What Is the Role of the Pumps In the Decline of Delta Smelt?

Complete Transcription of the Proceedings

California State University, Fresno

Saturday, March 14, 2009

Introduction

Efforts to protect the threatened Delta Smelt have resulted in severe cutbacks in water deliveries to agriculture and to two-thirds of California's residents. Experts at the University of California, Davis, estimate that the combination of those restrictions combined with the ongoing effects of a three-year drought could cost the state's economy $1 billion and more than 35,000 jobs in 2009 alone. And that only counts the impact on Central Valley agriculture. The potential impact on the state as a whole will be much greater.

Will shutting down the pumps that move water through the Delta actually benefit the Smelt? What does science say about the impact of the pumps as well as the other factors that may be contributing to the Smelt's decline? What are the standards of scientific evidence that the Endangered Species Act requires and are they being met? In particular, can it be shown with available scientific data that the pumps are responsible for the decline of the Delta Smelt?

Those are some of the questions that two panels of independent fisheries biologists and legal experts took up at a special one-day seminar at California State University, Fresno. This event was jointly sponsored by the Family Farm Alliance and the Council for Endangered Species Act Reliability.

This document includes the complete transcript of those proceedings. Reproduced on the following pages is the program for the seminar followed by biographical sketches of the participants. Time signatures that are noted in the text of the transcription refer to the video recording of this event.

For further information concerning the sponsors and the scientific papers that were included in the biologists' review, please visit the website of the Council for Endangered Species Reliability www.bestscience.org and for the Family Farm Alliance www.familyfarmalliance.org.

What Is the Role of the Pumps In the Decline of Delta Smelt?

California State University, Fresno
Student Recreation Center
Leon S. and Pete P. Peters Educational Center

Saturday, March 14, 2009

Program

9:30 a.m. Welcome and Introduction – Congressman Jim Costa

9:50 a.m. Dan Keppen, Executive Director, Family Farm Alliance

10:00 to 3:30 p.m. What Does Science Say About the Impact of Pumping and Other Factors Contributing to the Decline of the Delta Smelt?

Moderator: Craig Manson, Executive Director, Council for Endangered Species Act Reliability; former Assistant Secretary for Fish and Wildlife and Parks, U.S. Department of the Interior

Panelists:

- **Dr. Brian Dennis**, Department of Fish and Wildlife Resources and Department of Statistics, University of Idaho, Moscow, Idaho
- **Dr. Richard B. Deriso**, Inter-American Tropical Tuna Commission, Scripps Institute of Oceanography, La Jolla, California
- **Dr. Irv Kornfield**, School of Marine Sciences, University of Maine, Orono
- **Dr. Terrance J. Quinn II** , Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska, Fairbanks
- **Dr. Joseph Thorley**, R.P. Bio, Poisson Consulting Ltd., Nelson, British Columbia

3:30 to 5:00 p.m. The Legal Context for Endangered Species Act Determinations

Moderator: Craig Manson, q.v.

Panelists:

- **Brenda Davis**, The Brenda Davis Law Group, former Managing Counsel, California Farm Bureau Federation
- **Tom Gede**, Bingham, McCutchen LLP, former Executive Director, Western Association of Attorneys General

What Is the Role of the Pumps In the Decline of Delta Smelt?

Program Participants

Rep. Jim Costa

In January 2005, following a distinguished 24-year career as a member of the California state Legislature, Jim Costa was sworn in as Member of the U.S. House of Representatives representing California's 20th Congressional District.

The grandson of Portuguese immigrants who settled in the fertile San Joaquin Valley near the turn of the 20th Century, Congressman Costa represents portions of Fresno and Kern Counties and all of Kings County. He serves on the House Agriculture Committee, where he is a member of the Subcommittees on Livestock, Dairy and Poultry; and Conservation, Credit, Energy and Research. On the House Natural Resources Committee Costa is Chairman of the Subcommittee on Energy and Mineral Resources and is a member of the Subcommittee on Water and Power. Costa is also a member of the House Foreign Affairs Committee where he serves on the Subcommittees on the Middle East and South Asia; and Europe.

Costa is a member of the fiscally-conservative Blue Dog Coalition and co-founder and co-chair of the Congressional Victims' Rights Caucus. He is also a co-founder of the Congressional Water Caucus and a co-founder of the Congressional Organ Donation Caucus.

A product of Fresno County schools, Costa is a graduate of San Joaquin Memorial High School and has a Bachelor's Degree in Political Science from California State University, Fresno.

Brenda Washington Davis

Brenda Washington Davis heads The Brenda Davis Law Group in Sacramento where she manages her clients' administrative, litigation and legislative needs in environmental or resources related matters that have precedential or broad regional or statewide effects on industry.

Her experience includes representation of numerous public and private clients before a variety of state and federal agencies regarding rulemakings, compliance counseling and negotiations in matters such as contracts for sale or transfer of water resources, affirmation of water rights in property development, addressing threatened and endangered species listings, consultations and recovery matters in resources development, analysis of availability and use of groundwater, and land use and water resources-related litigation.

Ms. Davis was chief negotiator, completed agreements and drafted legislation for three key California and Nevada water resources development initiatives: Coordinated Operations Agreement, Suisun Marsh Preservation Agreement and Pyramid Lake/Truckee-Carson River Basin Settlement. She also helped to facilitate the more efficient and cost effective sharing of power, storage and conveyance capacity between the two largest water projects in the State of California, which together serve about two-thirds of the state's inhabitants with water for multiple purposes. And Ms. Davis negotiated changes in rate-setting methodologies for water marketing, review of Colorado River States' water rights and flow augmentation issues, and water and power contracting.

Ms. Davis is a graduate with honors of Duke University in Durham, North Carolina and Boalt Hall School of Law, University of California, Berkeley, where she was Associate Editor of the *California Law Review*. Among her numerous public service activities and appointments, she currently serves as a member of the Boards of Directors for The Forest Foundation (Vice-Chair) and Mercy General Community Council.

Dr. Brian Dennis

Dr. Brian C. Dennis is a professor with joint appointments in the Department of Fish and Wildlife Resources and the Department of Statistics at the University of Idaho in Moscow. He holds a Master's Degree in Statistics (1980) and the Ph.D. in Ecology (1982) from Pennsylvania State University. His research interests include statistical ecology, ecological population modeling, population viability analysis, nonlinear dynamics, statistical inference issues, and hierarchical statistical models. His extensive publications in scientific journals on statistics and mathematical modeling in ecology and natural resource management collectively have been cited over 2000 times.

Dr. Richard B. Deriso

Richard B. Deriso received his Ph.D. in Biomathematics in 1978 from the University of Washington. Dr. Deriso is currently the Associate Adjunct Professor of Biological Oceanography at the Scripps Institution of Oceanography and the Chief Scientist, Tuna-Billfish Program, at the Inter-American Tropical Tuna Commission. He is the co-author with Dr. Terrance J. Quinn II of Quantitative Fish Dynamics (see below). His current research interests include population dynamics, quantitative ecology, and fishery stock assessment.

A former member of the Ocean Studies Board, he has also served as Co-chair for the National Research Council's Committee on Fish Stock Assessment Methods and as a member of three other NRC committees: a Review of Atlantic Blue Fin Tuna, the Committee on Cooperative Research in the National Marine Fisheries Service, and the Committee on Ecosystem Effects of Fishing: Phase II--Assessments of the Extent of Change and the Implications for Policy.

In addition, Dr. Deriso has served as a consultant to several agencies and institutions, including the U.S. Minerals Management Service, Australian Fisheries Management Agency, Great Lakes Fishery Commission, Ontario Ministry of Natural Resources, Marine Stewardship Council, National Marine Fisheries Service and the U.S. Environmental Protection Agency.

Tom Gede

Tom Gede is a principal at Bingham Consulting Group LLC and of counsel at Bingham McCutchen LLP, in San Francisco and Sacramento. He provides legal and strategic planning for businesses working with state attorneys general and state government. Until October 2006, he served as the Executive Director of the Conference of Western Attorneys General coordinating the policy, litigation and legislative initiatives of 18 Western state Attorneys General, particularly focusing on water law, natural resources, Federal Indian law, environment and energy law. Previously, Mr. Gede was a Special Assistant and Deputy Attorney General in the California Attorney General's Office.

Mr. Gede serves as an adjunct professor of law, teaching Federal Indian Law at University of the Pacific - McGeorge School of Law in Sacramento, and he has been a participant in several planning and working groups for the University of New Mexico's Utton Transboundary Resources Center on water resource issues. He is also member of the American Bar Association's Section of Environment, Energy and Resources and is a Vice-Chair of the ABA's

Water Law Conference Committee. He has written and spoken on global climate change and greenhouse gas issues, including the California State Bar Section Education Institute in 2008.

He earned his J.D. in 1981 from the University of California-Hastings College of the Law, and his B.A. in German language and literature, *with distinction*¸ from Stanford University in 1970, having also attended the University of Hamburg, Germany.

Dan Keppen

Dan Keppen is the Executive Director of the Family Farm Alliance, a non-profit association that advocates for family farmers, ranchers, irrigation districts and allied industries in 17 Western States. The Alliance is a grassroots-based organization that puts Congressional and Administration staff members into direct contact with water users and local water agencies. The Alliance works to ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers.

Prior to joining the Alliance in March 2005, Mr. Keppen worked for over three years as the Executive Director of the Klamath Water Users Association. In that position, he worked closely with Congress, the Bush Administration, California and Oregon state legislatures, and state and federal agencies on issues that affected the people dependent on the Klamath Project, including farm and ranch families, local businesses, and rural communities.

Mr. Keppen received his Master of Science degree in Civil Engineering (Water Resources) from Oregon State University and his Bachelor of Science degree in Petroleum Engineering from the University of Wyoming.

Dr. Irv Kornfield

Irv Kornfield is Professor of Biology and Forensics in the School of Marine Sciences at the University of Maine. His research in population biology has included investigations of diverse marine species including commercially significant fishes such as herring, haddock and cod, as well as benthic invertebrates. Dr. Kornfield is Director of the Molecular Wildlife Forensics Laboratory at the University and an expert witness for public defenders in CODIS-related cases in California, the District of Columbia and New Hampshire. In 2000, he was the chief scientist for the State of Maine in the proposed ESA listing of Atlantic salmon. Dr. Kornfield is a Fellow of

the American Association for the Advancement of Science and a National Fellow of the Explorer's Club.

Craig Manson

Craig Manson is Distinguished Visiting Professor at the Capital Center for Government Law and Policy of the University of the Pacific McGeorge School of Law in Sacramento. He is also the academic director of the law school's Masters of Law (LLM) program in Government Law and Policy.

Professor Manson returned to the law school after a distinguished career in state and federal government and in the private sector. He most recently served in President Bush's administration as Assistant Secretary of the Interior for Fish and Wildlife and Parks from 2002 to 2005. In that position he oversaw the U.S. Fish and Wildlife Service and the National Park Service. President Bush also named him as U.S. Government Representative to the joint U.S.-Canada Great Lakes Fishery Commission.

Professor Manson was previously a Judge of the Superior Court of California from 1998 to 2002. Prior to that, in 1993, Governor Pete Wilson named him as the first person to serve as the General Counsel of the California Department of Fish and Game. He was in private law practice from 1989 to 1993. A graduate of the U.S. Air Force Academy, Professor Manson served on active duty in the Air Force from 1976 to 1989, primarily as a judge advocate. He had assignments overseas, at the Pentagon, and at the Academy as Associate Professor of Law. He retired from the Air Force Reserve as a colonel in 2006.

Professor Manson received his law degree from Pacific McGeorge with great distinction, having been elected to the Order of the Coif and he served as Editor-in-chief of the law review.

Dr. Terrance J. Quinn II

Terrance J. Quinn II has been a professor of fish population dynamics at the School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, Alaska since 1985. He is the co-author or co-editor of 4 books and about 100 scientific publications. He has shepherded about 25 students through their post-graduate careers at either the M.S. or Ph.D. levels. He has been a member of the Statistical and Scientific Committee of the North Pacific Fishery Management

Council since 1986 and is a former chair of that body. He is a former member of the Ocean Studies Board of the National Academy of Sciences and served on five of the academy's committees, including two as chair or co-chair. He is an Associate Editor of the Canadian Journal of Fisheries and Aquatic Sciences.

Dr. Quinn is the co-author with Dr. Richard B. Deriso (q.v.) of Quantitative Fish Dynamics, part of the Biological Resource Management Series published by Oxford University Press. This book serves as an advanced text on fisheries and fishery population dynamics and as a reference for fisheries scientists. It provides a thorough treatment of contemporary topics in quantitative fisheries science and emphasizes the link between biology and theory by explaining the assumptions inherent in the quantitative methods. The analytical methods are accessible to a wide range of biologists, and the book includes numerous examples. The book is unique in covering such advanced topics as optimal harvesting, migratory stocks, age-structured models, and size models.

Dr. Joseph Thorley

Dr. Joseph Thorley is a fish population biologist based out of Nelson British Columbia where he directs his own consulting company, Poisson Consulting Ltd. Poisson Consulting Ltd.'s clients include provincial and federal governments, large hydroelectric companies, small independent power producers and research-based conservation organizations. Dr. Thorley is a registered professional biologist with a degree in Biological Sciences from Oxford University and a Doctorate in Phylogenetics from Bristol University. He has published in a wide range of journals in fisheries and biological sciences including the Canadian Journal of Fisheries and Aquatic Sciences, ICES Journal of Marine Science, Journal of Theoretical Biology and Nature.

Dr. Joseph Thorley has over a decade of programming and analytic experience and teaches courses in statistical programming in the R language. He is also a practical and practiced field biologist who has worked on a range of aquatic systems and fish species. Examples of his research include acoustic tracking and movement analysis of large piscivorous rainbow and brown trout, *in situ* studies of salmonid egg incubation and analysis of egg survival, snorkel-based assessments of west slope cutthroat trout population abundance and population viability, and statistical analysis of Atlantic salmon rod and net catch time series spanning over half a century.

TRANSCRIPTION BEGINS

JUDGE MANSON: Good morning folks. Welcome, thanks for coming. We can get started here. I'm Craig Manson, I'm professor of law at the University of the Pacific and McGeorge School of Law in Sacramento. I'm with the Capital Center for Public Law and Policy. I think we have an interesting presentation today and I'll tell you more about that in just a moment as we get everybody settled. You should have, as you came in, gotten the agenda here, "What is the Role of the Pumps and the Decline of the Delta Smelt?, an important question for California. This morning we're going to explore the science of that issue and I'll tell you more about that when I introduce the scientists in a moment. Then later, at the end of the day, we'll have a brief discussion of some legal issues pertinent to that as well. I do want to stress that this morning we'll be focusing on the science and that's the key issue is the science. So if you'll hold any questions about any other issues to some other time, we'd appreciate that. [00:01:34] Let me at this time introduce the individual who's responsible for getting us involved in this effort and that's Congressman Jim Costa. Congressman Costa is well known to you all. He represents Kern and Fresno counties in

the Congress and before that was in the State Legislature and he's been interested in these issues for a very, very long time. And I would like to thank him for asking me to get together and convene the panel of scientists and to bring this presentation to you. It is designed to contribute to the dialogue on the Delta which is ongoing all the time here in California. So at this time, Congressman Costa, welcome, and thank you.

MR. COSTA: [00:02:24] Thank you Your Honor. I do appreciate your efforts. I want to thank the Council for Endangered Species Act Reliability and the Family Farm Alliance for also participating in this effort and all of you who are here this morning. I hope that this will be part of a continuing dialogue as we attempt to try to deal with a multitude of issues that are affecting California's water resources. And I might add, as we talk about California's water resources, present and future, as we try to plan for the future, decisions that are made here in California or decisions that are not made here in California I think certainly have the precedent as to what happens in the west because clearly the issues that we are attempting to grapple with here are not, as I try to remind some of my colleagues, not limited to California. [00:03:34] They're involved in the Klamath, they're involved in the Columbia, they're involved in the Snake

River. They're involved on water resource issues throughout the west. So as we try to do the balancing act as policymakers, that's my role, in terms of balancing the needs of growing population centers, the needs of maintaining agricultural economies and the needs of trying to restore areas of the environment where we think we can do the most good. Clearly that balancing act has been the subject of heated debate now for three decades that I've been a part of it. I sometimes, your Honor, think I'm young but this arctic blonde that I've got on top of here certainly leads folks to believe that's not the case. So let me describe to you what I hope will come out of not only today's meeting but hopefully future meetings. And an issue that, just as I try to encompass this in the next five minutes, [00:04:49] why I think your participation is so important and why this discussion is so important. Of course, Dan Keppen and I have worked together over the years and I appreciate his efforts involved on these water issues to try to raise the conscious level of the importance of family farmers, and the importance it plays in California. And let me tell you why I have a bias, I guess we all have biases, but I think agriculture's important. Among the committee assignments that you may have seen on the handout, I'm on the Foreign Affairs Committee. I've been to Africa a number of times in the last several years and to the Middle East and other parts of third world countries. [00:05:42] Last

summer we were in the UN and we had the food sponsors talking about issues dealing with, I mean the UN does some things well, they do some things not so well, but one of the things they do well I believe is food relief and relief through HIV drugs to combat that horrific disease. They provided some statistics and they keep track of this. And this year in light of the recession, I think the numbers are getting higher. We have six billion people on the planet, six billion people. Two hundred years ago we had a billion and a half people. Think about that, in 200 years we've more than tripled the population of the planet. [00:06:28] So the question of sustainability becomes a big issue, I think. And it becomes further complicated when you understand that the United Nations estimates, and these are approximate, that 600 to 700 million out of the six billion go to bed hungry every night. Over 10,000 children each day die, over half of them as a result of malnutrition. Think about that, 600 to 700 million going to bed hungry and, and over 10,000 children dying each day, over half as a result of malnutrition. I don't think this zero sum discussion that we too often have here in California is that, well, agriculture's expendable. It's really not. I mean we can get our food elsewhere. [00:07:20] I don't, I don't believe that, and so that's a strong feeling that I have, and I think maintaining agriculture production in this country, and by the way we've lost 12% of US agriculture production in

over 10 years, and I don't like the trend, when we know we do this so well. So it seems to me that when we attempted to describe a new water ethos back in the early 1990s, after Deukmejian's efforts and after Governor Wilson's efforts, that we would, all get healthy together again. Urban water users, the environmental community, and the agricultural water users, that we would try to develop a policy in which we would all get healthy together again. [00:08:16] Clearly, what is occurring today, is not just as a result of Mother Nature's drought. I would contend its a part of, what complicates it, is a manmade drought based upon laws that don't provide flexibility to balance our needs and to take into account all the factors that are resulting, in my view, in the decline of the environment and the fisheries. We have put ourselves in a position where we are now, in part because policymakers in Sacramento and in Washington have been unwilling to make difficult political decisions. We have been unwilling to forge solutions that would create this all getting healthy together again. We now are posing what I think is a Hobson's choice of fish over people or fish over food, and I don't believe that's the discussion we should be having. [00:09:26] And so we look to the experts today, Judge Manson, and I'm very pleased to see you. I'm very pleased to see you because we go back a bit. My first interaction, or intervention, with his Honor was back in the late 1980s when I was trying to get a

water bank. One of the things that our environmental community asks, who have a, kind of a DNA structure of opposition toward any dam is we'll do conservation and do water banks. I'm always one that wants to try to figure out how you get there from here. And so the first water bank we authorized (inaudible) in California was in the late 1980s, the Kern County Water Bank. The State was going to do it between the Department of Water Resources and the Department of Fish and Game. And typically, when the State had the jurisdiction to do it themselves they couldn't get anywhere. [00:10:24] But as a part of a larger agreement with our friends at the Kern County Water Agency, the Kern County Water Agency took that project over. At the time, Judge Manson was the counsel for the Department of Fish and Game and his hard work along with a lot of other folks allowed us to work out the legal issues and today we have the largest water bank in the State. It's being added to, and I believe it's probably the largest water bank in the country, the Kern County Water Bank. That's when we first met and of course we met later on as you were, not only the assistant director for Fish and Wildlife within the Department of the Interior, assistant secretary of Interior. We appreciate your hard work and the current efforts that you pursue in teaching law to future lawyers of California and America at McGeorge Law School. [00:11:20] Let me bottom line this. I will look forward to the

conversation and learning because I think we all need to learn. The reason for getting all of you together here today is, in large part in my view, due to a frustration that I've had now for several years. You know, we started off with this issue of a new water ethos in the 1990s and I carried two major bond measures. That's one of the reasons I don't like to take any backseat to any member of the environmental community when they talk about restoration efforts. In 1996, I put together Proposition 204 that provided the first effort -- $950 million under the notion that we'd all get healthy together again. That restoration effort was a situation with the environmental community, the urban water users, and the ag water users all supporting the bond measure. Then we went on to follow up with that in the year 2000 with Proposition 13 that provided, I believe it was $1.97 billion. [00:12:31] Others have done a great deal and I will acknowledge that, but no one has done any more than I have to try to provide significant money to restore the environment. You add those up and you add some of the other legislation that I've been a part of and we've put in about $3 billion to look at all the soft paths to restoring fisheries and restoring the environment because it was this mantra that we would all get healthy together again. I would like to report to you here this morning that almost $3 billion in efforts of over the last 15 years and the Cal Fed effort

and all the accompanying pieces of work that have been done at the local, state, and federal levels, that have included the CVPIA reform and the B2 funding for water and all of that stuff has resulted in us restoring the fishery, restoring the salmonid species, restoring the Delta Smelt, restoring all of these things. [00:13:31] That's what I'd like to tell you here this morning. Sadly we know that's not the case. And so you can get a sense of my frustration. I know some of you share that frustration because we've tried all the soft paths to trying to balance the needs of our state with growing cities, to try to ensure that we maintain our farms because agriculture's important I believe, and I think others believe that as well, and at the same time to ensure that we are good custodians of the environment and that we are able to ensure that future generations of Californians are going to be able to enjoy the environmental benefits of this state and the fisheries as previous generations have been able to do. [00:14:22] But clearly that's not the case. Why is it not the case? In my view, there are different factors. State water contractors believe that clearly today we're using 8,000 acre feet of water approximately each day to try to balance these needs. Think about this, if the state and federal pumps are operating at capacity that's almost 12,000 cfs. If they're operating at 10,000 cfs, it's about 20,000 acre feet a day. [00:14:53] So if 8,000 acre feet, and of course they're not pumping that,

you know. I've been following the regimes over the last six weeks and it's been anywhere from 2,000 to 3,000 cfs combined pumping, up to as much as 6,000 cfs combined pumping. I don't think they've reached 7,000 depending upon the various storms that we've had and where the Delta Smelt have been located over the last four to six weeks as they try to do this incredible balancing act. I mean I don't know how these fish biologists on the state and federal level do it. I always have this imagination where you know, it'd be nice if you could block a mile off of the Delta at some point and just stop and have a glass and try to see where those fish are. I think it's an amazing attempt to try to balance these needs. And as good as the science is, it's difficult clearly. [00:15:45] And so this is my description for the scientists and the various panels today, and for some of you who are aviation buffs like myself. By using simply the export of water and the regime of pumping both at the state and the federal pumps as the sole means, and that's what I believe we're doing these days, as the sole means to try to balance the needs of fisheries. It is akin to trying to flying an airplane where you're only allowed to use one of the elements of the controls of the airplane, i.e. the altitude. Let's say that the pumps are the altitude, you can fly at 2,000 feet, you can fly at 5,000 feet, you can fly at 20,000 feet. [00:16:38] But we're ignoring the ailerons, we're ignoring the power, the thrust of the

engines, we're ignoring the brake capacity. We're ignoring all the other elements of the controls of this airplane. Why? Because we're not taking into account invasive species, we're not taking into account the problems associated with tertiary treatment facilities and the City of Stockton and Sacramento that provided ammonia that we now think impact the Delta Smelt. We're not taking into account the other diversions that take place in the Delta. We're not taking into account the fact that we have approximately 1,600 diversions in the Delta of which I understand 90% of them are unscreened, pumping almost as much water and they have riparian rights, their rights are certainly legitimate, pumping almost as much water as we export south of the Delta. [00:17:46] And talk about a conflicting policy. It seems to me we've introduced a game fish in the 1920s, i.e. the striped bass, that competes for the same food chain as the natural salmonid species. We actually charge a fish stamp so that we can propagate this game fish so that it can compete against the native salmonids. I don't quite understand that policy. And so what I'm hoping is that the experts here will allow us to have a discussion based upon best science. Best science, as in, how do we get some rational discussion about using the other controls of this airplane if we're going to really truly try to fix the Delta. Whether we talk about an isolated facility, whether we talk about how we add to our water supply in a growing

state in which we have a system that many experts believe was designed for about 20 million people, today we have 38 million people living in California, imagine that. [00:19:01] We have a system designed for 20 million people, and we have 38 million. It's estimated by the year 2030 we're going to have 50 million people living in California. This is one of the most critical infrastructure issues of our day, and it will ultimately determine in the long term economically how well California does in the 21st century. I believe we are living off previous investments of past generations and we cannot continue if we want to have a water ethos in which we get healthy together again. We cannot maintain our farms, and we cannot provide water for a growing population and we cannot restore the fisheries in this state if we continue to do what we're doing today. [00:19:51] It's that old definition, I think it's credited to Einstein, one definition of insanity is continuing to do things the way you've always done them and expect different results. If we continue to do things the way we've always done them we're not going to get different results. we're going to get the same results. And we'll go insane trying. Maybe that's the point, that I don't want to go insane. So we've got to do things differently ladies and gentlemen, and your involvement is critical to this effort. So the experts here, as we try to look at how we use all the water tools in our water toolbox, all the water management tools in our water

toolbox is essential using best science if we're going to figure out how we work our way through this very difficult problem with an overlapping set of local, state, and federal laws that as his Honor will tell you have been used for various purposes. [00:20:50] Not always in my view with the ability to provide that balance that I think is so critical. But then, I'm not a lawyer so I don't want to tell you my own thoughts on that. I've spoken longer than I intended to but that's, obviously, because I feel passionate about this. I think this is a good start your Honor and Dan Keppen and I want to thank all of you for being here. And as we discuss the best science and as we discuss how we get to use, focus on the other stressors that are affecting the Delta, the Delta being California's most important estuary, the largest in the West Coast, and all the demands that are placed upon it and it's over subscription. And you add to that the fact that climate change will probably raise water levels and how do we deal with that? [00:21:43] We truly need to have a more logical, rational discussion on how we fix the Delta for all the right reasons for California's future. So that's the challenge that we're going to discuss, using the best scientific minds that are here today. And we hope to continue this discussion as we try to strive for a rational water policy that will get us out of the conundrum that we're in today. Thank you very much.

JUDGE MANSON: [00:22:15] Thank you Congressman Costa. You are as always a passionate but articulate spokesman for the point of view that you have on this. It's apparent that you care very much about what's going on here and that you have in mind keeping science in the forefront. So I thank you. Dan Keppen is from the Family Farm Alliance, one of the co-sponsors and Dan has worked water issues not only in the Delta but in the Klamath as well. So Dan, would you like to say a few words before we get started?

MR. KEPPEN: [00:22:51] I would, Judge, thank you very much. And thanks to you and Cesar and Congressman Costa for your leadership in setting up this important panel today. I thank the expert witnesses for coming in to this event as well. On behalf of the Family Farm Alliance I'd like to welcome you all. Our organization is a west wide organization. We advocate for family farms and ranches in 17 western states. The reason we're interested in this particular issue is we have a lot of members in the San Joaquin Valley that contribute to our organization. A large portion of our membership comes from this area. This is kind of the heartland of the Family Farm Alliance. [00:23:33] Despite that fact, we have representatives from other western states, and our Board of Directors, with guidance provided by our advisory committee, late last year took action and filed a request under the Information Quality Act with regards

to the biological opinion that was developed for Delta Smelt. And in a nutshell, we felt that that biological opinion failed to meet the standards of the Endangered Species Act for many of the reasons that Congressman Costa just outlined. We want to make sure that the science driving the biological opinion is the best science and will lead to the best decisions. Our organization knows that what happens in California will likely transmit to other parts of the west. [00:24:19] They're very concerned about what's happening here and we intend to use the IQA and encourage other water users throughout the west to start using the Information Quality Act as a method to get recourse, to make sure the best science and the best decisions are used in these biological opinions. I just wanted to expand a little bit on what Congressman Costa was talking about, this focus on the pumps, this pump centered focus here in California. We've seen this happen before. I think people need to realize that, and I think everybody here probably does. We have a drought that's driving a lot of this crisis that we're facing this summer. But in large part this is a regulatory drought. Water that used to go to agriculture and urban users is being reallocated to meet fish species needs. The science that's driving that decision is found in these biological opinions and the biological opinions that have been developed for the Delta Smelt. [00:25:18] And this centered focus on a water project or a dam or

irrigation is nothing new. I drove down from Klamath Falls, Oregon, to Sacramento yesterday. I live in the Klamath Basin, I was there in 2001, working for the Klamath Water Users Association, when that irrigation project for the first time in 95 years had its supplies out of Upper Klamath Lake curtailed. And I want to talk about this because it's very applicable to what's happening here. That project operated for decades without any sort of problems. The refuges were satisfied. The irrigation project was satisfied. The fish issues were satisfied. In 1987, two sucker species in Upper Klamath Lake were listed as endangered on the Endangered Species Act. [00:26:01] At the time of listing there was no mention whatsoever that the Klamath irrigation project was having any sort of an effect on those fish. In fact, once the fish were listed, the State of Oregon took an action which most scientists felt probably did more for the fish than anything else and that was they discontinued a state-sanctioned snag fishery. The State of Oregon actually encouraged people to go out and snag suckers out of Upper Klamath Lake. Once that practice ended, most people felt that those sucker populations rebounded. Nevertheless, once listing occurred, the fishery biologists working for the Fish and Wildlife Service started to focus on lake levels as the way to control impacts to the sucker fish. And every year the requirements to keep more water in the lake with less water going to irrigation kept ramping

up. [00:26:54] So that's happening with one agency starting in the early '90s. In the late '90s, Coho Salmon were listed as threatened on the Klamath River and Coho Salmon are located far, far away from the Klamath Irrigation Project. But they are in the river downstream of the dams. At the time of the listing of Coho, the Klamath Irrigation Project was not listed as a stressor. Things like brown trout fertilization, the hydro dams that belong to Pacific Power, over fishing, the drought of the mid '70s, the flood of 1964 -- all these things were listed as impacts to those fish at that time. The Klamath irrigation project was not identified as a stressor. Nevertheless, once the fish were listed, fishery biologists with the National Fishery Service started focusing on the Klamath irrigation project. The knob that they could control were flows downstream, and it became more of a focus solely on flows, that flows had to be released to avoid jeopardizing those fish. [00:27:51] Those requirements ramped up as well, which ultimately led to 2001 which was a pretty dry year. You had the highest requirements ever for downstream releases being issued by one agency for Coho, coupled with a requirement that more water be left in Upper Klamath Lake to supposedly protect a sucker fish by another agency. When those two requirements overlaid each other, there was actually not enough water in the entire system to take care of both needs. And for the first time in

95 years the irrigation project was shut off. I'm telling you, it's going to happen here this summer, and it's a shame because when something like this happens it destroys a community. It's a rural community where I live and what happened when that water got shut off, things that you can't even imagine. Probably the worst thing I think that could happen is some people are going to make it and the neighbors are not going to make it. And that creates a have versus a have not dynamic in the community which really tears things up. [00:28:48] And this is deriving primarily from regulations, not a natural drought. That's what you're facing here in California this year. After the tragic shut off in 2001 in Klamath, through the Secretary of Interior's office, we were able to get the National Academy of Sciences to come in and take a look at the science that led to that decision. We felt that a lot of the science was being overlooked Certain select studies were being used to justify these high lake requirements and these high outflow requirements for salmon. Ultimately the National Academy of Sciences came in, brought in independent science and several months after the water shut off, this independent committee came out and said that the decision making that led to the shut off of the water for the farmers was not scientifically justified by both agencies. [00:29:39] So you can imagine how the folks in my community felt. Congressman Walden, my representative up in

Oregon, had a big rally, kind of a public meeting at the fairgrounds to let the community know what had happened and they asked me to say a few words. I talked to a bunch of my members with the Klamath Water Users Association and the best way I can describe it was, you know, how would you feel. [00:30:06] It's kind of a like a guy that might get sentenced to prison unjustly for a crime that he didn't commit and five years later out of the blue a witness comes out and says this guy's innocent. How does that man feel as he's leaving the prison? That's kind of how our farmers felt. It was a very bittersweet feeling. So we are involved here because we're afraid that again, this focus on just irrigation as the cause of all the woes to fish throughout the west has to end. [00:30:37] We're hoping that we can learn more about the science behind this focus on the pumps. Today there are some questions that are going to be raised that directly relate to our IQA request that we submitted in December. A couple of key questions that I'm hoping to learn some more information about: Will further curtailing of the pumps actually benefit the Smelt? What are the standards of scientific evidence that the ESA requires and are they being met? And what does science say about the impact of the pumps as well as the other factors that may be contributing to the Smelt's decline? These are the questions today that this really impressive

panel of the legal and independent fisheries biologists will be discussing, and I thank them and I thank you for your participation today.

JUDGE MANSON: [00:31:26] Thank you very much, and it's time for the science panel to convene. Let me emphasize a couple of things about how we got to where we are and how the scientists operated and how they were chosen and so forth. First I want to emphasize that this is an educational forum, it's not an advocacy forum. We're not going to solve all of the problems of California and the west today so I ask the audience to be cognizant of that. This is a piece of a dialogue that will go on for some time now. But it's an important piece that will contribute to our knowledge and understanding of what happens in the Delta. [00:32:01] Now, the scientists have no affiliation with any of the groups who are sponsoring the event. They are highly qualified in their fields. When we decided to convene this look at the science, I asked some scientists that I know and trust, who are the best people out there in the field. They gave me a list of names of people that they knew and respected from their professional interactions. From that list we asked five of them to come and they graciously agreed and we appreciate that very much. [00:32:57] They were given a number of documents. They had a very limited amount of time to examine these documents I should point out. And so

they are going to give us their best take given their limited amount of time to look at these documents and tell us what they believe may be some of the answers to some of the questions that we may have. I should also point out that I have no idea what they're going to say, and I have not talked to them specifically about their conclusions. So it will be an educational event for all concerned. [00:33:43] But they will describe some of their methodologies and if they have conclusions that they have come to. They may not necessarily have come to conclusions. Then they may describe those as well. I would ask you to understand that science is an ongoing enterprise as well, just like law and policy are. This is the area that I teach under, the confluence of science, law, and policy. This is the science piece. Later on today we'll have the law piece. And at some other point in time we may have the policy piece. But we can only have the policy piece if we understand the science of it and we understand the law of it [00:34:28] because it's not only the law that our policies must be based on. Good science. It makes good sense that our policies be based on good science as well. I think you'll see that these are complex issues that we are talking about. if you have questions I'd ask you to keep them focused on the science and there's a mechanism by which you can ask questions. We'll ask the questions that are focused on the science this morning at first. So again, thank you very much for coming and I would

ask our scientists to come forward at this time and take seats at the table and we'll get started. All right, again, thank you gentlemen. I know this was an activity that you had to do outside your normal work and you're all very busy. So I appreciate your taking this on as well. I'll ask each of them to introduce themselves briefly and tell what their area of expertise is and we'll start with Dr. Brian Dennis from the University of Idaho down at the end of the table.

[START OF SCIENCE PANEL DISCUSSION]

DR. DENNIS: [00:37:00] My field of expertise is the use of statistics and mathematical modeling in ecology and natural resource management. I'm trained as a statistician and I was particularly interested in the data being presented in the various studies.

JUDGE MASON: Okay, and Dr. Joe Thorley from British Columbia.

DR. THORLEY: My name is Dr. Joe Thorley and I'm a registered professional biologist with British Columbia. I run a consulting company, Poisson Consulting Limited, we specialize in fish population biology and statistical ecology. [00:37:42] I teach courses in statistical programming and I have a range of clients from federal government, provincial government , large hydro

electrical producers, small hydroelectric producers and , one of my main areas of interest is the impacts of flow regulation on fish populations.

JUDGE MASON: And Dr. Irv Kornfield from Maine.

DR. KORNFIELD: [00:38:01] I'm a professor of biology and molecular forensics at the University of Maine. My specialty is population biology, of fishes in particular. I spend a fair amount of time doing population genetics of a wide number of, a wide number of species and participated in the State of Maine's review of the listing of Atlantic Salmon, in Maine in the year 2000.

JUDGE MASON: Thanks, and Dr. Rick Deriso from San Diego.

DR. DERISO: [00:38:36] Yes, I'm a chief scientist at the Inter American Tropical Tuna Commission, it's an international fisheries commission. My expertise is in quantitative population dynamics basically professional career has been involved with looking at data collected on fishes, fitting population models to that data, testing hypotheses about factors that affect the abundance of the population and looking at the impacts of those factors if they are significant.

JUDGE MASON: And Dr. Terry Quinn from Alaska.

DR. QUINN: [00:39:18] Rick and I enrolled in the same program at the University of Washington back in 1973 and so we've had a close connection with each other since then. I teach fisheries mathematics at the University of Alaska Fairbanks located in Juneau, that's a long story, and Rick and I are the co-authors of one of the primary books in the field of fish population dynamics. So we've long been interested in how you can take biological processes and come up with the proper dynamic equations to show how they affect fish populations and that's what we've been doing for the last 35 years.

JUDGE MASON: [00:40:10] Thanks, I was telling Terry last night that he has the best of all worlds. He gets to be affiliated with the University of Alaska Fairbanks but he doesn't have to live in Fairbanks. That's great. Well, thank you again. The first question that we had posed to you in our invitation was, what factors have had quantifiable effects on Delta Smelt abundance both in the long term and in the recent period of abundance decline? It's clear that the Delta Smelt is declining in abundance and so have you been able to tell from your review of the science what factors have had a quantifiable effect on that abundance and its decline. And I'll let anyone who wants to start start off.

DR. KORNFIELD: [00:41:04] I think I'll just say in general that, the signs that we looked at were numerous and comprehensive and they came from a large number of agencies, particularly governmental agencies. And one of the things that struck me in particular, and I'm sure the rest of the fellows in front of you, is the range of variation that was associated with the parameters that were estimated throughout all of these studies, and it really did depend on the specific factor that was being, being examined. The variance and the estimates were exceedingly large so when one makes a statement about the mean or median or tries to get an average in order to project that further, the errors associated with that, the uncertainties associated with those measurements were sufficiently large to blur the potential significance of some of these factors.

JUDGE MASON: [00:42:04] Okay, and Dr. Thorley, you wanted to add anything?

DR. THORLEY: Yeah, I'd like to add to that. In addition, the data set was a particularly, difficult data set for a number of statistical reasons, not all of which were even discussed in the literature. For example,, it looks like there are multiple factors involved and issues, for instance the introduction of the climate change and the food where climate changed, multiple things have been changing and the estuary, changes in predators, etc., and they all have had some maybe minor impact. [00:42:36] In addition, there

may be interactions between them so the effect of one depends on the size of another, so in order to determine the effect of that particular variable you need to know how it's effects are changing with another variable which you may not have data on. In addition, there's the problem of confounding where certain things are changing together so you can't say whether this one was responsible or this one was responsible. In addition, there's auto-correlation which means you don't have as many data points as you think you have so, you actually have less data. Auto-correlation is the non independence between data points entirely. [00:43:06] You got a problem of non-stationarity where the Delta has changed from one state, shifted to another state, which means you have, you could be looking at the effects of different variables here, suddenly the whole system is changing and now things will be having different effects, you have very short runs of data to try to determine what's happening. You've got a problem of what's called time series bias that affects stock recruitment relationships, that's not discussed in the literature. Time series bias is particularly strong in this case because we have an annual species so, you've got non-independence in between the stocksand then the recruits and the number of recruits then affects the stocks and that affects the number of recruits.

JUDGE MASON: I'm not sure what's going on with our lights here. We'll find out.

DR. THORLEY: [00:43:48] And then finally there's been a lot of exploration of the different hypotheses which , has resulted of the inflation of Type 1 errors. If you have 20 data sets and you analyze them you expect by chance that one of them to be significant. This has been a problem, there's been a huge amount of analysis assigned to a significant result but you don't know, just because so many different hypotheses were looked at. So that's a range of issues some of which were discussed and some of which aren't and that's kind of the qualifier I'm adding in on top of that, the fact that there's lots of variation in the data, there's a lot of problems with the data set as well.

JUDGE MASON: Okay, Dr. Dennis.

DR. DENNIS: [00:44:29] The analyses of the data that have been done to date have been rather limited in my opinion. The analysis methods have been somewhat old fashioned and contemporary statistical ecology has developed analysis methods that take into account some of the problems that were just described. Furthermore, the data have some limitations in that there are many many variables that are being followed but there are not all that many years by comparison with the number of variables that one is looking at even though the data go way back into the '70s and

even ‘60s in some cases, 20, 30 years of data and 20, 30 years of factors that one is studying in the data is not a good ratio. [00:45:42] I did a little bit of preliminary analysis and identified a few factors in the data that strike my curiosity and when some appropriate point comes up I will be glad to present that analysis.

JUDGE MASON: Okay.

DR. DENNIS: [00:46:00] Maybe not initially right now but sometime later in the day I’ll show you that.

JUDGE MASON: All right, excellent. Let me just follow up on something. You said that the ratio between the years studied and the variables, numbers of variables studied is, is uh, short I think you said.

DR. DENNIS: Yes.

JUDGE MASON: Can you explain that a little bit more?

DR. DENNIS: [00:46:27] Yes. Every, every variable that you want to study adds what statisticians call a parameter into the model, some quantity that you have to estimate with the data. The number of observations tells you how well you can estimate those parameters. If the number of parameters, that is the number of variables, is the same as the number of observations then you can essentially do no estimation, models that

would be fitted with such data would be meaningless. Twice the number of observations as variables would be good, three times would be better, five times you can do meaningful prediction.

JUDGE MASON: [00:47:35] So, for example if I can attempt to, understand that myself a little bit more, if I see a car and I attempt to measure it's speed and I do that once, measured that variable one time, then I can't really do any estimation of its speed because I don't have other, other parameters by which to compare that. Would that be accurate?

DR. DENNIS: [00:48:03] Hm, um…

JUDGE MASON: Or…

DR. DENNIS: [00:48:08] Let's try to make, make the analogy clearer…

JUDGE MASON: Okay.

DR. DENNIS: …by saying you are measuring the average speed that this car travels over a number of years.

JUDGE MASON: Okay.

DR. DENNIS: And that's what, that's what you want to study, the effects on the average speed. [00:48:30] So you have different people that have driven the car, different cities that the car has been driven in, different road

conditions that the car has driven in, different weather conditions, and so on. And if you have only five years of observing the speed but you have 10 different factors that you're trying to decide, or trying to estimate as to the effect on the average speed, then you're in a bad situation.

JUDGE MASON: Got it, got it. Thank you, thank you. Appreciate that. All right, Dr. Deriso.

DR. DERISO: [00:49:06] Yes, I agree with much of what's been said, I mean it's, in reading the literature you will see that someone will find a relationship and then they'll show that that relationship between two variables falls apart after a certain time and then perhaps even reverses it's effect. There was a great bit of this sort of almost storytelling where you sort of make a story up as, "Well I'm just gonna use this piece of data because…" and there's your story. And if you don't buy into just those years, or you use some other years or even exclude a year a data point or two, then the relationship just falls apart. [00:50:01] One of the problems with this is that this Delta Smelt is so susceptible to local events really, I mean, it lives in a very small geographic range, it's affected by, it has a very relatively narrow temperature tolerance, it's life history strategy is a bit odd I must say for an animal that really is not that fecund in that very few of them survive past age 1, so they basically have one shot, if you will, at

producing offspring. Usually animals that have just a single, essentially a single spawn, usually those are extremely productive populations, produce huge amounts of young, and do that to sort of buffer and increase their chances of survival. [00:51:05] And so you have this unfavorable life history strategy. Then there's the dependence of course on the copepods and the prey for it as well which is also in a relatively narrow window. So you have all these what look to be like narrow windows that this organism goes through, through its life. It's easy to imagine then that one of these windows can be , temperature for example, it might be an El Nino year for example, spawning occurs between 15 and 20 degrees Celsius so it's thought, the number of days for which the temperature is in that range was very small, for example in 1983 with that major El Nino. [00:51:53] So you can certainly imagine that for 1983, that year class could have been very poor just because of an extremely narrow window of spawn that it had and whether or not that even matched up with when the peak in the zooplankton production would occur. [00:52:14] So it's very difficult then when you're looking at factors, it's much easier if you have factors that operate consistently and over long periods of time so that you see repetition and repetition so that you see the responsiveness. I haven't been able to find in my looking at this literature any factors that really convinced me that it

has repeated itself over a longer period of time, and it may well be that that's unrealistic, that there is something in the literature of the system changing, after 1982, that there was a, something about the system was different earlier, there was not a population decline for Delta Smelt, as much, but then that applies to the fall trawls survey, not so much the summer of juvenile survey . And so maybe you can't use long periods of time. Certainly some of the relationships that were found in the earlier periods of time don't hold up after that. [00:53:19] For example, there was some relationships with this factor called X2 and that relationship held up in the earlier time period but then it doesn't hold up from 1982. But then if you do like the biological opinion and you say, well I'm not gonna start in '82, I'm gonna start in 1987, then suddenly you can get a relationship again. So whether these things are real or you're just picking the data links, you see it's very, very difficult.

JUDGE MASON: Yeah. Irv?

DR. KORNFIELD: [00:53:53] Yeah, I just wanted to say that in fact today as correctly pointed out, it is an unfavorable life history strategy and you wouldn't want to be a Delta Smelt. But if you cast yourselves back 50 years or 100 years or something like that, presumably since the population has persisted, since the species has persisted, the strategy in fact was a good

one. They've been around, they've survived, and so on. So what that implies very clearly is that there have been most probably extremely significant changes that have taken place over time, that make the life history as it currently exists and very difficult to change -- basic parameters like the fecundity, to make that life history, mismatch the current environment and resources and hydrography of the region. [00:54:44] When that occurred is a critical question, we have an idea about some of the time points perhaps and I think it's fair to say that some of this happens on an episodic basis, that is some years things look rosy, some years things don't look so good and that inconsistency in terms of the ability of these animals to survive and do well is precisely the kind of data that we've been trying to examine.

JUDGE MASON: [00:55:17] Let me ask about this life history strategy. It would seem to my lawyer's mind that that's not something that changes very frequently for a species or very rapidly, would that be right?

DR. KORNFIELD: That's, in general that's correct. We're talking about natural selection and for an annually reproducing species such as this it takes an awful long time to move things around. Part of it's based on, clearly the variation one sees for example, in the number of eggs in the fecundity. Part of it depends on heritability and other factors that are going on. [00:55:59]

But some of the basic information that we need to understand the life history of these organisms, is simply unavailable. In particular, it's of great significance to know in a temporal sequence, what proportion of the population spawns at multiple times. It's been estimated that approximately less than 5% are repeat spawners but those repeat spawners have fecundities that have been estimated, and it's, the number of estimates have been relatively few, of three to six times of what the standard fecundity is, number of eggs for a one year old fish. [00:56:44] So clearly the proportion of individuals that are actually second time spawners is significant to the population and what the population size is. Further, it appears from some data that it might be possible that there is multiple spawning which occurs in these taxa, although the data is somewhat speculative. Finally, I should point out that, and you may well be aware of this but there have been um, efforts underway to study the genetics of these organisms and to establish refugual populations as it were to make single pair crosses of these organisms to preserve genetic diversity, to make sure that we have a fish that will last long regardless of what goes on in the environment. Those preliminary surveys, they're very limited, suggest that the genetic parameters which can index the health of the species, even though they're based on small sample size, would suggest that the species is not

at the point where it is vulnerable to this so-called allee effect or , extermination vortex. That is when population sizes get too small, they're sort of self-reinforcing and things can proceed very rapidly. But the levels of variation, genetic variation, that the general paradigm is these individuals need for adaptation in the long term, appears to be present.

JUDGE MASON: Okay, Terry?

DR. QUINN: [00:58:15] The dynamical structure of Delta Smelt is actually pretty simple that, the main dynamics that describe the population consist of the adult phase of the population, most of them live to age 1. They then spawn and then you get a certain number of recruits out of that. That's just a very simple spawner, recruit type dynamical system. You don't have to worry about complexities of age structure, except for maybe some contribution from age 2s. You don't have to worry about complex migration and spatial patterns that are occurring across different areas and consequently you can write down the equations to describe the dynamics very very simply that your population, that next year it's gonna be made up of, of this recruitment that occurs when the spawning stock. [00:59:14] So essentially to write down the conceptual basis for the dynamics you need to account for two major biological processes. **(END**

OF DVD #1, BEGINNING OF DVD #2) …Paperwork on Delta Smelt. For those of us who deal with commercial groundfish fisheries management, this is, this is like data nirvana. You have 12 different abundance indices and you have environmental variables out of the kazoo, you have all these variables with stream flows measured, over 30 years of time. If we're, we're lucky to get that over 15 years of time in a lot of our commercial groundfish fisheries. [00:00:32] So what is really puzzling here is the difficulty in making any consistent understanding of the mechanisms that are involved here, that mechanisms seem to explain the data for a while as Rick said, then they fall out. Other things come in, seem to fall out. That seems like just the complexity of this, near shore environment and 38 million individuals who could have an impact on that system created the situation where that there are just so many things that could be involved here. [00:01:15] So my bottom line is to say that I bet lots of these factors are involved and we have a real difficult time, trying to do any kind of rank ordering or deciding which factors are important and what years because there's just so much going on.

JUDGE MASON: Let me ask you some, a little more on the life history of the Delta Smelt. They live to age 1, they spawn and then we have recruitment of a new juvenile class essentially, and this life span of one year, how has that

been observed? Or has that been observed throughout the time that we've been able to observe Delta Smelt or has it changed over that period of time that we've observed Delta Smelt?

DR. KORNFIELD: As far as I know it's been the same.

DR. THORLEY: [00:02:23] I would say that my reading of the literature, people don't know. It could have been historically more.

JUDGE MASON: All right.

DR. DERISO: There is one of the hypothesis in there that you get this extra survival to age 2 if for some reason they're not successful at spawning at age 1, so that there's some ability, I don't know if it's just the, for example maybe that El Nino year might have been one, I don't know that they took note of this in '83 and '84 but it could have been the narrow window of available spawn time was too short so the animals, some of them didn't get, have an opportunity to spawn, perhaps they waited the next year. [00:03:08] I don't know what, how much plasticity there is in that characteristic.

JUDGE MASON: All right. and this may have been answered implicitly but let me ask it more explicitly, how accurate are the population estimates of Delta Smelt?

DR. DERISO: The Delta Smelt is at, I'd describe it as a loosely aggregated species, we would, it's not quite tight schools okay, but in aggregations. It is usual that when you're dealing with taking trawl samples which is what they do in the fall, they're taking samples of a population which occurs in local aggregations that you're going to have extremely variable results. [00:04:05] You can look on the Cal Fish and Game site, they have a wonderful website there that shows actual densities from these various trawl samples for the various surveys and it's very striking when you look at it, they put them in these little size of a pie because you'll have in one sample location a huge pie and then little pies in some other ones, then maybe another huge one elsewhere so that it's extremely variable. When you have an extremely variable situation like that, the variance is going to be quite high so the reliability would be reduced because of that. [00:04:46] It's further compounded now because the Delta Smelt abundance is so low that it really is hit or miss and as one of the literature pieces said, this population could double or triple and you wouldn't be able to tell so that's kind of where it is.

DR. KORNFIELD: [00:05:10] Is it possible, Rob, for you to bring up the website on the CDFG stuff on the web? There you go. 2009, yeah, you'll have to change the year I think to, make it 2005, say Survey 3. [[[Insert the figure here.]]]

Projectionist: Okay, 2005, Survey 3.

DR. KORNFIELD: Let's try that.

Projectionist: We're on that.

DR. KORNFIELD: And move that up a little bit.

Projectionist: There you go.

DR. KORNFIELD: [00:06:07] So this was precisely what Rick was talking about. You can see those certainty, small empty circles represent sampling points where no Smelt were recovered. This is one of the trawls dominated by those large aggregations and why they occur there is unknown and if you were to take a deep breath and wait a day and go back and sample again, or even in the same day, go back and sample those stations, you might well get a different distribution. [00:06:40] One of the most important points is that you're taking those three point estimates as the car image, analogy that you gave before, Your Honor, and averaging them together to get an index of how many pieces there are at this particular point in time when most of those locations in fact are empty.

DR. DERISO: Then, okay, so what we've talked so far about just getting the density estimate. The next step and what has been attempted, is to try to take those density estimates and scale them so that you get absolute

abundance estimates, how many million adult Delta Smelt are there in the fall? [00:07:26] What's done to produce them is to treat this sample design like something that it's not, mainly it's not a randomized, stratified random design but the estimates try to treat it that way, at least it looks to me by looking at it, it looks to me like there are systematic stations and they're going to the same place, so that's not the way you would do it if you actually were interested in getting an abundance estimate, you'd want to do some randomization inside of there. [00:08:02] So that's a problem. The other problem is knowing exactly what the habitat is and that's apparently affected by things such as turbidity and what other factors, I don't know. So it's hard to take the volume which is swept by a trawl and then so you have a number of animals per swept volume and then you want to raise that, expand it to the total volume that's in the strata for their habitat. But that's part of the problem, you don't know what the volume is in that strata, and then sum up across all the separate strata. [00:08:45] That's the way that it's done and this has these intrinsic problems that we always see, at least in marine surveys, of trying to use a swept area. They don't usually work particularly well, and part of it is the animal avoidance issue. There's a size selectivity which is associated with pretty much every kind of gear, and so you see for example in the fall survey that measured efficiencies increase during the

fall, so that when the animals were largest, toward December, that's when the year is most efficient. So just a straight average for the fall, what you really are doing is you're averaging in a way which is giving disproportional weight to the animals for the end of the year as opposed to equally weighting, if that's what your intention was. [00:09:41] These things are all, when I look, like Terry, when I look at this data and I say, oh my goodness, look at how rich this data set is, even just from the standpoint of measuring fish abundance, okay. The way we normally do our assessments is that we build population models that are at the resolution of the data or as close as we can get. We do some aggregating and we've been working, with a lot of the tuna stuff at quarterly time steps. But the idea with something like a Delta Smelt I would think with biweekly surveys is that you would build a population model, you would have these animals born, in perhaps, even in biweekly time periods in your model, and then you would have, those animals in little cohorts if you will. [00:10:38] Then, sort of growing through the year, and encountering the sampling gear at a certain size distribution for that cohort and you would get, you would match that against the selectivity distribution of the gear and calculate probability of the encounter, and then you would just accumulate that through the year. And then that would sort of naturally take care of the features of selectivity of the gear,

interacting with the size of the animals and growing through the year. That as far as I can tell hasn't been done, or I couldn't see it if it's done in here. [00:11:15] But if we were fitting a model like that, it's probably the way we'd do it, because then we'd want to test hypotheses like export of water from the diversion, then we'd want to have the diversion matching up with the time of the year, in the life cycle. And then, the same thing with the matching for some of these other data sets that they have on copepods and such, of trying to match it in with the cohorts.

DR. THORLEY: Could I just say…

JUDGE MASON: Yeah, Joe.

DR. THORLEY: [00:11:49] I have a document here that I'd like to show, it shows some steps have been taken but there's a lot more that needs to be done with the data. But this plot is nice because it illustrates the uncertainty.

JUDGE MASON: Yeah, (inaudible) here.

DR. THORLEY: See, it's just these four plots here for the fall midwater trawl survey in the different months running from the period, you know, 1990 to 2005, by September, October, November, and December. It just analyzed the months individually, you should really be analyzing them together because you know the number of fish can't increase from September to

October, it could only go down through mortality effects. [00:12:37] But lots of general patterns aren't in dispute, the numbers have severely declined, the uncertainty around these estimates is huge, and this probably hasn't even incorporated all the uncertainty that exists as well. So when we try to look at the effects, we can see big general patterns but there's a huge amount of uncertainty around the estimates, midyear.

JUDGE MASON: Let me ask about the recruitment issue and you've talked Rick about the modeling that's been, that ought to be done in terms of the adult survey but what about the summer juvenile surveys?

DR. DERISO: [00:13:21] Well certainly, in fact I think some of this work is ongoing right now. I think that my, my colleague that's in the office next to me that works for me is doing it, and he's doing it kind of the way I described it. And when you build a population model, well usually what you do is you run around and try to find all of the kind of survey data that you can that bears upon it. [00:13:45] So you have this 20 Millimeter Survey that they do for post-larvae, you have the Summer Townet Survey that's done. There's the Fall Midwater. There's the Winter Kodiak. So there's at least those four and then I think there's some others that have happened sporadically. So you have several observation data sets. On some of the observation data sets, not only do you have an estimate of a number of

animals caught but the size of the animals so that you actually have the length, and

the distribution of lengths of the animals from each of the samples. [00:14:25] So, all of that kind of data is the stuff that would be used as input to fitting a population model. The population model, as Terry says, really the only things that are going on is there's birth of a cohort and then there's their mortality. Well, I guess growth too if you want to really put it in to mesh with this whole thing. So what you have is mortality and it's a variable mortality, and it varies throughout the year and between years, possibly as a result of different kinds of variables.

JUDGE MASON: Terry?

DR. QUINN: [00:15:08] I just wanted to elaborate a little further on that in that in the papers that Brian and Rick and Dennis and I took a look at, we found some major flaws in the analyses that were carried out because they were not looking at mortality but they were looking at abundance. So what they were doing is they were just trying to take the abundance from one of these indices and say that's related to some environmental variable be it temperature or something like that. [00:15:39] Well that's kind of like the theory of immaculate conception, that somehow an environmental variable is going to create a whole number of different

eggs independent of the process of the number of fish that are out there. So there's been an attempt to do the modeling in terms of the abundance when they should be looking at mortality in some kind of way. And I think one of the main reasons that there's been such little progress in trying to isolate the key factors that are affecting the population is the fact that this kind of population modeling that accounts for mortality has not been done to the level at which, that you would have these absolute estimates of abundance at a stage. So then, what the poor scientists have to do, is they have to take relative indices of abundance, relate them to other relative indices of abundance and other relative indices of environmental variables too, which aren't measuring the whole impact there. [00:16:56] So by that time you're at so many subjective judgment calls as to what the, the relative importance of any factor is because you don't have this absolute number of animals known, even if it's done to the stage of that crudity. That's the future right there. Improving on that. And I dare say there won't be much progress made in that until that question on absolute estimates of abundance gets resolved at the recruit stage and at the adult stage at a minimum.

JUDGE MASON: [00:17:40] Let me ask you about the population modeling that Rick was describing. This isn't just some Deriso-Quinn production is it, that you

guys thought of? Where would you say it lies on the spectrum of what I might call state of the art? Is it, is it advanced, is it current, or is it…?

DR. DERISO: [00:18:05] I don't know all the details, Mark Monger who's doing the work, described it, didn't really want to go through too much with details with it because it's a work in progress. He described an idea of what they were doing and what I'm describing as a model of a higher temporal resolution that builds into it the growth process and the selectivity process of the years that allows for a variable mortality is state of the art, that's pretty much state of the art.

JUDGE MASON: [00:18:40] So that can be done today?

DR. DERISO: That could be done today. There's still lots of difficult issues with exactly what those, in statistics they're called likelihood functions. What does the likelihood function look like for the kind of year that they're working in. I mean ,this is where someone like Brian could contribute a lot because it's clear from looking at the data that it's not normally distributed which is what you like to have for the nice simple likelihood functions, and it's clearly not normal where you can just use a robusticized likelihood and handle it that way as a technical issue. [00:19:22] And usually, the sort of thing that we've done, and it's contemporary as well, what Terry and I and others have done. I had a paper last summer that does this, is you ,

find the list of candidate factors that you think could reasonably affect the population. There's certainly a list of them here with Delta Smelt. And for which you have data on, and that's the rub in some places is that, sometimes people don't collect data until sort of after the event and so that makes it hard to get a baseline. [00:20:06] But the factors for which you have data and are reasonable to look at. And you build a population model fitting it to the data and then you take these factors and you, go through and fit the model with these various factors as alternative hypotheses. And from that you try, you go through a building process where you build a model of various numbers of factors that are added to the model by some statistical rule. There are scores, like the Kiki scores and other things that can be used to try to build these kinds of models. [00:20:48] You then end up at the end of that process with a few numbers of sort of your best candidates , that are parsimonious with the data. You don't have too many factors in there. They are statistically justifiable. Then you have things that at least correlate with the changes in abundance, or changes on survival really, mortality and recruitment too, then you have these. [00:21:19] And then you look at the impacts of those factors. Just because a factor is significant doesn't necessarily mean that it has a measureable impact on a population, Some things are very precisely known but they don't vary enough to have had a

measurable impact. So you do that and that's sort of the way that this sort of science is done. I haven't seen that sort of sequential approach in any of the literature here. Most of this from what I've seen, most of it looks like taking rather simple regression analyses and then just fitting, estimates of abundance with some factors. [00:22:07] In some cases they try to take an estimate of, like an estimate of survival by taking the ratio of the summer survey to the previous fall and so I have seen some cases where they used that ratio. And that is a little more sensible to me, although I would probably logarithmic transform it because I don't think these factors happened additively, they probably happened multiplicitly and so they're affecting mortality rates, not additive things like fractions like that.

JUDGE MASON: Okay, Joe.

DR. THORLEY: Can I add really quick by saying that in terms of, can I try drawing it on the screen?

JUDGE MASON: Sure.

DR. THORLEY: Thank you. So yeah, one of the major documents talking about an effects analysis and the questions we've been asked is, what's the importance of an effect, so everything is in terms of what is the effect size. But generally

the literature is discussing things in terms of P values and I can show you a quick diagram of how to visualize the difference between the the two of them. [00:23:21] [Dr. Thorley starts drawing the figure illustrating his points.] So we quantify, sorry, we quantify this as the percent change in the population and it could be, you know, it could be a negative change. Do you see that? Yep. Or it could be a positive change in the population. So we can draw that. If we had variable information, well, it could be from here all the way down to there, that basically says we know nothing about the effect of that variable. Equally, and in this case P value would be , 0.45, scientists call not significant, it said there was no effect there. You could have it where, draw it there, it could be slightly positive or it could be very negative. In this case the P value would still be probably slightly greater than .05, so scientists would say there was no effect there, we couldn't detect an effect. [00:24:25] If the analysis had shown that it was here, it was definitely negative, it could be a tiny bit negative or it could be really negative. Now your P value would be less than .05 and everyone would get really excited and say that was great. But again, it could actually be very small, it's not zero but it could be very small, it could still be very large. Alternatively you may have a case where here, it's definitely a very negative effect. In this case would be very small, it would be much less than .05 but equally you could have a case where it

was extremely tight, it was here, and again it would be much less than .05. [00:25:06] So we're really sure about it and it definitely has an effect and it's definitely not zero but it's actually very small, it's not really important either. So the discussion focused on P values is misleading and it should be focusing in terms of these effects. Could it include a big one, is it, could it actually be positive? Is it definitely known but it's small, etc. So that's a good framework for thinking about these questions and moving away from the P value and trying to visualize them in these terms to deal with uncertainty.

JUDGE MASON: [00:25:39] Okay, that I think explains the statement that there could be something that's significant but not necessarily important.

DR. THORLEY: Yeah.

JUDGE MASON: Right. Okay and this question I think has been also discussed in an implicit way but it sounds to me like , there's not any, well, let me put it this way, would you say that threats have been quantitatively evaluated?

DR. THORLEY: Uh, no.

JUDGE MASON: Okay. Brian?

DR. DENNIS: [00:26:20] I will add to that, I would say, no. The data exists to start to get a handle on that, for instance with regard to the quality of the estimates of Smelt abundance. We saw the pictures there of the great uncertainty and the estimates, and we saw the picture of the static, laid-out sampling protocol. And we have seen how such a protocol might not lead to such good estimates. Yet there might be information there that is worthwhile to at least start considering. When we saw the picture of the uncertainty through the years we also saw what seems to be a sudden change not only in the level of abundances but also in the degree of uncertainty of the abundances. [00:27:30] That's a very interesting thing to ponder as to whether this sampling protocol is getting some fish when they're abundant but getting them sporadically around space causing the great uncertainty to take place. But that very low average and very high certainty with which they are low is intriguing and the hypothesis is that indeed the Smelt abundance has gone down drastically after the, in the year, in the 2000s and beyond is one hypothesis. Another hypothesis is that they're all hiding out in some unmeasured tributary somewhere during those years. The second hypothesis you know, I wouldn't put it past nature to do something like that but knowing the habits that we have seen in Smelt to date, that's probably unlikely in that there's probably information in the estimates that could be used but it's going to

take some substantial study to use them properly in a statistically proper way. [00:28:56] And with regard to the factors, we're going to have to measure factors better and measure them for more years. Some of them were started later on in the data set so we have that number of factors and observations problem. That contributes to the problem that some factors seem to operate in some periods and not in other periods, that's one thing that's mixed in with that is the fact that there aren't a lot of observations in those periods. So in any data set you can find little short periods where some factors seem to operate and then don't seem to operate in other short periods.

JUDGE MASON: [00:29:46] I get from that you would, you think that there would be consistency for the operation of these factors over some period of time?

DR. DENNIS: I don't necessarily think that. There might be long term change, another thing you have to worry about. [00:30:06] I think the big things that would come out of this sort of panel is that science and management have to partner better and science and management have to change, this is our sampling protocol, that static fixed location. Maybe it will give us good information and maybe that's something to continue. But gosh we would certainly like to have some testing of it through other means, maybe some random sampling calibration of that method a few years

just to see whether that information that we're getting from the static method would be correlated with different sampling methods that might be more expensive, might be used just to test what we're seeing. [00:31:05] Science and management will have to adapt in that these statistical methods are based, are being done on observational data, the variable levels are just given to us, the, the inflows and outflows of the Delta and so on, the food abundance, are just given to us by nature unmanipulated. And correlation is not cause say the scientists and the statisticians. And when you have a lot of things going on at once in a complex system what scientists really would like to do is to grab onto a few of them and manipulate them, and so some adaptive management manipulations of this system might produce a lot of interesting information that could be used for future management.

JUDGE MASON: Okay, all right.

DR. DENNIS: [00:32:15] In other words, a good experiment goes a long way.

JUDGE MASON: Right, right. Terry, you were going to say something.

DR. QUINN: I think one of the real quandaries of ocean and estuarial science right now is we're finally starting to recognize that there are different scales of operation, both in the spatial domain and in the temporal domain.

[00:32:47] What brings this to mind as one of the factors that I think is really important right now is the Pacific Ocean decline that's occurred, so that it's not just happening to Delta Smelt, it's happening to a number of pelagics over a wide area. That suggests a very large factor that has a very large area of effect that affects species across a whole variety of different life histories. [00:33:20] Contrast that to something that involves flow, that's only going to involve those species that are affected in the area of the flow and then you take other variables and their scale of operation is going to be much different too. So trying to tease out all these different things that operate on different spatial scales is important. And then think of temporal scales. There's some factors that are decadal in character, like hot periods and cold periods that occur with regime shifts of which the POD may be an example of that occurring. There are those factors that operate annually and then you have those factors that only operate over a short time in a season. [00:34:08] So that is another scientific and statistical issue that makes it very difficult to attribute causation to any number of factors that are being studied.

JUDGE MASON: Okay, thank you.

DR. DERISO: [00:34:29] And one other, with these factors, in a lot of, pretty much everything I've seen they've all been entered as though they affect the

quantity that you're interested in linearly, okay, so that is a proportional response. So even if they are looking at survival, they're looking at a proportional increase as the factor increases. It may well be that these processes are non-linear. In fact there's some pretty good reasons to think that they may behave non-linearly with respect to the population size. [00:35:07] That is, for example, this X2 or the distance where the two part isohaline is, a measured distance from the Golden Gate Bridge, that may be a measure of habitat size. But habitat size in the fish population model that is usually followed is something like a carrying capacity. Now that's a non-linear effect, so that when the population abundance is large then it could well be a binding constraint, then the larger the habitat improves survival. But when abundance is low then it's no longer a binding constraint. so it won't. It no longer has an effect. That kind of storytelling can go along with, for example, looking at this paper by Bennett where he finds that there used to be a relationship with X2, until 1981, then after that there wasn't one and the abundance was low. [00:36:11] So you don't necessarily have to have that these things flip the signs on all these regressions and cut the lines and stuff. It could be all part of a continuous process but it's just not really being modeled correctly, if you will.

JUDGE MASON: Okay, I think we should take about a five minute break at this point and let everyone refresh themselves. Then we'll come back and move on to another area.

[FIVE MINUTE BREAK]

And so we resume after our break. We've been talking about the quantifiability of effects on Delta Smelt abundance and the population modeling and so forth. [00:37:07] I wonder, Rick, if you're ready to show some applications.

DR. DERISO: Yeah, I can, or, either I or Brian. I guess I will.. Mine's simpler than his so I'll show mine. So I looked at two things, mainly focusing on two factors here. What I'm focusing on in this, in things that I'm gonna show you are some results using the two factors in a set of data that we were given that relate to the water diversion. [00:38:36] One of them is this variable X2. which the assumption is in the literature, is that the location of X2, or this two part isohaline is a function of the amount of water which is not diverted, or is a function of water diversion so that finding significant results with X2, implies that this cause and effect thing, that if you were to reduce water diversion then you would improve the situation. Let me, show you the variable here is, it's because I'm a quantitative guy, I don't write plain English, what that is [Dr. Deriso pointing out features of the

figure projected onscreen.] That's a measure of recruitment is the summer net trawl and then the fall trawl is a measure of, especially if it's lagged by one year, is a measure of the adults. [00:40:01] So you have your recruits, divided by spawners okay, so this is then an estimate of the survival and reproduction from spawning through to when they're measured as recruits in the summer. Taking the logarithm of that, it's what this LN thing does, the logarithm so that factors that would be looked at with it, would be factors affecting the rate of productivity of recruitment per spawner. [00:40:38] And you can see that if you put all of the data that we were given on the spreadsheet, which goes back to 1972, I think, and goes through 2006, but there were a couple of years that were missing, '75 and '80, I think those were the years the surveys weren't done. Then you don't get a negative relationship between X2 from September to December of the previous year affecting this productivity measure. [00:41:10] The reason that I was looking at the X2 averaged of the previous year is this is what was used in the biological opinion, in the biological opinion they found that there is a negative relationship between X2 and this summer townet survey index and concluded that the water diversion was having an impact. What this shows is if you use all of the data you no longer would reach that

conclusion, particularly if you look at it in terms of productivity instead of just the summer index.

JUDGE MASON: Rick, when you say you use all of the data, can you describe again the data set that was used?

DR. DERISO: [00:41:58] Yes, the data set that was used, we were given copies of the data set that were in paper on multivariat analyses, that we were allowed to review, to look at as part of the material, and that data has a whole bunch of factors in it that they looked at as potential factors affecting juvenile abundance, as one index, the summer townet abundance index,, here's the previous fall. [00:42:34] So this was the sheet that I looked at in order to pick off some factors to go straight at the factors that are related to water diversion, okay, and it goes from 1972. You can see there's a couple of years missing here and then it goes all the way through 2006.

JUDGE MASON: And what was the data set used in the biological opinion?

DR. DERISO: [00:43:03] The one in the biological opinion for some reason, and they don't even explain in it, they only start in 1987. Now I've seen in the literature, Bennett and I think, and another paper where they argue that you should start in 1982 because prior to that there were a lot more

Delta Smelt, so this is sort of like previous to the decline and then once you get into the era of low Delta Smelt. [00:43:36] So, that argument I've seen in the literature. I haven't seen an argument in the literature for starting in 1987 though the biological opinion gives as its reference when it starts to do this analysis an unpublished manuscript. So apparently there's some unpublished manuscript and maybe the unpublished manuscript gives the rational as to why you would start in 1987, but like I said I couldn't find it. So I wanted to look at the issue. So here it is with all of the data. [Dr. Deriso points to results of his analyses in plots and spreadsheets throughout this section.] [00:44:16] Now if I move down to 1987 to 2006, this is the result that I've been able to replicate from the biological opinion. Here's the summer net trawl and here's X2 from the previous winter and sure enough I get an R-squared of 0.3, I get a negative slope, and this thing is statistically significant if I fit it just like that. [00:44:46] Now we've gone through reasons why we don't think that the townet survey itself should be the dependent variable, it should be something like this, the logarithm of spawners per recruits per spawner, or even just the logarithm of recruits, if you were looking at a mortality process that would be related to this X2 variable. One of the letters written as a review of the biological opinion is one by the Water Authority and some other agency, and what they point out is that if you

delete this one data point, this 1999 data point, that in fact you don't get a significant regression, and that's true, I've confirmed that. [00:45:40] What I've also been able to confirm is that even if you just do the logarithm transformation of the summer index, so that at least you're looking at something that's affecting a mortality rate, then even restricting it to those years that they did you no longer get a significant result. So essentially what I found is that the result that was in the biological opinion on a negative effect with X2 hinges very precariously not only on the choice of the years that you use but the choice of not even transforming the dependent variable, doing something which as Terry mentioned earlier, it just, it doesn't, from a population dynamic standpoint it makes no sense. [00:46:28] You wouldn't expect a factor to affect an absolute quantity, it's got to affect the rate somehow. I did a whole bunch of things that I'm not going to bore you so much with, we have things like our standard fisheries population dynamics called a Ricker spawn recruit model. It's kind of like what I had done before but it includes the term for density dependence. And I'm sorry for the way that this stuff is printed, this is just, I'm a quantitative guy so I sort of learn by just sort of exploring the data. So this is just exploring the data and seeing what makes the thing tick. [00:47:11] Going through with this one, this is not significant, the P value needs to be .05 or below for the previous, this

is the X2 line. Um, here's the model that was used in the biological opinion, uh, let me see, no, it must not be, what do I have here?

MALE: That's '82.

DR. DERISO: Oh, that goes back to '82. Yeah, this is, right, so I replicated the same, used the exact same model that they did in the biological opinion. But I went back to 1982 because that's where Bennett said you should start the time series and so, but if I add on an extra five years, it also was not significant. [00:47:49] Here is the one that I replicated, sure enough you get the biological opinion result is significant if you use their model, if you do it for the years that they do it, and you don't transform any other dependent variables, then yeah, you can get that. You can, you also get it by using a different index instead of the entire summer net trawl index, Manley and Miller picked out July and then did a stratified weighted average for the July part and used that as an index. It gets essentially the same result. [00:48:28] It is significant as long as I use that model, but it doesn't make sense to. If I use the Ricker model starting in 1987, it's no longer significant. If I start in 1987 and just look for, and have a density independent model, so I'm mainly just looking at this, again this X2 variable in relation to the logarithm of recruits per spawner, it's not significant. So that's what I found with X2. Now, Terry and I, we looked

at this other one. What we were looking at was using the same kind of analysis but now looking at total water exports so the hypothesis in here that you're trying to test is whether or not, productivity if you will, logarithm of recruits per spawner is affected significantly by water exports. And the water exports here are the average for the first six months of the year I think, or maybe it goes from December through May, something like that. [00:49:47] And the result is that if I use all of the data, I think this is, yeah, this is using all of the data it's almost significant but not quite. I can get a significant though using all of the data, here, I think this is the one. Yeah, I can do it if I use their juvenile index, and if I use their juvenile index and I still use all of the data\, except for the two years that there wasn't any, then I can get a significant effect with exports, okay, and so, that's that. Except, what I noticed was this one data point here. [00:50:34] Now this data point is, corresponds to a year of sort of the best productivity on record. And it's also one of the lowest export years, okay. So the question in looking at this is how influential is that data point in driving the result that I got? And what I found is that if I exclude the 1987, 1977 data point it's no longer statistically significant. Now, we see these kind of things sometime in regressions where you have a very influential data point driving the result. But, so you're either left with the conclusion that yes, exports

affected and I'm gonna leave the 1977 data point. But basing a decision on water diversion based on a single data point 30 years ago, when other scientists would say you shouldn't even be using data from 30 years ago, is a bit of a precarious position. [00:51:42] And I don't know whether that result would hold up if I used a robust statistics procedure. What I've done in the past to try, sometimes you have what are known as outliers that will cause results because the data point is just way out of whack compared to everything else. But the model is so severely penalized if it doesn't sort of get close to that data point that it affects the results significantly, qualitatively, okay, like it's a big effect right. [00:52:14] And there's a whole branch of statistics, robust statistics, and they have methods of doing these kinds of fittings where they down weight data points which are far away from the fitted line so to speak.

DR. QUINN: [00:52:36] And Rick, it's worth going back to the data and just showing the magnitude of data from '75 to '81 for the recruits and the spawners.

DR. DERISO: Yeah, okay, so…

DR. QUINN: Would that be fall, summer factors, could we get it there?

DR. DERISO: Oh yeah, here it is, sorry. Got to pay attention to what I'm doing here. [00:53:15] Okay, this has, so here's the fall survey in the '70s. You can

see it's going along thousands and the hundreds, mid 500s, skip a year of sample, here's another high one in the thousands. And then in 1982 it just sort of, it dropped off the cliff right? Now this was the previous fall so actually if I use the actual fall it'll carry over one more year. So let's go to summer, fall, so here's the index itself and 1980 is actually the last strong year. Then 1981 the fall survey, and this is considered the index of the pre-adults so this has been historically one where they said here's the Delta Smelt abundance, is they're typically talking about the fall midwater trawl index. [00:54:04] So if, so there's a big drop and whether you say it's in '81 or '82, I actually did the analysis both ways and I get the same result but it drops off and you can see there's, okay, yeah, it got over a thousand but by and large it's always down in the hundreds after that, okay. Now it's gotten so low who knows exactly how low the abundance index is because these numbers have to have huge variances associated with them.

DR. QUINN: Can I just butt in?

DR. DERISO: Sure.

DR. QUINN: [00:54:39] This happens in a lot of fisheries in the world, it's called the shifting baseline phenomenon, that we tend to continually readjust what we think is normal on the basis of what we've seen more recently and we

fail to go back and look at earlier time periods to show that things really were much different then, and to just hope for what we have right now compared to what we had back then is, is very sobering to me.

DR. DERISO: [00:55:22] This is the result if you use 1982 through 2006, looking for again, the export, and it's nowhere near significant, okay. So again, the only way I could get a significant export is I had to draw in all the old data , and I have to make sure I leave 1977 in there, okay, because that's what's going to drive the result. So again, this is, to me, if somebody asked me you know, is this water diversion having an impact? Well, if I look at exports and I look at the X2 factor, I'm not getting any consistent results showing impact.

JUDGE MASON: Okay, thanks Rick. Brian, do you want to show your analysis? [00:56:14]

DR. DENNIS: Sure. **(END OF DVD #2, BEGINNING OF DVD #3)** Can you hear me now? The analysis that I did is somewhat similar to Rick's and somewhat different. [00:01:36] [Dr. Dennis points to results of his analyses in plots and spreadsheets throughout this section.] Populations grow multiplicatively just like money and just like money invested in some vehicle with variable return rates, populations vary with variable return rates. And the analysis that population scientists like to do is to take the return rate every year, which changes, and on a logarithmic scale look at

the factors that are associated with those changes. Now, this is that spreadsheet of data and this first variable there, that's that midwater trawl of the adults. [00:02:38] And what I did was I took each pair of abundances, that would be the spawners in the previous year and the spawners in the current year as measured in the winter, take their logarithms and take the difference, that's the change in the spawner population from last year to this year. And then I looked at how that changed as result of these different possible factors. Now some of the previous analyses that we studied in these reports use some statistical methodology for finding out which of these variables are important. [00:03:43] The problem with the statistical analysis is that for instance, you have salinity factors, there are two of them, you have different temperature factors, they're related to each other as well as possibly to the thing that you are looking at. And if one thing is highly related to another predictor then they're essentially surrogates for each other, and if you enter one into the model then it might look like the other is not significant or if you enter the other into the model that it might look like the first is not significant. [00:04:19] The method for dealing with that problem that was used in previous analyses was called stepwise regression and it goes like this. You find among all these which one's the best predictor according to some measure and then you put that in the

model, and then among all the rest which is the best predictor and then you put that in the model and so on until good predictors are gone. That's called stepwise regression. I haven't seen that in 20 years. It has basically disappeared from statistical practice. The reason it has disappeared is that we know that doing that, we can't find often the subset of variables that give the best prediction. [00:05:11] It's like picking a basketball team sequentially, you pick the best player, then pick the second best player and then pick the third best player. You might end up with a team that's not necessarily a good team, they might not do very well at all, you might not have a point guard, you might not have a post or whatever. So the method that I'm going to show you looks at, tries to find the best possible subset of predictor variables and this method takes into account the fact that they are related to each other, that they might possibly be related to each other. And if two highly related variables are in the model that means that both of them together can predict the value into the model. [00:06:10] The method uses, takes a little computer power, it takes all possible subsets of these variables and computes model and calculates some index of predictive quality. The index is called AIC after Professor Akaike, Akaike Information Criterion. He invented this in the 1970s. Now, the other thing about the data, I'll just glance over this way, you see that the data are incomplete. Some of

these ammonia variables don't start until there. Occasionally there might be variables that have missing observations, and then over here [Pause] I brought my wrong glasses for this.

DR. DERISO: Hit your escape button…

DR. DENNIS: Yeah, I got, okay, okay. [00:07:45] Over here the salvage variables they don't start until substantially later. We got export data however for all the time periods. Anyway, this analysis that I'll show you only uses the variables for which there are complete data as complete as the variable that I want to predict which is the change on the logarithmic scale and the population size from one year to the next. Okay, so let's, this is not acting how it's supposed to act. [00:08:59] [Pause] Okay. I'm not going to try and show you numbers on here but I just want to show you that there is a list of variables here. This one is that change from year to year, it's called YT, and one of the important things in population dynamics is that that change is very frequently related to the numbers of individuals that are there to start with. That's called density dependence. If it's too crowded and resources are scarce often times this change might be negative or if there are a few individuals and resources are abundant, often times this change is positive. [00:10:11] And then here are the list of the variables for which the data are complete and then this little thing,

AIC, asks the computer to calculate that index and this routine will fit every one variable model, every two variable model, every three variable model, and so on, on through all possible models that can be fit. And the one with the lowest AIC, which is the best predicting one, had, need to go back to that spreadsheet, it had 10 variables in it. The first one was the number of days of spawning temperature. The second one was the maximum temperature during larval development. [00:11:55] Third one was this first salinity factor previous September to December EC. The fourth one was the second salinity factor previous September to December average X2. The fifth one was a food variable, rotifers in late April. The sixth one was another food variable, Limnoithona density in late April, or I'm sorry, Limnoithona density in late April. Then the next one was an export average December through March export. [00:13:10] And then finally the last three were flow factors, average inflow October, I'm sorry, average inflow October through April, average Delta inflow in April, and the average outflow in April. [00:13:56] Now, the model that results from that, maybe we can zoom in, yeah. I think that's better now. In the model that results from this, some of the variables are "significant" and some are not significant. However the statistical methodology used to detect significant and not significant actually is not valid in this context. In order to find out if they're significant one has to do a

numerically intensive type method. [00:14:52] The statistical distributions involved in calculating these P values are not valid for this model, it's a time series model, and so these are not correct. But these parameter estimates are valid in the model and one thing you can do in the model is to go in and take a look and see if any observations are overly influential. That is if you drop out any observations, does it change the results very much? And that can be done with these things called DF Betas and basically you scan through them and just as a rule of thumb, if any of them are bigger than about 2 or so, that observation might be somewhat influential. [00:15:52] There's one, the very first one in the data set for X14, that's the average rotifer density. But all in all the others, DF Betas, are pretty small and pretty tight, that is if you, drop off the first, if you drop out the first observation then the coefficient for rotifers changes a great deal. Other than that no observation is appearing overly influential in this analysis. Now an analysis like this is not hypothesis testing, it's observational data, and so one should regard it as hypothesis generation. That is, here is a working model, might be one of several models one might develop. You know, you have to use less data but put in the variables that had missing data in them and develop another model on that basis and develop another model on the basis of the other abundance indexes and so on. [00:17:19] It's one model of a

set of working models that could be used to start to specify management changes, management experiments, science changes, science experiments to see if these models continue to predict the population sizes on into the future. Okay, I'll stop there.

JUDGE MASON: Great, thank you.

DR. KORNFIELD: [00:17:49] So, what's the next best model to this? Does it change dramatically or is it effectively the same in terms of the factors and their magnitude?

DR. DENNIS: That's a good question. This analysis might identify a collection of models that are pretty close to each other in quality and yes, there are a few other models that are pretty close to this model in quality that have more or less the same types of variables in them, variables that are surrogates of each other that are entered instead of these variables. [00:18:28] So a similar model but slightly different variables.

JUDGE MASON: All right. Any other comments on that issue from the panel? Okay, , here's the last question in this segment and that is, if you can summarize, which pieces of critical information may be missing from the analyses in order to understand the Smelt habitat and life history?

DR. KORNFIELD: [00:19:28] There's in the biology of these organisms, there are a number of pieces of information that are not considered. The trophic arrangement, that is what these, what Smelt feed on, appears to be not a simple linear type of model. A relatively recent though non-replicated study suggests that there's a trophic level between that of the dominant phytoplankton or phytoplankton and some of the zooplankton. That is there are other organisms that are substantially smaller that act as intermediaries in this trophic web. Their contribution and how many of them exist in the system is currently uncategorized. [00:20:25] The other kind of information that are, that may potentially be missing concern the actual distribution of some of the parameters which are used to define what the habitat is for these organisms. As you well know, the spawning sites for these are not located so that's a fundamental piece of information that's lacking. The other rather interesting piece of information has to do with turbidity. Delta Smelt require a certain level of non-clarity of water in order to begin to feed and in order to reproduce. It appears from experimental work that there is a critical value of 10 ETUs, a measure of how much, how clear the water is, which is not significantly different than levels which are higher than that. [00:21:35] So one doesn't really know where in the water column these fish are actually located to optimize their performance in terms of both food

capture and predator avoidance. That is they could easily be down at the bottom or they could be somewhere else in the water column. So it's difficult to use these units to predict precisely where they are, so really where they are in the water is somewhat unknown, and this impacts on the estimates with respect to catching them and where one puts a net in. I think a fundamental importance is some basic biology of both the Smelt and their prey items. [00:22:29] In particular, and I will mention this later on, maybe I'll hold onto that answer for question 3, but with respect to Smelt, they're not neutral particles of course and they can use the various dynamics of the estuary to move one way or move another. They may and do in fact migrate vertically at different times of the day and at different times during the year. Those dynamics are not really known and in fact can influence rather dramatically where they might be at any particular time and what factors might impinge on their health.

JUDGE MASON: Okay, thank you. Anyone else want to comment on that, whether and what pieces of critical information are missing with respect to the Smelt's life history?

DR. DERISO: [00:23:24] One thing that's missing is I've never found Smelt eggs in the wild and I think…

JUDGE MASON: There's never been Smelt eggs found in the wild?

DR. KORNFIELD: It turns out that there was one found but where it was found isn't known or I wasn't able to resurrect it. But it is a fundamental datum I think to figure this out and the location of the spawning sites is based on where one first sees juveniles after egg sack or yolk sack absorption. And that period of time while they're apparently on the bottom, eating and absorbing their yolk, is on the order of two to three weeks before they appear in the plankton. So there could be a fair amount of movement, not necessarily one that's perceptible over space, so trying to resurrect where they actually occur prior to that is somewhat problematic. [00:24:26] So it is somewhat speculative, lots of other Osmerids, of fish of this family do prefer, sandy, sort of structured substrate but there are individual requirements for separate species so it's somewhat speculative.

DR. DERISO: And so related to that is, what they haven't been able to do, I understand, is to relate backwards, those progeny that survive to become juveniles, where did they come from? I mean, is it, there's sort of this implicit assumption in here that everywhere is equally good for producing, for rearing Smelt and that may well not be the case.

JUDGE MASON: Okay.

DR. KORNFIELD: It's probably not the case.

DR. DERISO: It may not be the case. [00:25:26] The other thing I find curious is, I think it was Bennett, shows a correlation between salvage and the juvenile townet abundance index, and writes that well, it just looks like the salvage is going to be high when the when the abundance is high. Then you get into a separate piece of analysis like in the biological opinion and elsewhere where they relate OMR, Old and Middle River Flow, to salvage. Whether it's related linearly or exponentially means the exponential model fits better. But nevertheless there's this curious thing where this OMR when very negative is associated with high salvage but high salvage is associated with high juvenile abundance. [00:26:43] So, it makes you wonder, doesn't it, whether these conditions that they're concerned about, mainly the high OMR negative flows are actually the conditions under which there's the best survival to the juvenile stage. I found the whole thing curious, yet no one's said anything like that, I don't know why they don't.

JUDGE MASON: That would seem to be an interesting research project.

DR. DERISO: Yes, because presumably then, I mean if it's negative OMR then that's saying something about where the Smelt are coming from, well, no, they have to be going, I don't know, I don't make sense. [Laughter]

JUDGE MASON: All right. Last opportunity for anyone else to answer that question about any critical missing information. All right, hearing none, I will move on from that topic. All right, let me look at question 2 just briefly because I think we have probably approached this and gone past it but has the average salinity of Delta Smelt habitat in the fall, as measured by X2, had important effects on subsequent juvenile abundance in the summer?

DR. THORLEY: [00:28:31] I would say probably not but, it may interact with other factors. And given, at the start of the discussion we outlined all the challenges of the data set, which means it could be difficult to show this as having an effect but it could also be difficult to rule out as this having an effect as well.

JUDGE MASON: Okay.

DR. THORLEY: But overall there's nothing in terms of correlated relationships that comes up strongly, but there are some arguments that can take it to an extreme of course as trying to push everything out beyond the bay. You push X2 out so everything's out in the open ocean, it's going to be a problem likely if you suck it all out so of course at some level it does have an affect but I've got this specific question probably not from what, how I see it in the literature.

JUDGE MASON: Okay, anyone else? Terry?

DR. QUINN: [00:29:20] We also have to turn to the statistical caveat that the absence of a relationship doesn't mean that there isn't a relationship, it's just that we have not been able to detect it, and that happens when there is uncertainty in data, and so we can't definitely say that X2 is not related to that, except that we have not been able to uncover strong evidence except in rare cases where that is the case.

DR. DERISO: I mean, there's a couple of curious things about it. [00:29:58] I mean, when you're seeing how tentative the regression results are that have this fall X2 related to summer juvenile abundance, how tentative that is, and trying to describe what mechanism could be involved is a challenge as well. If you're taking, as they do, a September through December average of X2, then that would seem as though it's already impacted in the fall midwinter trawl that you should see an effect there because that, I mean if it's affecting survival of adults, then it would seem like it would show up there as well. [00:30:45] But that doesn't seem to be the case. But it may well be that it's, it's like we talked before, that when the density of Smelt were high perhaps X2 was a constraint, acting like a carrying capacity constraint, okay. But if X2 is is large so that there's less inflow into the Delta, that has the effect of increasing the residence time

in the Bay of zooplankton, so that the, so that productivity, basic primary productivity could actually be enhanced by an increased value of X2. [00:31:35] So it's like this tradeoff between the two. You may have a smaller habitat but you may be more productive, and it may be that that increased productivity is even more important now that they've introduced the overbite clam into it. So that it may not have been an issue before but it may be becoming a more important issue now. So, you know, you can see a certain argument from the biological standpoint of which way this factor should even work, you can make arguments both ways. So there's no *apriori* conceptual reason why I would say even though the data doesn't demonstrate it or may not demonstrate it, although I think Brian could find it among the multiple factors, that, and they will be either positive or negative. I don't know which way it would go. [00:32:28]

JUDGE MASON: Okay. All right, I think what we'll do now is, it's lunch time, I think we'll take maybe about a half an hour and if we're not finished we'll continue on at that point. And so I'm going to declare a recess of about a half an hour right now. [00:32:53]

[RETURN FROM BREAK]

I mentioned that we would take up the issue of the entrainment of the zooplankton, and the question is, has that entrainment had important effects on subsequent fall sub adult abundance of Delta Smelt?

DR. KORNFIELD: [00:33:16] There's some biology that's associated with these species, in particular the most dominant one, Pseudo diaptomus , where it appears that the planktor is capable of vertical migration, actively and, may well avoid predation or may well feed or whatever it is but regardless it cannot be modeled as a simple particle floating along. And it may be, it may occur for significant periods of time in localized areas without moving around. [00:34:01] The same thing is true for some of the other taxa that are involved. I don't know enough about the chief phytoplankton that the, or phytoplanktor that this copepod grazes on but it may be benthic rather than being absolutely pelagic and it too may be constrained to moving slower than is generally predicted with water currents.

JUDGE MASON: Okay, anyone else want to weigh in on that question? All right, well, let's move on to question 5 and I think I know the answer to this based upon what I've heard you say, but we did ask of the identified threats how would you rank the threats? [00:34:56] And I guess what I've heard here

is kind of a consensus, maybe that's too strong a word, that there are a number of factors and it would be difficult to rank the threats.

DR. THORLEY: Can we get back to question 4, I thought we were on question 3.

JUDGE MASON: Oh, wait a minute, yes, I skipped one. Let's go back to question 4. Question 4, has entrainment.

DR. QUINN: Since we're done with question 5 now…

JUDGE MASON: Has entrainment of Delta Smelt at the state and federal export pumps had important effects on subsequent Delta Smelt abundance and why?

DR. DERISO: [00:35:41] Well we've shown the results that we've got from these simple models and what we've seen elsewhere on looking on, looking, at least using exports as a measure of entrainment that if you look at that, then certainly in the shorter time series from using sort of post-reduced abundance, say 1981 to current, there's no statistically significant effect of total exports on productivity. Brian did show that there was, if it was a factor among the factors in the larger model covering a longer time period, so I guess that means it's equivocal.

JUDGE MASON: Okay.

DR. THORLEY: [00:36:31] I would say possibly and maybe sporadically so if we're looking along the whole time series then no. In certain years it may not be important but from my reading of the literature and from the, I was surprised by the volumes of water percentages of total water in certain areas that was sucked into the pumps, it's possible that in some years if the large proportion of the population was in the vicinity, I wouldn't see why it wouldn't be unreasonable but it could have an important effect on the population, that was my take.

JUDGE MASON: Okay. Anyone else on that issue?

DR. KORNFIELD: [00:37:14] There was one mention I think, and I can't remember where it was in the federal document about the indirect effects and it wasn't, it wasn't a quantified statement, nor was it qualified really. It effectively said that there, it was arguing that there must be significant indirect effects that are occurring because of pumping that may affect factors that may eventually affect abundance. But in no manner was it discussed in a logical complete way.

JUDGE MASON: It was just a statement that there must be…

DR. KORNFIELD: There must be.

JUDGE MASON: Just an assertion that there must be. There may be some of these subsidiary issues that need some pairing out, maybe not. But are estimates of entrainment or concerns about its effect based upon best available data inadequate for drawing conclusions about the importance of entrainment to subsequent abundance?

DR. DERISO: [00:38:21] No. I mean the problem that they have is that trying to measure entrainment as a mortality rate and what you need is a denominator so you need to have an estimate of the abundance of the population at the time of the entrainment. Or even if you were going to do an average what the average abundances are. The only thing they've got for the winter period is the Kodiak trawl and again that is extrapolated to estimate a total abundance by taking a water filter and then multiplying it by the volume of water in their habitat. [00:39:02] That device, from my understanding is it goes through the top two meters and whether the, that covers the habitat, I thought the habitat was larger, deeper than that, so I, you know, you have this whole problem with patchiness. It's all the problems we had discussed this morning on using those things even as a relative index but then especially problematic trying to carry those relative indices to absolutes. [00:39:34] And that's why when you, even when you look at things like the salvage,

so you're looking at the older animals okay, to where they can have some counts, looking at that relative to these population estimates, it's just basically speculative as to whether or not they, I mean they, at least they put the conference intervals, they'll show the conference intervals and they're huge. So I just don't think that the estimates are good enough to draw any conclusions.

JUDGE MASON: Okay. Anyone else on that issue?

DR. QUINN: [00:40:19] I'd just like to make a, a general comment about this whole issue. I wonder if it has to do with the responsibility of the people who conduct the biological opinion, that I think there is a lot of pressure put on them to make statements that can be used for the development of remedial actions later on. And I found that characteristic along with so many other biological opinions that I've read of this one in particular where a mechanism is brought forward and then that mechanism becomes not a null hypothesis to be tested but a baseline statement of what must be. [00:41:18] And because of that I think that biological opinions really irritate us scientists because we, we see journal articles and other things like that that go through a scientific peer review. But in a biological opinion, the agency is almost being forced to come up with a set of reasonable alternative actions if it doesn't find jeopardy. I think

that, I have a certain sympathy for those who would ever have to do this kind of thing because it's kind of like being put between a rock and a hard place where you're supposed to establish statements of fact that can then lead to a reasonable and prudent alternative. And you have to say what you believe at the time of action, you just throw up your hands and say well, we don't know anything, then probably it'll go to, someplace where somebody's going to sue over and then they have to, they're right back where they are before because they didn't consider enough things. [00:42:31]

JUDGE MASON: Okay. Anyone else? Let me go to the next subsidiary point. Are there conditions under which curtailment of export pumping would be appropriate to prevent adverse effects on subsequent abundance? And I asked that because it was one of the questions that we had put before you, although I don't know that we've had any discussions that would be sufficient to base an opinion about that but maybe we have. Joe?

DR. THORLEY: [00:43:04] I think if a large proportion of the population was in the vicinity of the pumps, I guess, quite straightforward in a sense. Question is how you define vicinity and exactly what proportion is sucked out, but if they're a long way away in terms of entrainment you're not going to be entraining them (inaudible) close you are, it's a matter of degrees.

JUDGE MASON: Okay.

DR. DERISO: [00:43:29] I think it also depends on the state of the population. Most of the work that I'm familiar with on entrainment impingement has been primarily on the Hudson River and on the Delaware as well, and that has to do with the water removed from the river, through a once through a nuclear power cooling systems. [00:43:57] And this situation is somewhat similar to this with the water withdrawal and those systems are concerned about mortality to the anadromous fishes that occupy is not so much because none of those species are so low in abundance that we could think that the entrainment losses threatened the abundance of the year class. What we typically find, especially in more abundant populations and actually with Delta Smelt is that the relationship between the number of offspring and the number of eggs spawned, using spawners as an index, there's not much of a relationship typically when you get up to larger numbers of spawners. [00:44:52] And what that means is that other factors during the early life history of the animal affect the success or failure of the year class. So whether you would lose even a significant portion of the year class to entrainment may not have any impact on subsequent recruitment because it would be offset by this compensatory response of the population that have, even if it did reduce

it, then that would cause, the way, fisheries operate by having and populations are exploited on the basis of the underlying assumption that there is compensatory mortality or density dependent mortality. That with the density-dependent mortality you can remove individuals, increased productivity of the remaining survivors and then in that sense generate a surplus production. [00:45:51] It's much the same way with the entrainment, in that it can be thought of as a fishery and that by removing some of the individuals through entrainment the smaller population that is left afterwards is more productive and increases its productivity to compensate for that. So it's that kind of mechanism which at least at larger populations there is less of a concern. Certainly in very small populations where there are a few of them, that is such a hit and miss situation, you know. I don't know what to say to something like that. I don't have any good experience with situations of entrainment where you're dealing with really small populations.

JUDGE MASON: All right. And we can go on to number 5 which we've sort of dealt with but maybe it's time to, well we have to open number 5 but let me just make sure that everyone concurs with the notion that I, the proposition that I laid out earlier that I perceive that there was a consensus that could not be ranked based upon what I've heard. Okay. [00:47:10] Well,

then we're at a point where we could take a look ahead and, the question that we asked in terms of looking ahead is, what are potential avenues available for restoration and recovery in the short term and the long term, and how might we quantify the success or failure of such efforts?

DR. QUINN: One thing that I think is that rather than doing all the eggs in one basket type of approach where they just focus on the one factor that's involved, there needs to be a large coalition of individuals from across the spectrum that come together and bring in some ideas about how they might be able to reduce the effect of different things, like what things can be done to reduce ammonia, to bring contaminants out of the water, to assure the Smelt, the type of habitat and environment that they need. [00:48:20] Consequently I think that that's going to require a lot of in-season type management where different experiments are attempted to try to affect the change in the Delta Smelt population. This is widely known as adaptive management in fisheries management and I'm not sure that we've proceeded very far along the lines of adaptive management but I think that we're at least trying to move in that direction. So I think that, a lot of involvement by the stakeholders in coming up with alternatives that can be examined, to try it over a set

period of time so that those consequences can be evaluated, is what's needed. [00:49:11] The problem with the kind of day, or year in, year out type approach is where everything gets changed every single year is you never have a program in place long enough to ever evaluate it because by the time you look at the data from that, everything's all changed and you're dealing with a whole new system again. So having definitive experiments that are going on to look at various factors, is I think very necessary.

JUDGE MASON: Okay, anyone else?

DR. KORNFIELD: Life history with respect to a spawning site for these organisms is probably critical. What we want to know is not only where they are but the temporal dynamic of the things, are they stable? [00:50:12] And I'm confident it could be done, I think we're all confident it could be done, it's a question of putting in the effort and prioritizing them. The other thing that would be of interest that I think has been expressed by the modelers and is obvious, is trying to get an estimate of, a real estimate of how many organisms actually exist rather than these relative numbers that we're dealing with. The extrapolations that have to be made and they've been talked at at length, are so stupendous standing crop in the area of water that you're dealing with like some quasi-arbitrary multiplier

makes it difficult. [00:50:58] So in terms of what the, what the joint investigators could do putting that high on their priorities of things in addition to getting together and figuring out new avenues I think would be beneficial.

JUDGE MASON: Okay, Joe?

DR. THORLEY: I just want to add of course there's going to be limitations to those because you would like to remove the clam and would like to remove all the other invasive species and would like to reverse climate change, etc. [00:51:26] So I think at the same time it's important to recognize the limitations and when looking at these options to weigh the cost because, and to weigh the probability they actually will have an effect as well before spending large sums of money.

JUDGE MASON: Okay. Brian?

DR. DENNIS: I'll re-emphasize my call for increased partnership between science and management and the increased ability to adapt, and increased focus on the system, that it's the whole system, the invasives, the plankton, the Smelt themselves, and any predators and prey that they might be associated with. The various factors that could be causing changes in Smelt abundance are, could be many and diverse and to get a handle on

them we need to make sure our monitoring of all the variables is of high quality.

JUDGE MASON: Okay. All right, that's that. We've gone through our program basically. [00:52:58] We have, folks that may have questions and what we wanted to do was to have you write your questions down so that we can get them recorded because we don't have a microphone out there. So we have some cards to write your questions down so I can ask them and get them recorded. [Pause] All right, I have, admitted a gross oversight and to not introduce Dr. Rob Ramey who's been sitting up here with us and Dr. Ramey is really imminent geneticist among other things and uh, helped put this panel together and helped develop the materials and, helped develop the entire approach in the program. So Dr. Ramey , thank you, I appreciate that very much.

DR. Ramey: Thank you.

DR. DERISO: Getting credit for almost single handedly taking down the the net at the University of Alaska. [Laughter.]

JUDGE MASON: [00:54:41] Here's a question. It says please elaborate on how regression analysis works in this case and its strengths and weaknesses. I think in terms of population modeling.

DR. DENNIS: I'll give that a try… Regression analysis takes a variable you would want to predict, like height and writes it in terms of variables you would wish to use to predict, we would call those covariates or predictor variables such as weight, or nutritional status, and the regression uses the mathematical method of least squares to estimate the quantities in the prediction equation in order to have the equation to predict what you want to predict. And the data that we are dealing with here, they are time-series data and time-series data do not obey all of the assumptions of linear regression analysis, and indeed population time series have further difficulties associated with them that make them not obey the regression assumptions very well. The device of using the change in population size on a log scale, reduces mathematically the problem of calculating the estimates to a regression. However, you don't get anything else, you just get the estimates themselves. You do not get any statistical inferences about the estimates such as whether or not the predictor variables contribute significantly to the prediction or not. But you can use regression in a limited sense, that is the numerical technique of regression to fit these non-regression popualtion models provided you know exactly what regression can give you and what it can't. In the case that I demonstrated, the regression mathematical technique can give you the estimates of the parameters in the prediction equation and it can give you the ability to do that all possible regression equations technique where you find the best possible subset of the variables under consideration,. I just drew a picture, would you like to see it? **(END OF**

DVD #3, BEGINNING OF DVD #4) [Dr. Dennis projects the results of analysesto illustrate his points.] This is a graph of things through time, on the horizontal axis are years, for instance here is the year 2000, 1990, 1980, and so on, and the solid line is the data that is the logarithm of the midwinter trawl survey of the adults. And the circles are the one year predictions according to that model that I showed you. That is you take all the conditions of the previous year, put them into the regression equation and use that to predict next year's trawl survey. [00:00:58] The results that come out, are I know fairly interesting, predicted quite a crash there, predicted an increase there, increase, and so on, and here was the last year in the data and it predicts a little bit of an increase after that. I'd like to see if the more recent data actually has a value there. Anyway, these work okay for the time period span by the data.

JUDGE MASON: Joe, or Brian, do you have anything that compares this regression analysis prediction to the actual data?

DR. DENNIS: [00:01:59] Compares it to the, the actual data is the line here.

JUDGE MASON: Oh okay, I get it. This is more than just the…

DR. DENNIS: The solid line is the actual data.

JUDGE MASON: But this is the result of predictions?

DR. THORLEY: I would add as Brian pointed out when he did it was kind of exploring the key relationships and he fitted all combinations of variables. Wasn't there like 30 variables? So the number of models looked at was huge, it was like a thousand, so I would suggest a particular model is over-fitted so even though it's suggesting these ones may be important, it looks extremely good but in reality it's actually over fitted to the data slightly. So it's indicating what might be important but then what's needed is some longer runs of data to see how they actually stand up.

DR. DENNIS: How they actually predict. [00:02:47] This is fitted, fitted predictions rather than predicted predictions.

JUDGE MASON: Right, that's what I understand.

DR. DENNIS: But the AIC kind of hedges for over-predicting, over-fitting in that if you have too many variables in that and the prediction confidence level gets larger the AIC says that those variables aren't going to contribute very well, so it is penalized in that way.

DR. THORLEY: [00:03:16] Do I understand that having too many variables in your model but AIC in and of itself doesn't correct the fitting too many models the data.

DR. DENNIS: Right, right, that's right.

DR. THORLEY: Make that quite strong point, and in this case we should really be model averaging because I'm sure there were other competing models that were really close in support, and there could even be 10 to hundreds of them, and we should maybe be model averaging them and then looking at those fits of those averages across all the competing models and it would be, it would be less impressive.

DR. DENNIS: [00:03:45] There's a lot that you can do from here, yes.

DR. DERISO: So this regression, we done with this?

DR. DENNIS: Yes.

DR. DERISO: [00:03:58] Yeah, so in our field of stock assessment we seldom use regression analysis because techniques like this for example that do these one step ahead conditions, they're all conditioned on knowing what the current state is. Then you predict one in advance so there's no model. The model doesn't have to sort of defend the choice that it made one year just to get fresh out at it again next year. And so in some instances you'll even find when we try to do this with population models that the best prediction next year is this year, and it would look pretty good against the observed data because there's some auto-correlation there. [00:04:36] But instead, so what we end up doing in fitting is use dynamic

population models so the advantage of going away from a regression approach to the dynamic population model is that the fit to it and the factors that are involved with it have to work through the propagation of the model over time. [00:05:03] It's, if you've done something really bad in one time period, there's no forgiveness, the model is going to chug off into the wrong space and your simulated population will die or something like that if you really blew it. So there's none of this lack of feedback I guess is what you can call it with the regression analysis and particularly, concluding factors are important. There's no feedback there. So typically that's one of the reasons why, even in the simple models, just total populations state next year predicted from this year, we would tend to do a dynamic type model that would then say, then next year's got, they have to spawn from the year after that, they have to spawn from the year after that, you know, it's a continuum process like that. Then whatever factor that you would come up with in a model dealt with that way,, [00:06:00] you would test the importance of it by looking at how well this dynamic model fit the data given the factor that you had. And if the factor was important then presumably it would dynamically fit the data even better. So that's in a nutshell the difference between regression analysis and population stock assessment. It's quite different that way. [00:06:30] And in the stock assessment models in the dynamic,

you do have a random element to it, often the recruitment is treated often like it's just a random process so that you don't know what the recruitment is. But then again you've got all of these indices to measure, you got the 20 millimeter, you got the summer net trawl, you got the fall, all of those indices that have to tell you something about abundance, and it has to all be for the same year class right, it's all for this single year class. [00:07:01] So there is no two estimates of population abundance, there's only one and that one estimate on population abundance at a given point of time of course, that one estimate population abundance is an integrated estimate that reflects all of the data that's collected for the entire year, including length frequencies. We always use length frequency measurements in our stock assessments as well to try, especially to take into account this interaction between selectivity of a year and the size of the animal. [00:07:38] So I consider regression analysis, the advantage of it is it's simple. I was doing it on Excel spreadsheets here. I could take 30 factors and even Excel will give, it will only go up to 16 factors but it'll give you a multiple linear regression with 16 factors this fast, okay. So that's the advantage of it. The disadvantage is the results are misleading. [Laughter.]

JUDGE MASON: Anybody else want to weigh in on that? [00:08:04] Well someone mentioned earlier the overall pelagic decline and the question everyone wants to know, how does the Delta Smelt decline compare with that overall pelagic decline? Is it at the same scale, is it less or more, or how does the data, or does the data deficiency mask the comparison?

DR. QUINN: [00:08:37] We had, we had a very good paper on that, the IEP POD Investigation Review from 2005 where they essentially, what they're trying to do is they're trying to put together an integrated set of people from different agencies who all have interest in this decline of the ocean pelagics. And they're developing an integrated research program that is trying to deal with the whole ecosystem at the time rather than just saying okay, here's our Smelt studies, here's this study, here's that study. [00:09:22] And I was really taken with it in the way they were doing this because not only were they doing the correlated studies but they were also looking at process studies to look at actual mechanisms and doing field experiments that would help elucidate the kind of things that are going on. So that, Rob, I don't know if you could put up the reference for that figure.

JUDGE MASON: Anybody else want to weigh in on overall pelagic decline?

DR. THORLEY: [00:10:01] I think that more information in that data that could be compared with the Smelts across the species and the kinds of matters Rick was talking about, the kinds of processes and seeing how they fit to the alternative species and additional information in the data that hasn't been fully analyzed yet.

JUDGE MASON: Okay, that's the new panel report from 2005. Here's an interesting question. Captive propagation has proven useful for many long lived species that have been critically endangered. How might this approach work with the Smelt, which has a relatively short life history? Is it a viable option to aid the recovery of the Delta Smelt?

DR. KORNFIELD: [00:10:51] There's two efforts underway to keep nominal populations of Smelt propagating. The interesting thing is that these are very touchy animals and all the techniques necessary to propagate them in culture have been worked out, which is no small, no small feat for this group of fishes. The federal government is involved and has a hatchery that's propagating as a back up to the propagation that's going on at Davis under Bernie May. I mentioned before that the the beginning population was made of single pair crosses so the diversity is rather high. [00:11:40] My understanding is that those will act as genetic reservoirs for future eventualities and there is, as a guarantee against for example, slumpage

in the Delta or seismicity where the levees collapse and everything goes by the boards. But at the current time there is, there are no plans to use those populations for introduction to try and increase population size. In principle, it could be done. Iin practice, it probably will not be done. And it for sure will not be done until there's a better understanding of what factors are constraining the extent of the fishes that are already there.

JUDGE MASON: This question was asked, is there another endangered fish species along the Pacific coast that you have experience with that we can learn from as it relates to the decline of Delta Smelt? Is there some species out there that we might compare to the Delta Smelt that we can glean something from?

DR. DERISO: [00:12:54] The only analogy that, and it's not a fish like Delta Smelt and this is the spring Columbia River Chinook upper river fish. I was involved in quite a bit of analyses involving those populations and it concluded there were a number of factors that could affect Chinook. [00:13:26] What most of the individuals involved with it thought was that the main thing that could be done to improve it is to remove some of the dams. Now that's a very radical action, to me much like the radical action that is proposed perhaps here. There what they did instead is they found a whole set of alternative mitigating projects and so they went the route of

all of these other ways of mitigating as an alternative to removing the dams. In part not removing dams because there was not unanimity if that's the right word, it was not a complete consensus, okay. [00:14:17] I don't think the way adversarial science goes, if you want to call it science, that you'll ever reach unanimity or whatever the word is here either. So I might hold that out as one example and the way that they've gone with it of doing lots of smaller mitigating things. Can you mitigate, because all of these hypotheses there, none of it is really known, they don't really know that doing this action is going to make an improvement. It's thought that they might have a good chance. [00:14:54] They might not know that reducing the ammonia output is going to improve the situation, but it might. They don't know that, pertaining to the reductions in the contaminants at certain times will improve the situation, but it might. Perhaps a lot of those kinds of things which may work are less costly than sort of the big one.

JUDGE MASON: Anyone else have any ideas about comparable species? Okay. This question asks about the paper touched around peer review. Give us your impression of the depth, diversity, and unbiased nature of the peer review in the biological opinion process.

DR. DERISO: [00:15:44] The one peer review group that I guess was the official peer review of it, didn't include anyone like us on the panel. As far as I could tell there was no one there who really does fishery stock assessment for a living, that does fitting population models for a living. I may be wrong on that but I didn't recognize any of the names as people like that. There is some ecosystem modelers in there so they do modeling of populations that way but not the sort of down in the trenches, taking the data, fitting it to population models, you know, the kind of things that we routinely do. [00:16:28] So that's part of it. In fact I hadn't, until you assembled this group I don't think I've seen anywhere that had that kind of person looking into this stuff.

JUDGE MASON: Okay, anyone else? Okay, how do you determine with factors, stressors, that you seek to collect through data and are there other likely stressors that should be collected and analyzed that aren't currently being collected? How do you determine which factors you seek and are there any that are not being collected, with respect to Delta Smelt presumably?

DR. QUINN: [00:17:23] Even though I will probably be quoted for years for saying this, I don't think so. When you look at the hundreds of different factors that have been proposed as contributing here, I think this has received incredible scrutiny and I don't think that there's some magic bullet cause

out there that's going to be uncovered that's going to give the answer, oh, this explains 95% of the variability. I think that the decision on what additional variables and resources should be collected really depends on the chances of those studies leading to a conclusive result, the chance of that factor being an important factor, and just the overall cost and feasibility of doing anything that has the chance of being useful.

JUDGE MASON: Okay, anyone else? [00:18:32] Okay. Joe, go ahead?

DR. THORLEY: Just to name one specific, example which might be relatively straight forward would be looking at predation. The literature says that the Delta Smelt are not very common in the stomachs of species but when you look at them in the trawls, they're not very common in the trawls either. They're not that common for predation. Potentially it could be a big factor. And again by working in terms of absolute abundances and then looking at data samples of fish and looking at stomach contents to try to expand it into absolute numbers of fish eaten, that might be interesting.

JUDGE MASON: Okay, in fact, predation is not something that I, I have heard a lot about in connection with this issue. This one is specifically for Brian Dennis. What factors were most closely associated with the recent decline?

DR. DENNIS: [00:19:30] Most closely. I need to understand what, what exactly that means.

JUDGE MASON: Okay, does the questioner want to identify yourself? Okay.

MALE: If you, if you, one way to ask it, if you left some factors out, could you leave some factors out and still duplicate the recent decline?

JUDGE MASON: Could you leave some…

MALE: Or another way to put it, was the recent change in abundance from one year to another most sensitive to one or more of those factors?

JUDGE MASON: So was the recent decline most sensitive to one or more of those factors?

DR. DENNIS: [00:20:21] That, I, I don't know from the analysis done so far, that would be an interesting thing to explore, to quantify the influence on predicting the recent decline among the factors and then explore around and see which are most closely associated with that somehow. It probably could be done.

JUDGE MASON: And this question, I think I understand the answer that is likely to come out of it but it says: based on the data reviewed how comfortable would each of the panelists be in forwarding definitive conclusions for policy decisions and/or law?

DR. KORNFIELD: Definitive.

DR. DERISO: Love that word, don't you?

DR. QUINN: Very uncomfortable.

JUDGE MASON: I had a sense of that was going to be the answer. [00:21:21] Are there any other questions out there? Okay, one more coming. Anybody else? I catch on quickly, I knew that one was coming. Okay, what about the idea of simultaneously collecting Smelt water quality and prey density, analyzing Smelt condition and trying to link conditions to water quality, prey density, etc.

DR. DERISO: That'd make sense.

JUDGE MASON: Okay.

DR. QUINN: [00:22:10] An energetics type study done? Has there been any effort along those lines?

MALE: Some, yeah. There's been, but the efforts have been separate in those respects. Somebody's analyzing Smelt to see if they're food limited or show evidence of contaminants and then other people are collecting water quality data at a different time than when the Smelt were collected.

JUDGE MASON: And the answer, just so we can record it, the answer was that there have been separate efforts along these lines but nothing coordinated.

MALE: Right.

DR. THORLEY: [00:22:56] And it would have to be more in terms of historical data, the Smelt is at such low levels now, in one month of four midwater trawls recently they caught seven fish in all the trawls. So now you have a problem with such low levels to try and understand the mechanisms and relationships.

DR. KORNFIELD: [00:23:17] Actually it turns out if you look at the data, they caught nine, but they reported seven, and who knows.

DR. DERISO: One of the, I don't know how much of it is an issue to the Smelt I mean, digestive processing time for Smelt is probably a lot quicker than it is for tuna but certainly with tuna when we're looking at a single sample, unless it's a snapshot, whereas the stomach contents is an integrated quantity, integrated over the previous day perhaps of the tuna's life. So how far you would have to integrate back in time the water samples that the Smelt lived in in order to get really a representative estimate of what it's food was like in its stomach during that time period is a complication.

It is to say so, which is why nine fish isn't going to work. You need lots of snapshots.

JUDGE MASON: Okay, Joe?

DR. THORLEY: [00:24:15] Can I just make one point as well to do with, one of the biggest problems is dealing with uncertainty and how much analysis is done. Uncertainly is always going to remain, and when you're making a choice based on uncertainty you have to weigh a risk and then you have to weigh out the utility you place on certain functions. So how do you value the Delta Smelt as opposed to agriculture? And in some cases people are going to value Delta Smelt very highly and other people disagree and value agriculture must more highly. And to the extent that those biases creep into decision making they should be explict. So it should be, part of the analysis should be simply what is happening and what do we know is happening and what the effect size is and what, the predictions of alternative courses of actions. [00:25:01] And then given those predicted outcomes, given those costs, given those risks, then the values should come in. I think it's a danger, particularly from both camps if they're kind of creeping into the discussions about what should be done or not, and it should be made as explicit as possible what's happening there.

JUDGE MASON: Okay, Irv?

DR. KORNFIELD: [00:25:26] I just want to put another perspective on risk. Can you dim the lights for a second? [Dr. Kornfield projects a figure from a recent publication.] This is a snapshot from a San Francisco Estuary and Watershed Science publication, 2005, and what it's showing is the risk of inundation and collapse in the Delta, and it's significant. The calculated odds are roughly, two-thirds within, or two to three within 50 years or so. I mean so the San Francisco odds, but the calculated odds are you know, two and three within 50 years. There is apparently no active projects to increase what the levees are, to try and bring them up to code what the Corp of Engineers had wanted them to be, and even at that level was probably insufficient to prevent both the action of storms and the action of earthquakes. [00:26:30] So this is a problem, this is sort of an elephant-in-the-room problem that is affecting the entire, the entire area and the Smelt may or may not persist with, in the occurrence of this kind of event but will have dramatic implications obviously for the economy of the entire region. And I think that it might be prudent for the policymakers to put this a little bit higher in their agenda than it has been rather than throwing it aside.

JUDGE MASON: Okay, let's go, put our lights back on. Okay would you write your question so we can get it from you. In the meantime, is there anything

else anyone wants to add? Okay, we'll take this one last question and then we'll wrap up.

MALE: So Iive got to do my brackets tomorrow night for the basketball tournament, are you guys available? Help me predict things.

JUDGE MASON: It is that time, isn't it?

DR. QUINN: I just go to USA Today and take theirs. There is a journal of sports statistics, I wonder if they have any basketball papers. It's usually baseball that really attracts the statisticians but I imagine they've moved into basketball.

DR. DENNIS: There was an article in the New York Times Magazine just a few weeks ago about basketball statistics and how it's kind of a different beast from baseball statistics in that in baseball, getting lots of hits or lots of RBIs usually helps your team, but there are situations in basketball where doing more of something might actually be hurting your team's winning chances. That is, if you're a selfish basketball player and taking lots of bad shots but getting lots of points as a result, you may be destroying your team's chance to win. And so the current idea in basketball statistics is to try and identify those players, those totally unselfish

players who might be overlooked but who is contributing greatly to their team's chances of winning.

DR. QUINN: [00:29:36] Well, like Kobe Bryant. [Laughter.]

DR. DENNIS: (inaudible) in the absolute opposite direction.

DR. DERISO: So my anecdote, fitting time series of data with the models, one of the ways it's done, especially when you have a lot of observation error, there's a technique called common filters. Common filters try to estimate parameters, sort of assuming that you're dealing with a time series and you've got a lot of errors. The predictors for football scores. And so he was running these common filters through these teams and he ran them from one year to the next, that's from one game to the next, because you got the same players that tend to go along so he was fitting that like it was a time series thing to try to infer what are the predictors that he can use so he can handicap the scores. A sophisticated piece of analysis. Well, then you know, the one step filter of tomorrow is going to be like today is a pretty good predictor. You just gotta forget the past and just say tomorrow's gonna be like today man.

JUDGE MASON: That's a long question you have.

MALE: Yeah, I know. I was almost done.

FEMALE: Which means it should have more than one or two words for an answer.

MALE: Okay, no it starts on the other side at least.

JUDGE MASON: Okay.

FEMALE: Make sure you start the question the right way.

JUDGE MASON: Okay. Oh okay, I see. [00:31:20] Most if not all of the panelists raised significant questions about the population sampling. At the same time, me, I have been taking today's discussion, have begun today's discussion by noting that no one disputes the Smelt's decline. So what do the questions about the population sampling mean? The Smelt is threatened, the Smelt's threatened status itself is questionable or the question is important for some other reason?

DR. KORNFIELD: [00:31:57] Well, one of the basic problems is, in fact there has been a decline as indexed by the metrics that are available. One of the difficulties that's been pointed out is we don't know what the errors are associated with those estimates. Further, as emphasized, it's impossible at this point in time given the way that these things are measured to distinguish, effects, or to distinguish whether in fact there are fluctuations in population numbers, even substantial increases relative to what we can estimate now, were they to occur. That is the numbers are

so very low the sampling schemes are so constrained and the distributions may be so patchy that we simply can't tell. [00:32:42] So, I don't think that you can assert with certainty that there is a downward decline of these fish at the current time. The data are consistent with the idea that yes, they are decreasing in numbers but beyond that I think it's difficult to say.

JUDGE MASON: Joe?

DR. THORLEY: So yeah, adding to it in that graph that I put up where it showed the confidence intervals around some estimates which was derived using more advanced methods and again more work's needed in those abundance estimates. [00:33:10] But it shows what's extremely certain. We could be sure that it has definitely declined a lot so the year to year variation there's a lot of uncertainty in that but in the big overall picture in the big changes I think there's no doubt about those and it's a lot lower than it was.

DR. DERISO: [00:33:29] And the estimates themselves or getting the best estimates from the data are important for doing analyses if you want to try to test hypotheses about factors that affect survival of Smelt. And from the estimates that we've seen it's very difficult to address that, the various

hypotheses because of what is probably a lot more uncertainty in the estimates than we see by the variation in the annual estimates.

JUDGE MASON: Okay, anyone else?

DR. DERISO: And one thing, at least for just looking at broad questions like has the population really declined, just looking at the number of non-zero tows percentage of non-zero tows is, you know, it may be just as good as an index of abundance as what's being done now because of the problems with the current one.

DR. QUINN: [00:34:36] [Dr. Quinn projects the results of his analyses.] The top one is the townet abundance, then the July of juvenile abundance index, and then the previous fall midwater trawl abundance index. No matter how much error is in that data right there, those are low values and so I don't have any problem in believing that there's a population level response in the last three years. Where we're left so puzzled is, is this the end or is there just going to be some proper combination of factors, a perfect un-storm come in that can bring the population back in? Was it a perfect storm that led to those, those values dropping so dramatically low? I don't think that was anticipated very well even though maybe Brian's forecasting technique will show that it actually was something coming if those factors went a certain way.

JUDGE MASON: Okay, thank you. Well that really brings us to the conclusion of this particular panel. As I said this is an ongoing dialogue and it can be continued in other forums, in other places. This was designed to educate us about the science and I think they did an admiral job of raising some issues that we may not have thought sufficiently about and I appreciate that from all of you. [00:36:21] All of the materials that they considered are posted at www.bestscience.org if you want to see the materials that they considered and the various things that have been put up here, you can see them at that website. We will take a break of about 10 minutes and when we come back we'll have the legal panel discussing some legal issues related to the whole issue of science and the Endangered Species Act and so forth. But if you'll join me now in thanking these gentlemen, I'd appreciate that.

[Break - Science Panel has concluded, Legal Panel starts]

I'm joined today by Tom Getty who's to my far right and Brenda Davis who's to my immediate right. Tom is the principle at Bingham Consulting Group LLC and of council at Bingham McCutchen in San Francisco and

Sacramento. He was the previous executive director of the Conference of Western Attorneys General coordinating policy litigation and legislative initiatives of 18 western state Attorneys General focusing on water law, natural resources, federal Indian law, and environment and energy law. [00:38:03] And he has served as a special assistant and Deputy Attorney General in the California Attorney General's Office and I'm proud to say that he's one of my faculty colleagues at Pacific McGeorge teaching federal Indian law. So Professor Gede, welcome.

MR. GEDE: Thank you.

JUDGE MASON: And we're glad to have you. Brenda Washington Davis practices law in Sacramento and her experience includes the representation of numerous public and private clients before various state and federal agencies regarding rule making, compliance counseling, and negotiations in matters such as contracts for sale or transfer of water resources, affirmation of water rights, addressing threatened and endangered species, and the availability and use of ground water and land use in water resources litigation. [00:38:58] She was the chief negotiator, and drafted legislation for three key California and Nevada water resources initiatives: the coordinated operations agreement, the Suisun Barge preservation agreement, and the Pyramid Lake, Truckee/Carson River

Basin settlement. She has also negotiated changes for rate making methodologies for water and marketing and review of Colorado River State's water rights and flow augmentation issues, and many many other things. And she is one of the outstanding lights of Sacramento's legal community so we're glad to have you here too. [00:39:44] We want to talk a little bit about some legal issues that touch upon some of the issues that we have discussed today, and let me start off by saying that the Endangered Species Act requires that decisions under it be made using the best available scientific and commercial data. And that includes biological opinions, that includes listing, that includes most of the decisions made under the ESA have to be informed by the best available scientific and commercial data. And we need to have an understanding of those terms as we look toward the idea that at some point someone will make some policy or will take some regulatory action based upon the science. What is the best available science and how dowe make that determination under the ESA. [00:40:47] And the other aspect to this is something that's fairly new and not much understood. It's a law called the Information Quality Act and the interaction between the ESA and the IQA has not been explored very much at all. It needs to be because it may have an impact on what constitutes the best available scientific data and it may have an impact on how policymakers use the information

provided by scientists. And so we'll, I think we'll start off today talking about the IQA, the Information Quality Act and Tom Gede is the one that we turn to for that.

MR. GEDE: [00:41:32] Thank you very much and let me just start off with a general comment about law and science. The approaches to the two are really different, and the scientific method looks to finding data, evaluating it, testing hypotheses and the like. The law is constrained in many different ways in distinction to how science works. The law is an adversarial system here and is constrained by deadlines and timelines and decisions that come out of courts and judges and juries. In the criminal context the adversarial system makes some sense in which facts are tested and you can see that a verdict comes about and is enforced. In the civil context, it gets more difficult. And then, when you finally get to these questions whether they're economics or biology, when it's pushed into the legal system it becomes much more problematic [00:42:52] because the law's about process in which all these questions get gurgicated, I guess that's the root word of regurgitated through a process that has various temporal constraints and other constraints all being pushed to an ultimate decision right or wrong, which can then be tested on appeal. And then not until the exact same question comes up again will it be

tested. [00:43:24] So you have to live with the consequences of litigation. A lot of our public policy laws that have been enacted in the Congress and in state legislatures that deal with science-based questions often end up stuck in the courts through litigation. Almost all the laws, the IQA excepted and I'll discuss that, provide for the opportunity for challenges in court. [00:43:54] And so whatever the scientists have discussed here today and in the future about where the truth may lie on difficult, uncertain areas in the world of, the natural world and nature, somebody's going to litigate. Somebody has the right to go into court and challenge the public agencies that make decisions based on that science. Where Judge Manson has been squarely at the center of that kind of crux between public policy, the law, and science, and it's a difficult place to be and I think he carried it off with great distinction. [00:44:43] But it is difficult because we're trying to put a little bit of a round hole on a square peg or vice versa when we do that. All that said, it is nonetheless important probably in this context, and I don't think either Brenda or I are going to get into Smelt in particular, to discuss what some of the legal frameworks are and what the structure is when we face these scientific questions in the context of the legal constraints that have been imposed by our public policymakers. [00:45:24] Interestingly before the passage of the Information Quality Act or Data Quality Act that was passed by the

Congress the relevant agencies here already had in place various standards for the quality of information. We'll discuss that in a little bit more detail, but the Information Quality Act was a very short piece of legislative language dropped into an appropriations bill in 2000-2001. It became law and was barely noticed and really not well understood, and I'll tell you a little bit about it, including its origins. [00:46:15] Interestingly it didn't receive much attention when it went through the Congress as it was dropped into an appropriations bill but it really came out of a public health issue. The real impetus to the Information Quality Act related to environmental tobacco smoke, ETS, and risk assessment associated with tobacco. There was tobacco litigation going on all through the 1990s and a lot of discussion and litigation over the question of how to evaluate public health risks associated with everything from chemicals to tobacco. [00:47:02] The origins of the Information Quality Act actually go back to some of those disputes that were going on over how the EPA and the Department of Health and Human Services evaluated information scientifically and accurately and reliably and objectively when it came to coming to terms with how to regulate or follow up with regulation on tobacco and other public health matters. It first came to light when pressure by, and it came really out of the industry side of the world in the 1995 Paperwork Reduction Act. You've

all read regulations in which you have to ensure compliance with the Paperwork Reduction Act. [00:48:01] But the 1995 act also included a requirement that the OMB develop and oversee implementation of policies, principles, standards, and guidelines relating to information and to the federal agency dissemination of public information including statistical information. And the agencies were regularly required to solicit and consider public input on the agency's Information dissemination activities. Now there were those that saw that language as compelling the requirement that the public have an opportunity to comment on information that is disseminated by federal agencies, not merely comment on how federal agencies handle their information internally. It became a question of whether it was more external and it ended up that that interpretation of requiring public comment on information that is disseminated by federal agencies ended up in a House report on another appropriations bill. During the Clinton administration it got no traction for being inserted into actual language in a bill. [00:49:15] But with the change of administration, Joanne Emerson, a member of the House from Missouri, inserted language almost identical to the language that was in that earlier house report for the 1999 appropriations bill into the language of the 2001 appropriations bill and it passed. It is called the Information Quality Act and all it says is, and I'm only going to give you a

few words that are pertinent, is that the Office of Management and Budget is required by a date certain to issue guidelines that will provide "policy and procedural guidance for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies in fulfillment of the purposes" etc., etc. [00:50:17] That pretty much is all there was in the statute. There was criticism from the public health advocates that while it was limited in scope the OMB might go overboard in implementing it, And particularly those who were involved in tobacco classes and paper industries were concerned in particular that OMB might do that. OMB did in fact do that and issued a large and important set of regulations to the federal agencies providing a template or standard how agencies should go about implementing their own information quality acts or procedures within their agencies. [00:51:17] As it is summarized in the congressional report on this, the direction of OMB was to issue the government-wide regulations for the federal agencies. So that was OMB's purpose, to put together a set of regulations implementing the environmental, excuse me, the Information Quality Act, and then each agency would proceed accordingly and tailor it to their respective agencies. Establish a procedure for people to seek corrections of agency information. You may recall that was part,of an understanding of an

earlier amendment to the Paperwork Reduction Act and as a consequence now the OMB saw the Information Quality Act as mandating that opportunity for the public to seek corrections of agency information. [00:52:12] And to require periodic reports to the director of OMB of complaints regarding agency information. In fact Congress generally is now asking agencies to step forth and testify as to how they've implemented the Information Quality Act. The guidelines of the OMB issued in 2004 included a lot of definitions and sort of fundamental requirements to implement these procedures. Government information they defined as information that is created, collected, processed, disseminated, or disposed of by an agency, which sounds like a lot more than just disseminated by a federal agency. [00:52:59] Disseminated means agency initiated or the sponsored distribution of information to the public as opposed to another agency or in response to a Freedom of Information Act request. In further defining what is involved here, quality of information includes the objectivity, utility, and integrity of the information. And objectivity in the view of the OMB involves presentation and substance, whether information is presented in an accurate, clear, complete, and unbiased manner, and whether information is accurate, reliable, and unbiased. I think they built in a rebuttable presumption with respect to, for example, peer review. External peer review would be

viewed differently by the OMB than internal peer review so that data and analytic results that were subjected to formal, independent, external peer review generally are presumed to be acceptable, of acceptable objectivity. [00:54:11] Of course there's a rebuttable presumption in there that if it can be demonstrated that the external peer review failed to meet those standards that it would not be appropriately acceptable objectivity. There's a very interesting critique of the Information Quality Act by a group called the Center for Progressive Regulation, and they spent a lot of time, of course, fighting with a different center, the Center for Regulatory Effectiveness, and you'll see interest groups popping up on one side or the other of the Information Quality Act. [00:54:58] I think you'll find ultimately that the Information Quality Act is used by people on the industry side of things and people on the so-called public interest side as well. So whether it's the peer group or similar groups like that for the environment or public health, they're now using requests to correct information under the Information Quality Act just as much as industry. If you look at those that have been filed with federal agencies you'll find that municipalities are using the request to correct information under the IQA. The criticism that comes from the original public health advocates, Professor Tom McGheraty and Sydney Shapiro and those folks at CPR, or whatever it was, Progressive Regulation, claim that the Information

Quality Act wasn't needed and that it undercuts existing regulation through a couple of mechanisms. [00:56:07] First of all they argue that it was a solution and searchable problem but there was no proven need for it, that the underlying statutory authorities that most agencies already have, including for example the ESA, are sufficient to provide a guarantee of accurate quality in information dissemination and objectivity and unbiased information and the like. When you get down to it, most of the critics have their argument , that their argument really is not with the science itself but with the protective and precautionary use of science within the existing statutory framework. [00:56:58] You can see unlike the ESA this would have a more direct and immediate impact on the EPA and other agencies that are responsible for public health. And now I guess we're going to see it with green chemistry and the like. Really they… **(END OF DVD #4, BEGINNING OF DVD #5) …**mix a gradation between kinds of information including that which is substantially influential information as opposed to that that isn't. [00:00:11] That doesn't appear in those few short words you heard when we talked about what the statute itself said. But the OMB views it was in their mandate to come up with definitions to make gradations in the kinds of information to discuss what constituted dissemination and the like. I think that any court would probably uphold what the OMB has done. But

probably the most controversial thing that the OMB did is that, not withstanding various standards of information quality that exist in different federal agencies, [00:00:44] they adopted one in particular with respect to risk management that for those in the tobacco, plastics, and paper industries were concerned about was crucial. That is that the regulations required that the federal agencies adopt or adapt, they can either adopt in some cases but generally they would adapt the quality of principles applied by Congress to risk information used and disseminated pursuant to the Safe Drinking Water Act amendments of 1996. The Safe Drinking Water Act amendments of 1996 were very specific and required, and I'm just going to read you the two parts, there's two prongs to it. [00:01:32] Prong one is that the agency is required to use the best available, peer reviewed science and supporting studies conducted in accordance with sound and objective scientific practices. That's prong one. And prong two is data collected or accepted, excuse me, let me restate that. Data collected by accepted methods or best available methods, if the reliability of the method and the nature of the decision justifies the use of the data. So it's the best available peer reviewed science on the one side and data collected by accepted methods or best available methods on the other hand. [00:02:18] While that, as we discuss the Endangered Species Act, may or may not make a huge

difference because the Endangered Species Act already requires, let's see the language, what's our language, best, the word commercial's in there right?

MS. DAVIS: Best available scientific and commercial data.

MR. GEDE: Best available scientific and commercial data or information?

MS. DAVIS: Data.

MR. GEDE: Data. [00:02:46] Well for the non ESA context and in a lot of the EPA and health service areas for those federal agencies, this appeared to be the first time that they would be mandated to put a preeminence to quantitative quality data, science driven data, as opposed to qualitative information. And I think that the rest of the criticism that came to the OMB's original promulgation of their regulations to implement the Information Quality Act rest mostly on those areas where uncertainties are involved. Coming to a public public policy decision or regulation, [00:03:43] the OMB and their view, excuse me, use the Information Quality Act to advance an agenda as they put it, pushing agencies to perform quantitative risk assessment and not mere qualitative analysis. And then they say that this creates the unfortunate illusion that decision makers can make judgments on how to apply the precautionary principle

and other statutory mandates on the basis of factual, numerically based data. Well, in most cases I can't imagine too much argument with wanting to have public policy decisions and regulation based on precise, factual, numerically based data, [00:04:29] but there's an awful lot of federal decision making that can be driven by information that is based on various kinds of qualitative information and judgments. And so the critics claimed that the Information Quality Act butts heads right into the Clean Air Act, the Clean Water Act and other EPA authorizing statutes that permit the use of information that is less precise, more qualitative in nature and that may be uncertain because of the lack of availability of information on which to come up with a decision. I think that's pertinent here as I wrap this up at this point in the context of the Endangered Species Act as Professor Manson said. Now we have to see, will the Information Quality Act, with its standards, standards that are drawn from the Safe Drinking Water amendments, butt up against the Endangered Species Act requirement for best available scientific and commercial data, and whether the IQA will in fact trump the ESA with a higher standard or whether it displaces the same standard. [00:05:56] More important I think, and we can get into this in more detail, is not so much whether the two standards match but whether the IQA being later in time will trump some of the decisions of the DC Circuit Court of

Appeals in a number of cases that have allowed for moving ahead under the Endangered Species Act with less certain information, with less than precise information on habitat and listing decisions and biological opinions. That is pertinent today as we discuss uncertainties that we face when we're looking at an endangered species.

JUDGE MASON: [00:06:40] Well before we go to Brenda let me ask you this Tom. Suppose the ESA had no requirement for best available scientific data and instead the IQA was the only thing that existed. How would the IQA operate with respect to endangered species' decisions?

MR. GEDE: Well, pure unadulterated speculation on that, I would suspect that it would have the force of law and that the relevant agencies within interior at Fish and Wildlife and in Commerce would then have an obligation to follow this standard. As the OMB requires, using best available peer reviewed science and data collected by accepted and best available methods [00:07:36] would not be far from, I don't think the data driven requirement that exists in the consultation handbook that Interior Fish and Wildlife uses now.

JUDGE MASON: Okay, let's suppose that someone believed that the agency had not followed that IQA mandate and again, we're positing a world where there is no ESA requirement of best available science, or scientific data, just the

IQA. If someone believed that that had not been followed what would happen?

MR. GEDE: Good question. We need more lawyers in Washington, DC, to solve these things. There aren't enough lawyers. I suspect that there would be grounds for a challenge to any particular action by, say, the Fish and Wildlife Service, if it failed to follow the mandate that the OMB put down and the Fish and Wildlife ultimately had to issue themselves. [00:08:43] It would probably be cognizable within the structure of the Administrative Procedures Act as an act that is arbitrary and capricious and not rationally related to whatever requirement is there because the agency is moving ahead without following the procedures that are required by,at least by the OMB. That's my guess of what would happen, but I suspect it would go to court and it would get litigated like all good things.

JUDGE MASON: Okay, let's go to Brenda Washington Davis and talk about the ESA's mandate of best available scientific data. And then we'll get to the point of figuring out what the interaction between the ESA and the IQA would be and how in particular actions those two statutes might act in conjunction with each other. Brenda.

MS. DAVIS: Okay, thank you Craig, and thank you for that very erudite description of the origins of the Information Quality Act. [00:09:54] Essentially under the Endangered Species Act, I think everybody in this room is aware of Section 7 of the statute that pertains to federal agencies' requirement to consult with the Fish and Wildlife Service or the National Fishery Service on actions authorized, funded, or carried out by them, and in that consultation to produce a biological opinion that uses the best available scientific and commercial data. Usually shorten that to best available scientific data. And we're really sticklers about the distinction between data and what would be considered simply science or scientific information because there are qualitative differences between the kind of information that you would find acceptable if you're talking about data as opposed to simply talking about a broader,defined science. [00:11:00]

JUDGE MASON: What uh, what is that distinction?

MS. DAVIS: One of the distinctions iswhat leaders among scientists talk about as normative science as opposed to what we would call sound science. The issue is squarely on point in terms of what decision makers are called upon to do because I believe his definition of normative science is you have your scientific information but you're bringing interpretations to that information that include value judgments that may be unique to the

person who is applying the science or delivering the scientific information. This is opposed to simply the permissible requirement under the IQA which is that it be, you know, the numbers, give us the numbers, just the facts ma'am, not the… [00:12:03]

MR. GEDE: Quantitative.

MS. DAVIS: Yeah, the quantitative stuff, not the sort of social values we want to drive a certain policy so we skew the science to support the policy rather than just deliver the numbers and let the policymakers do their thing in terms of, okay, what have we decided about what needs to be done in the Delta or on the Columbia River or where else. But I don't need the scientists to tell me that. Just tell me what do the numbers show about populations, about flows, about other quantitative things that we need to know. [00:12:47] So that makes a difference and our interpretation of data is that quantitative information delivered to the decision maker. Information may include some value judgments but we think the reason the Endangered Species Act is very specific about best available data is because you want to have those numbers delivered, obviously. And I think Terry Quinn said it earlier, when you're delivering a biological opinion, that biological opinion is delivered by the decision makers but it's supposed to be driven by underlying data. [00:13:30] And what you

want to do when you're using the Information Quality Act to get at what that data should be that the decision maker is using, that data still should remain quantitative. But by the time you get to the biological opinion, whatever the decision maker is delivering in terms of what needs to be done, what's a reasonable and prudent alternative or whether there's jeopardy or not jeopardy, it's got to be based on the underlying data. And you should be able to look at that data and say, okay, we see why you've made that call. [00:14:07] Even in the face of uncertainty we should be able to see what the limitations were on the quantitative underlying data and be able to understand how you got to where you are telling us there's jeopardy or there's no jeopardy or that there are reasonable and prudent alternatives that make sense because they're going to be not only legally defensible but they're also going to be supported by data that show it will be effective or it's likely to be effective.

JUDGE MASON: Okay, let me ask you this. Both statutes use this term best available. What does that mean in your view?

MR. GEDE: Well there's a problem there already because the District Court, or excuse me, the DC Circuit Court of Appeals in the BIA versus Norton case determined that best available doesn't mean just best. [00:15:04] It doesn't mean absolute certainty when it comes to best available. It could

well be best possible and, let me find the language, the service must utilize the best scientific data available, not the best scientific data possible. And so the IQA doesn't really address that. But the DC Circuit Court of Appeals has repeatedly reflected on this question of uncertainty under the standard before the IQA came into effect and indicated that the notion that best scientific and commercial data available is not a standard of absolute certainty is a fact that reflects Congress' intent that the Fish and Wildlife Service take conservation measures, let's see, read this correctly, is not a standard of absolute certainty but reflects Congress' intent that the service take conservation measures before a species is conclusively headed for extinction. If the service does not base it's listing on speculation on, excuse me, on speculation or surmise or disregard superior data the fact that the studies on which it does rely are imperfect does not undermine the authority as the best scientific data available. [00:16:29] In other words the courts had been, before the IQA, the courts leaned towards protection of the species as the mandate of the law. And so if there's uncertainty even under the best available commercial scientific and commercial data standard, that all doubts are to be resolved in favor of the species. The IQA doesn't speak in those terms. So now the IQA comes along and it's the language that Congress has provided and the OMB has interpreted and developed and required

the agencies to follow that doesn't say best available data possible or whatever is available. [00:17:19] It says best available science and it doesn't have any qualifications or any deference whatsoever really to any underlying federal statutory requirement, whether it's in the EPA or whether it's in the Interior Department. And so I think that there is a possibility that it will run head long into the existing way that the service treats what is best available.

MS. DAVIS And I think you really hit the nail on the head when you said deference because I think that's where the IQA interacts with the ESA to make a substantive difference in how you treat best available science because now you're saying, whereas with the DC Circuit line of cases, the fishery agencies could sort of get a free pass as long as the challenger couldn't demonstrate that they had superior data that was ignored, they could go forward with things that were less reliable, no I wouldn't say speculation, but they were more uncertain.

JUDGE MASON: Let me ask a…

MR. GEDE: Can I?

JUDGE MASON: Yeah.

MR. GEDE: You finish, let me follow it up.

MS. DAVIS: [00:18:37] But with the IQA what it's saying is these things are so important, and it comes back to the issue of influential or highly influential, they are so important that you can't just leave it at that. You have to, you're now obligated to take additional steps to ensure where you can that you are using superior data. Whether you like that data or not, if it's not there you're not obligated to go out and create it, but if it's available to you, you must use it.

MR. GEDE: [00:19:06] And the IQA provides two additional mechanisms that I think are important. One is an incentive for the agencies to make sure they're doing their job on getting the best available scientific data. But secondly, it has a mechanism that allows for a correction of information so that when the public or anybody sees information that is disseminated by the federal agency in the process that is off base or even if it is in an area of uncertainty, look what we went through today, this morning, and looking at all those various uncertainties if an agency just picks out this part or just picks out that part or glosses over all these parts [00:19:51] the mechanism that allows for correction of information puts it squarely back to the agency. Wait a minute, you forgot about this, wait a minute, this is out of context.

JUDGE MASON: Let me ask a practical question. How does either a scientist or a decision maker or even a member of the public know what is the best available science?

MS. DAVIS: Well that's the million dollar question.

MR. GEDE: We're lawyers, we'll go to court and argue it for you.

MS. DAVIS: [00:20:28] Well as a practical matter, just speaking from my experience, what we find is you, pretty much have to sit down and do the hard work of literature review. You have to look at who's working in various fields, sort of like the panel that was assembled today. You have to find out what is the area of expertise and then what do those disciplines say about what you should or should not be doing here and have you done it. It comes down to that simple question. Did you get it done as it should have been done in this arena and if you didn't get it done then you can't claim that that's the best stuff. And so let's go out and see, first of all, in literature review, if somebody else did it and second, if it hasn't been done, you have to make a statement about that. [00:21:23] Now obviously you'll get a response from the agencies that we're not obligated by law to go out and make it up if it hasn't been done. But I think for the Information Quality Act, from one thing the peer review bulletin that was published in 2004, which requires that a certain rigorous

analysis, whether that's internal or external, and as Tom said, it favors external review for the objectivity and the integrity and the other factors that are required by the IQA. [00:22:02] There's real pressure on the agency to submit whatever data or science it has developed to that process and in that process it should be identifying those people and those works. And to the extent that it says you need to do X, Y, and Z, while you may have a time driven biological opinion whether it's a court deadline or a project that just needs to move forward that prevents you from getting it done by that deadline. [00:22:33] I would argue that under the IQA now you have an obligation to continue that inquiry, bring in those people and bring in that science. You can't just leave it and say well, it's uncertain and this is all we have right now so we're going to rest on our laws and do that. The other thing, and it's a longer timeline, but under the Endangered Species Act you have mandatory five year status reviews and if nothing else I would argue that if the agency hasn't gotten it done by the time the project has to go forward and you know, there's nothing happening, you have a mechanism to force the agency to at least do it within that five year deadline.

MR. GEDE: [00:23:18] Yeah, I think there are like three words that are not in the IQA that are part of what it pushes though: openness, transparency, and

accountability. And so external peer review and the peer review standards play a key role in that I think because these are things that have to be openly discussed and shared just like we were doing today. Where there's disagreement that can be countered, discussed, and corrected in a dialogue, the IQA mandates that. [00:24:01] And so I think you're right Brenda that, like the Florida panther case, when the service had the opportunity to reevaluate data in a very open, transparent, and accountable way, the service moved in a different direction because new information came along. Much like a five year review, the IQA actually calls for correction on an ongoing basis if that's what it requires as open and transparent scientific review is occurring.

MS. DAVIS: And as you know Craig, you also have the pressure under Section 7 where, if there's changed circumstances for example, or there is some new information, you can force a reinitiation of consultation and get the service's attention that way to say you know, it's got to be the best available data and this isn't it yet.

MR. GEDE: [00:25:00] What is different though is that the IQA has no provision allowing somebody to go to court to challenge it.

MS. DAVIS: Right, there's no official review.

MR. GEDE: There are procedures, it is a commentator to the agency relationship, and there's an opportunity to appeal within the agency, unlike the built-in procedures in so many statutes from the EPA to other agencies that allow a suit to challenge the procedures that are being followed by the federal agency. [00:25:36] And so an IQA challenge is not so much. It's a request for correction of information, it's not a challenge to the decision making. Now it may have the effect of challenging the decision making because of the information that the decision making is based on. But it doesn't, it's not a self-executing statute that offers the opportunity to go to court and litigate the matter like ESA.

JUDGE MASON: Right.

MS. DAVIS: Right. But when you have a final agency action such as a biological opinion and that biological opinion does not employ the best available science, scientific data, then you would proceed to challenge it under the same standards that you would challenge that biological opinion which would be to pursue it under the Administrative Procedure Act. [00:26:31]

JUDGE MASON: Okay let's see if there are questions out there, and ask you to write your questions down again and we'll take a few questions and then we'll summarize what's been said. I should note that you mentioned the Administrative Procedures Act a couple of times and the Administrative

Procedures Act requires that agencies act in a manner that's not arbitrary or capricious, as you pointed out. And the Supreme Court in a number of cases, but particularly in a case called Chevron Inc. USA versus Natural Resources Defense Council, the Supreme Court by Justice Stephens said that an agency acts arbitrarily or capriciously if it fails to consider the standards that Congress required it to consider or if it considers matters that Congress did not intend for it to consider in terms of making a decision. [00:27:35] Then it's a decision that would be arbitrary and capricious. The court has the ability to enjoin such a decision and to return it to the agency for the agency to make a new decision. Now the thing that the court cannot do is the court cannot substitute its judgment for that of the agency. The court cannot say you must take this action. The court can only return it to the agency with instructions to re-examine its opinion in light of the court's opinion that it failed to consider these factors or considered these other factors which it should not have considered. Here's a question. [00:28:22] Are not the guidelines issued under IQA just that, guidelines rather than requirements?

MR. GEDE: They have the force of law.

MS. DAVIS: Yes.

MR. GEDE: Under our scheme of federal law, a federal guideline may be termed a guideline but the OMB issued it as a regulation. They issued a preliminary regulation that allowed agencies and people to comment on it and then they finally issued in 2004 a final regulation. That final regulation has the force of law even if it's called guidelines. It's something like the consultation handbook. It's more of a true guideline and sometimes these terms get used a little loosely. [00:29:08] But it has the force of law and an agency is required to provide those opportunities to the public to file a request to correct disseminated information and the agency's required to respond to it and make the correction or explain why it doesn't have to.

JUDGE MASON: Okay, here's a comment. It says regarding best available science, commenter says I believe the court can make that determination. Can you respond to that?

MS. DAVIS: [00:29:44] Well the courts have made that determination but you still have a circumstance where on any given administrative record, that's what was before the court at the time. And to the extent that you're trying to operate in a world that's not just sitting in a courtroom waiting for a judge to decide whether to grant deference to agency scientists or to referee a battle of scientists, you still have to live in the real world. And

in the real world you say okay, the case law provides for this but the IQA on an everyday basis in terms of what you need to be basing those decisions on, what needs to be in the record before the agency that's issuing your permit or whatever it is that you're getting as a result of the Section 7 consultation, that needs to be what you can operate to because your facts are unique to your circumstances and you need to be able to to get things done right now and not wait and say, well maybe, if, in Bennett versus Spear, American Wildlands, that had this record and these facts, they would have decided that the best available science was something else. [00:30:58] You need to operate in the real world and in the real world it is the Data Quality Act that can best inform those…

JUDGE MASON: But you would agree wouldn't you that in a particular case the court can say, based upon the record that's before it, that this was not the best available science.

MS. DAVIS: Yes, I would agree.

MR. GEDE: It's…

JUDGE MASON: Or conversely could say this is the best available science.

MS. DAVIS: That's it, right.

MR. GEDE: [00:31:24] Although a judge is trained in the law and not necessarily in science, present company excluded of course, but the judge has to take it on faith in part that the record accurately represents the information, the proper scientific methodology being used…

JUDGE MASON: Well as a former judge I'll say the judge doesn't have to take it on faith, that's what lawyers are for.

MR. GEDE: And the judge can hold the lawyer accountable. But what the IQA does do is offer an opportunity to get the record corrected if the agency has built up a record with respect to a particular decision based on factual data, quantitative data that may not be fully developed or accurate or it might well be misleading because it only looks at one side of something and not some other side or some other aspect or use that methodology that is suspect. [00:32:26] And so the IQA doesn't provide an opportunity to go to court but it does provide an opportunity to allow people to get the information more into the record, more into the sunshine. Then under an APA challenge, if it becomes clear that the agency has failed to consider information that it had, or relied on information in the record that doesn't necessarily lead to the proper conclusion, then the IQA has served an additional purpose of building the record.

JUDGE MASON: Okay.

MS. DAVIS: [00:33:04] And the other thing about the IQA just briefly is that even if you're not the permit applicant or the agency, if you are affected by the decision because either it's influential or highly influential and you can show that in fact it is, you can go in and ask for those corrections and you can help build a record that might not otherwise get built.

JUDGE MASON: So does the IQA change in essence the standing requirements under the ESA and other statutes?

MR. GEDE: I don't think so. I think because Congress thought that it was important that information that is disseminated to the public by federal agencies was so important that the public has the opportunity, and this is why I think they built it into the reg, [00:33:51] The public has the opportunity to comment and request corrections of that information if they think it's wrong. Now the agency's free to say no, you're off base, and they've dismissed a number of requests for correction as frivolous or, excuse me, typically the dismissed requests for correction of information under the IQA is, are to request correction to something that was submitted to the agency by somebody else, it wasn't the agency's information.

JUDGE MASON: Okay. [00:34:28] Here's a question from a questioner who asks does the IQA need to be amended to strengthen its potential application? Let me just say that based upon what you just said Tom, it seems to me the questioner says e.g. give it more teeth. But based upon what you just said the IQA is enforceable in a sense through the APA process. And so if for example someone made a request for correction under the IQA and the agency failed to make that correction or made a correction that was not accurate, then the person would have a cause of action under the APA to say that the agency acted arbitrarily or capriciously in failing to make the correction or making an inaccurate correction.

MR. GEDE: I don't know Judge. [00:35:28] I don't think that that's necessarily true. I think the standing requirements that currently exist under Babbitt and the other cases…

JUDGE MASON: Lumon.

MR. GEDE: Lumon, still require uh, that actual injury and…

MS. DAVIS: Concrete harm, you're still going to have the…

MR. GEDE: Harm to the individual who brings that claim under the APA, whereas the individual who requested a correction of information under the IQA may be just a member of the public at large. My Aunt Polly could do it, but my

Aunt Polly isn't going to be able to sue the Fish and Wildlife Service as a consequence.

MS. DAVIS: Right, unless she shows injury.

JUDGE MASON: All right. [00:36:11] But Congress could choose if they wanted to, to build in a private cause of action in the IQA, could they not?

MR. GEDE: Certainly.

JUDGE MASON: All right. I think we'll leave that where it is and thank our panel for participating in this today. Thank you very much Tom and Brenda and thank you for coming and that concludes our panel on Delta Smelt and the pumps and we ask you to watch the website, www.bestscience.org, which is where your documents will be posted and there may be news of follow up conferences and forums and so forth. So thank you very much.