow formulated the opinion the Court might require further testimony from her or input from her on Friday. Was that the Court's understanding.

THE COURT: I do have a vague recollection. I've heard about 15 or 20 cases since her testimony in addition to this one. And so what I vaguely remember is that if there were additional questions for her or if she were going to be asked about additional things, she would be available on Friday. I do not remember specifically asking her to be here.

If anybody does, you can tell me now or else I'll have the court reporter look at the transcript and see what, if anything, I said to her about being here on Friday. I hadn't planned on calling her.

MR. MAYSONETT: Okay, Your Honor. Thank you.

THE COURT: But if she could remain available, that would be helpful.

All right. Then we are in recess until 8:30 a.m.

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