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SCIENTIFIC ASSESSMENTS OF DECLINING PELAGIC FISH POPULATIONS IN THE CALIFORNIA BAY-DELTA

OVERSIGHT FIELD HEARING

BEFORE THE

COMMITTEE ON RESOURCES
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

Monday, February 27, 2006, in Stockton, California

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OVERSIGHT FIELD HEARING ON "SCIENTIFIC ASSESSMENTS OF DECLINING PELAGIC FISH POPULATIONS IN THE CALIFORNIA BAY-DELTA"

Monday, February 27, 2006
U.S. House of Representatives
Committee on Resources
Stockton, California

The Committee met, pursuant to call, at 8:00 a.m. at the Port of Stockton, Rough and Ready Island, 315 Fyffe Avenue, Stockton, California, Hon. Richard W. Pombo [Chairman of the Committee] presiding.

Present: Representatives Pombo, Radanovich, Miller, Napolitano and Cardoza.

STATEMENT OF THE HON. RICHARD W. POMBO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

The CHAIRMAN. The Committee on Resources will come to order.

Welcome to today's proceedings and I thank you for coming and being part of this very timely and important congressional hearing.

I would like to welcome everyone to the Port of Stockton and first I want to thank the Port Staff for all of their help in setting up the hearing.

I am pleased to see that so many of my colleagues from neighboring congressional districts and throughout California could make it this morning.

I would also like to thank some of my constituents from Stockton and Lodi, who presented the invocation, the Presentation of the Colors, the Pledge of Allegiance and singing of "God Bless America."

I'd like to welcome Fred Bentley, the chaplain of the American Legion, Karl Ross Post No. 60 in Stockton, who gave the invocation; the Lincoln High School Color Guard commanded by Lt. Commander Jasmine Mercer, who presented our Colors; and Dino Adame, the Post Commander of American Legion Karl Ross Post No. 16 who led the Pledge of Allegiance; also Brendan Kender, a 7th grader from Mokelumne River School in Lodi singing "God Bless America."

I thank all of our presenters and performers for coming today and your participation is truly important to me. As a token of my appreciation, I'll present an American flag which has been flown

over the U.S. Capitol to all of our presenters this morning. Thank you.

We gather here today in Stockton to focus on the Delta. As we all know, the Delta has a multi-purpose value to our State. It's not only the largest estuary on the West Coast and the home of hundreds of animal and plant species, but it's also a vital source of drinking and irrigation water for two-thirds of California. We depend on the Delta—but the future of the Delta also depends on us and our actions.

There are many issues surrounding the Delta. Last week, I surveyed the Delta with Senator Feinstein, our Governor and others to assess the need for levee improvements. It's clear: we are one earthquake or massive flood away from another Hurricane Katrina-like economic, environmental and social disaster. The time to act is now. Senator Feinstein and I are leaving no stone unturned to avoid a massive Delta levee failure and to have our governments be fully prepared if that ever happens.

The Delta may be facing its own environmental nightmare as we speak though—and that's what the topic of today is. Some Delta fish species are at an all-time low but no one can responsibly say why. The easy way out is to finger-point to some policy or infrastructure hated by some groups. Throwing money at the cause-of-the-month will not get us anywhere either.

As public servants, we owe it to everyone to ask the hard questions. We owe it to the American public to find scientific facts and not to invent fiction that has political appeal. Science, not politics, must be the basis of our environmental policies and responses.

Today's hearing is about finding the scientific answers to why our Delta fish species are declining. We have some of the best and brightest biologists here who are tackling the issue before us. They are the ones with the on-the-ground credentials who will tell us what they've learned, continue to learn and where they're going. I'm especially glad to have worked cooperatively with my colleague, George Miller, on this witness list. The panel before us today represents our mutual belief that the need for science is truly bipartisan.

We may not get all the answers today, but it will be a major step on the long road to resolution. In this year alone, this hearing will be the first of many to focus on the Delta's and California's many water problems. I look forward to working with my colleagues on this endeavor and thank the witnesses for being here today.

I now would like to recognize Mr. Miller for his opening statement.

[The prepared statement of Chairman Pombo follows:]

Statement of The Honorable Richard Pombo, Chairman, Committee on Resources

Welcome to today's important hearing.

We gather here today in Stockton to focus on the Delta. As we all know, the Delta has a multi-purpose value to our State. It's not only the largest estuary on the West Coast and the home of hundreds of animal and plant species, but it's also a vital source of drinking and irrigation water for two-thirds of California. We depend on the Delta—but the future of the Delta also depends on us and our actions.

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Hurricane Katrina-like economic, environmental and social catastrophe. The time to act is now. Senator Feinstein and I are leaving no stone unturned to avoid a massive Delta levee failure and to have our governments be fully prepared if that happens.

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STATEMENT OF THE HON. GEORGE MILLER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. MILLER. Thank you, Mr. Chairman, and thank you for convening this hearing and to those presenters, thank you for your time to appear before us.

When I requested this hearing on this topic last year, the population of the Delta smelt—a tiny fish that was once abundant here in the Bay-Delta—was at an all-time low after declining for many years.

In the months since my request, the smelt population has continued to decline, and they are now apparently on track for the brink of extinction.

As today's witnesses know, the smelt is a leading indicator of the Delta's overall health. When this fish is in trouble, it means the whole estuary is in trouble. And when we simultaneously see declines in the longfin smelt, the threadfin shad, and the young striped bass, we should act as if the future of the State depends on it, because as many of those in the audience know, the future of the State does depend on the Delta.

More than 20 million citizens of California drink water from the Delta, from Contra Costa County to San Joaquin to Los Angeles. With increasingly poor water quality in the Delta, it is increasingly difficult, and expensive, for these communities to meet water quality standards.

The State's commercial and sport fishing industries depend upon the Delta, as to hundreds of thousands of recreational fishermen. Between the Delta ecosystem crash and the ongoing threats to California's salmon and steelhead populations, our State's fisheries are in serious trouble, as are the businesses that count on them for their activities.

Local farmers, not just the major irrigators further south, draw their water from the Delta, and Delta farmlands are harmed by poor water quality. The policy of the last 15 years, since the Central Valley Improvement Act and CALFED, has been to place the

health of the Bay-Delta on equal footing with agricultural diversions. One of the questions today is whether or not that is, in fact, being carried out in reality. But if the Delta is in a tailspin, we need to determine if we can continue to increase diversions.

A failing Bay-Delta estuary is not just an environmental problem. The Delta is the heart of California's river systems, its fisheries and when the Delta's vital signs are plummeting, it is a statewide crisis and we need to act accordingly.

After a year of silence, this is the first time Congress has looked into what is currently happening in the Delta. But this should only be the first of several steps. In addition to talking to Federal and state agency scientists, we have a responsibility to discuss and implement policy. In addition to learning what has been done, we need to determine what should be done to protect the health of the Delta.

For the benefit of all Californians who depend on the health of the Delta, we have a responsibility to find out what is killing the Bay-Delta and its fish, and we have an obligation to design appropriate solutions. And I look forward to hearing from our witnesses.

The CHAIRMAN. Thank you. Now I'd like to recognize the Chairman of the Water and Power Subcommittee, Mr. Radanovich, for his opening statement.

STATEMENT OF THE HON. GEORGE P. RADANOVICH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. RADANOVICH. Thank you, Mr. Chairman. I appreciate the fact that you're holding this hearing to investigate the health of the Bay-Delta and I will submit my statement for the record in the interest of moving the hearing forward. I do appreciate the fact that you're holding this hearing. Thank you.

The CHAIRMAN. I'd like to recognize Congresswoman Napolitano for her opening statement.

STATEMENT OF THE HON. GRACE F. NAPOLITANO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. NAPOLITANO. Thank you, Mr. Chairman. And thank you for hosting the hearing in this District. It's always a pleasure to come back and overview some of the work that is being done and as we debate the water problems here in California and that's really pretty much what we do is debate it. We always come back to the Delta. We all take from the Delta. We enjoy its beauty. We profit from it. We grow from its abundant water and we think we know it very well. And we do take it for granted.

We always seem to be puzzled when things go wrong. Studies of planning and promises to protect the Delta have been going on for decades. And that's one of my major issues is where have all those studies been in the last several decades and especially as CALFED was supposed to be the answer to a lot of these problems and the money that was put into it for this research and being able to answer some of these questions. The State Water Board, the DWR, the Bureau of Reclamation, Fish and Game, Fish and Wildlife,

everybody studies the Delta. And after all this time being under the microscope, you'd think we would know more than we do.

I hope our witnesses this morning will tell us that the Delta is still keeping its secrets well hidden and how we are going to be able to find what is actually ailing it and be able to put our heads together and do the win-win instead of the finger-pointing and being able to work together to get this work continued.

We thank the witnesses for taking their time to appear before the Committee and for their continued work for all of California, especially Southern California. And I must point out, I think I'm the only one here from Southern California. So take your barbs and take your shots at me, if you will. It's been going on before. I must remind you that a third of the population in L.A. County alone, so we do benefit from everything that you do up here and we certainly want to work with those that want to continue to keep the health of the Delta and the whole water delivery system.

Thank you, Mr. Chair.

The CHAIRMAN. Thank you, and I guess in response to your statement, whether or not you're the only one from Southern California, I think depends on your perspective. Many people in the room consider Mr. Radanovich and Mr. Cardoza from Southern California, too.

I'd like to recognize Congressman Cardoza for his opening statement at this time.

Mr. CARDOZA. Mr. Chairman, after that last insult, I'm not sure I'm willing to talk.

Ms. NAPOLITANO. Insult, wait a minute.

The CHAIRMAN. Actually, Congressman Cardoza shares San Joaquin County with me, so he goes all the way from here all the way to Southern California.

STATEMENT OF THE HON. DENNIS A. CARDOZA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. CARDOZA. The folks in Fresno are going to have to start lobbying the Chairman on that.

Mr. Chairman, Members, I want to thank you for calling this hearing today to receive scientific assessments from some of the key, state and Federal agencies regarding an issue that is troubling and compounding to us all.

What is causing the decline in the California smelt and other fish populations is truly perplexing to me. Many have ideas about the cause and then quickly point a finger to an alleged culprit, the pumps. It's the pumps. It's the toxins. It's non-native species. It's the power plants. It's a decline in the food upon which these populations feed. Is it all those things put together?

The state and Federal governments and the water agencies have spent valuable dollars and precious water and time implementing solutions that have yet to address the problem and result in healthy fish populations. Yet after years of restricted operations of Delta pumps and plentiful water supplies, instead of seeing improvements, the situation appears to be worse than before the so-called fixes were imposed. What we have to show for our efforts

is a continued restricted water supply, economic impacts and all-time low populations of Delta fish.

These findings have confounded many and have caused the experts to rethink some of their original theories. Looking back, if we have one lesson to learn is that we cannot allow notions or some popular belief to dictate our actions. Shutting down the pumps has wasted money, water and time. Any action that we take now or in the future to address these issues needs to be based upon well-founded science. We need to bring in the best scientists, many of them are here today, who really know and understand the Delta, to gather the data and conduct modeling and to ask the tough questions and answer those questions.

Hopefully, we will have the benefit of some additional data and modeling despite having implemented solutions that haven't worked. I applaud the Chairman and Congressman Miller for working cooperatively and putting together today's hearing and for focusing today's hearing on science and not rhetoric. These are complex issues and I realize that we will not get all the answers today, but I look forward to hearing from our witnesses and hope to gain a better understanding of the science and of what additional information we may need in order to get on a course that has a sound, scientific footing.

Thank you all for being here and sharing with us.

The CHAIRMAN. Thank you. I'd like to introduce our panel of witnesses for today and then administer the oath.

We have Mr. Chuck Armor, Operations Manager, Central Valley Bay-Delta Branch, California Department of Fish and Game; Mr. Randall Baxter, Senior Biologist Supervisor, Long-Term Monitoring, Central Valley Bay-Delta Branch, California Department of Fish and Game; Mr. Matt Nobriga, Environmental Scientist, Aquatic Ecology Section, California Department of Water Resources; Mr. Rich Breuer, Environmental Program Manager, Chief, Environmental Water Quality and Estuarine Studies, California Department of Water Resources; Dr. Ted Sommer, Environmental Scientist Supervisor, Chief Aquatic Ecology Section, California Department of Water Resources; and Mr. David Harlow, Assistant Field Supervisor, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service. Mr. Harlow is also accompanied by Dr. Mike Chotkowski, Fisheries Biologist, Scientific Support Branch, Mid-Pacific Region, U.S. Bureau of Reclamation.

If I could have you all stand and raise your right hand.

Do you solemnly swear or affirm under the penalty of perjury that the statements made and the responses given will the whole truth and nothing but the truth, so help you God?

[The witnesses were sworn.]

Thank you, let the record show they all answered in the affirmative. I'd now like to recognize Mr. Armor to testify and just for the good of the witnesses, the timing lights that are on the table in front of you, what we normally do under the Committee process is your oral testimony is limited to five minutes. Your entire written testimony will be included in the record, but it helps to move the hearing along and so if you could try to abide by the five-minute rule in terms of your oral testimony. The yellow light will come on

when you have a minute left, so that will be an idea as to how much time you have.

So I recognize Mr. Armor first for his testimony.

STATEMENT OF CHUCK ARMOR, OPERATIONS MANAGER, CENTRAL VALLEY BAY-DELTA BRANCH, CALIFORNIA DEPARTMENT OF FISH AND GAME

Mr. ARMOR. Good morning, Mr. Chairman and Committee Members. I would like to thank you for the opportunity to present the collaborative work we've been doing on the decline of pelagic species in the San Francisco estuary.

In late December 2005, a small group of us were reviewing the data we had from our trawl surveys and we were very concerned about the numbers we were seeing for Delta smelt and young striped bass. And we asked the question is this problem just here or larger? We looked at a lot of the other long-term monitoring that IEP has been carrying out and then from that we concluded that not just two species, but four species of pelagic species numbers had shown severe declines and that this was limited mainly to the upper part of the estuary.

By pelagic species, we're talking about fish that live in the water column, not on the bottom or along the shore line. So they're occupying kind of similar niches out there. We then drafted a white paper that described this decline and we gave some possible causes that could be leading to it. We then went and briefed all of the directors of the IEP, individually or in small groups, and they instructed us to develop a work plan and a budget to address this issue.

We next formed a working group called the POD or Pelagic Organism Decline Management Team of which we're all members here. We set about developing this work plan and budget. The draft was presented to the directors on April 7th and it was also sent out to an independent peer review panel that was arranged for by the CALFED Science Program.

We got the results back from the peer review. We modified and made a number of changes to the work plan. It was approved by the directors on June 2nd. We then instituted work at almost break-neck speed during the summer and moved a lot of contracts in record time to get this done. In October, the members of the POD Management Group, along with a group of outside experts met to synthesize all the information we learned into a report. This is what's referred to as the 2005 Synthesis Report. At the end of October this report was again submitted to an independent peer review panel for review by the CALFED Science Program.

November 14th, we held a public workshop where we presented the results of our 2005 work. And this was held in Sacramento. We then developed the 2006-2007 work plan that included many of the peer-reviewer recommendations. We will be updating this work plan as we go along and we'll be including more, addressing more of the recommendations made by the Panel.

On January 12th, the IEP directors approved the work plan and budget, so we're in full implementation mode right now. I do want to note that this has been an unprecedented response by the IEP agencies, especially at the director level to this issue. There's been

a rapid movement from problem identification to reporting of results and this has included independent reviews, numerous meetings, briefings, press reports, etcetera and one public workshop and we'll have more public workshops as we go along to get the findings out.

In 2005, our basic approach was a triage model. We had a sick patient. We didn't know all the symptoms and we wanted to know more about what was going on before we started putting forth cures. We partitioned the possible causes into three broad groups to help us conceptually. Those are toxins, flows and exports and food web/exotic species. We developed a conceptual model to help guide our work and we took a slightly different approach than in the past, that this model was more of an ecosystem approach, rather than a species centric approach. You can't solve a problem for one species. You have to solve the problem for the ecosystem.

The budget was $1.7 million, shared equally between the state and Federal sources. Approximately $1 million of this went to new work by our academic collaborators.

One thing I can tell you that we learned in 2005 is there's no simple answers, smoking gun to this. Most likely, there will be multiple causes that may vary by species and life stage. This is a tough problem.

What we've learned is contained in the Synthesis Report that is available on the web. We developed a matrix model that tried to capture what we know and this is used to guide what work we'll do in the future. This combines stressors with time and location for each species. We also developed two narratives that you'll hear more about today and these is where we tie these very stressors to the observations. And also I want to tell you that there will be several more narratives coming along because they don't explain everything that we see going on out there yet.

So in 2006, where are we headed? We're going to expand our existing monitoring program. In fact, we already have. We've already got that started. We're going to continue a lot of our on-going work. We're going to institute 15 new elements and new work for this year and there will probably be more as we go through the year. This is an adaptive process. As we learn, we modify what we're doing and where we're going and so we're not locked into one pathway. As we learn, we move, we adjust.

The budget for this year, I'm over already, is $3.7 million, 50 percent state and Federal. Along with this is $2.3 million of CALFED grants that are for work that complements or adds to the POD efforts, so CALFED is stepping up also.

I want to leave you with two quick points at the end here. First, we're refining the process for moving from data to information to synthesis to recommendations. And that there's been a strong commitment to make data and findings available as they arise. We're not going to wait until the end of the year. As we learn stuff, it's going to come up and it's going to be made public.

Last, our data, reports and peer reviews are available on the internet. So with that I thank you for your time.

[The prepared statement of Mr. Armor follows:]

Statement of Chuck Armor, Operations Manager, Central Valley Bay-Delta Branch, California Department of Fish and Game

OVERVIEW OF PELAGIC ORGANISM DECLINE WORK

I. History

A. How problem was identified
B. Actions taken

II. Basic strategy in 2005

A. Triage model
B. Possible causes
C. Developed conceptual model
D. Gathered and reviewed information
E. All suspected causes were on the table for review
F. Broad overview of work done
G. No simple answer
H. Workplan is a living document and is updated as new information becomes available

III. What have we learned

A. Will be subject of next speakers
B. Developed a matrix model to combine stressors with time and location for each species
C. Developed narratives that tied various stressors to observations

IV. What is ahead 2006 +

A. Current and planned work
B. Budget
C. Process for data to information to synthesis to recommendations
D. Data, reports and peer reviews available on Internet
- Trawl data—www.delta.dfg.ca.gov
- Report—HTTP://Science.calwater.ca.gov/pdf/workshops-ftp://ftp.delta.dfg.ca.gov/ (2005 Synthesis Report and Appendix A)

The CHAIRMAN. Thank you. I now recognize Mr. Baxter for his testimony.

STATEMENT OF RANDALL BAXTER, SENIOR BIOLOGIST SUPERVISOR, LONG-TERM MONITORING, CENTRAL VALLEY BAY-DELTA BRANCH, CALIFORNIA DEPARTMENT OF FISH AND GAME

Mr. BAXTER. Good morning, Mr. Chairman, Committee Members. Thank you for having me.

My comments today will focus briefly on describing some of our abundance indices. I'll present 2005 abundance results and discuss some of the other measures of fish well-being that we collected in 2005 or developed in that period.

The Interagency Ecological Program, or IEP, uses relative abundance indices to monitor the status of young fishes and zooplankton in the San Francisco Estuary. These aren't estimates of absolute population size, but instead are relative measures, meant to be compared against one another to depict population trends and changes over time. To gather this information we use the same sampling gear or sampling techniques to collect the organisms at the same locations, month to month and across years, so the data collected can be compared.

IEP uses nets towed through the water column to capture the young fishes and zooplankton, providing information on their size and distribution as well as their abundance. Young fishes are targeted in their first year of life as indicators of that year's

reproductive success and as early predictors of eventual trends in the adult population size. Zooplankton species are important diet components of these young fishes and are targeted as a means to examine their role in the survival of young fish during their first year of life.

Long-term monitoring information from the fall midwater trawl is used primarily to monitor trends or has been used for quite some time.

The Mysid-Zooplankton Survey captures zooplankton monthly year-round. And the monthly indices are broken into spring, summer and fall groupings and these seasonal indices track trends in food resources available to pelagic fishes.

Our concern for pelagic fishes resulted from the observation that four species, all with slightly different life history traits, all exhibited low abundance in the 2002 to 2004 period. At the same time, several species of copepods were observed in low abundance. This latter observation on zooplankton was partly due to a calculation error which has since been corrected.

Our expectations for 2005 were for modest improvement in abundance for Delta smelt and striped bass based upon improved spring outflows. And we expected threadfin shad and the important copepods would do well in summer. We didn't expect winter spawning longfin to do particularly well, due to relatively low outflows in the winder and their abundance is well related to the magnitude of winter outflow.

In the 2005 Fall Midwater Trawl Survey indices were below expectations for striped bass and Delta smelt. Striped bass improved, but remained at very low indices. Delta smelt were at record lows. Longfin smelt were close to record low abundance and although threadfin shad increased modestly, their abundance remained low also.

The two copepod species, Eurytemora affinis and Pseudodiaptomus forbesi are important early foods and their contributions to these species, these fish species food resources were low in spring of 2005, but were very high by summer.

In 2005, we collected information on fish diet, fish condition and growth. We wanted to know what fishes were currently eating and how much, and whether the diet and ration might be related to their condition, that is, the relative fatness or skinniness of fish at a particular size.

Field collections for diet began in June, so only part of the year was sampled. Diets were determined for young striped bass, Delta smelt, threadfin shad and a species we used in comparison to the others, inland silverside which is still doing well in the estuary. Most individuals of all species had food in their stomach during the summer. Delta smelt were reliant on copepods for food, but ate a broad range of species. Striped bass were less reliant on these copepods and focused more heavily on mysids, shrimp and amphipods. Inland silversides, the species that's increasing in abundance, ate a broad variety of items including a more abundant recently introduced species called Limnoithona and terrestrial insects that were not found in high fractions in other species' diets.

Fishes caught during the summer were in good shape weightwise. The condition of the four target species in 2005 tended to be the same or "fatter" when compared to recent years 2001 to 2004.

Initial investigations of fish growth focused on whether changes occurred coincident to the fish declines, between 2001 and 2002. What we found was that striped bass and Delta smelt did not appear, their growth did not appear to decline after 2001.

That's the end of my testimony here. The last statement? That the growth rates of striped bass and did not appear to decline after 2001. So they're still growing well.

[The prepared statement of Mr. Baxter follows:]

Statement of Randall D. Baxter,
California Department of Fish and Game

1. My comments will focus on briefly describing some of our abundance indices. I'll present 2005 abundance results and discuss some of the other measures of fish well-being collected in 2005.
2. Interagency Ecological Program (IEP) uses relative abundance indices to monitor the status of young fishes and zooplankton in the San Francisco Estuary.

These are not estimates of absolute population size, but instead are relative measures, meant to be compared against one-another to depict population trends and changes over time.

To gather this information we use the same sampling gear and sampling techniques to collect organisms at the same locations month to month across years, the data collected can be compared across time to examine the patterns of change.

3. IEP uses nets towed through the water column to capture the young fishes and zooplankton, providing information on their size and distribution as well as abundance. Young fishes are targeted in their first year of life as indicators of that year's reproductive success and as early predictors of eventual trends in the adult populations. Zooplankton species are important diet components of young fishes and are targeted as a means to examine their role in the survival of young fishes.
4. Long-term monitoring fish information is from the Fall Midwater Trawl Survey collects fishes from September through December.
5. The Mysid—Zooplankton Survey captures zooplankton monthly year-round. The monthly information is combined into seasonal abundance indices for spring (March-May), summer (June-August) and fall (September-November), and these seasonal indices track trends in food resources available to pelagic fishes.
6. Our concern for pelagic fishes resulted from the observation that four fish species, all with slightly different life history traits, all exhibited low abundance 2002-2004. At the same time, several species of copepods, small zooplankton that form important components of the fishes' diets, were observed to be in low abundance also. This latter observation on zooplankton was in part due to a calculation error that has been corrected.
7. Our expectations for 2005 were for modest improvement in abundance for delta smelt and striped bass based upon improved spring river outflows and we expected that threadfin shad and the important copepods would do well in summer.

We didn't expect winter spawning longfin smelt to do particularly well, due to relatively low winter outflows (their abundance is well related to the magnitude of winter outflow).

8. Similarly, the 2005 Fall Midwater Trawl Survey species indices were also below expectations for striped bass and delta smelt (see Figure 1):
   - Striped bass improved but remained in very low abundance.
   - Delta smelt were at record low abundance.
   - Longfin smelt were close to record low abundance.
   - Threadfin shad increased modestly, but remained in low abundance.
9. Two copepod species, Eurytemora affinis and Pseudodiaptomus forbesi, are important early foods for all upper Estuary fishes.

The contributions of theses two species to fish food resources were low in spring 2005, but were very high by summer.

10. In 2005, we collected information on fish diet, condition and conducted growth analyses based upon changes in length. We wanted to know what fishes were

currently eating and how much, and whether diet and ration might relate to their condition (that is, their relative fatness or skinniness).

11. Field collections for diet and condition began in June, so only a part of a year was sampled. Diets were determined for young striped bass, delta smelt, threadfin shad and inland silverside.
    - Most individuals of all species had food in their stomach
    - Delta smelt were very reliant on copepods for food, but ate a broad variety of species.
    - Striped bass were less reliant on copepods and focused more heavily on larger "shrimp-like" mysids and amphipods.
    - Inland silversides, a species increasing in abundance, ate a broad variety of items including more Limnoithona than others and terrestrial insects not found in other diets.
    - The copepod Pseudodiaptomus was important to all.
12. Fishes caught during the summer were in good shape weight-wise. The condition of the four target fishes (delta smelt, striped bass, threadfin shad, inland silverside) in 2005 tended to be the same as or "fatter" when compared to data from recent years 2001-2004.

We did have some data from 2003 and 2004 indicating regional differences in striped bass condition. These will be discussed in conjunction with an upcoming presentation about 2006 hypotheses.

13. Initial investigations of fish growth focused on whether changes occurred coincident with fish declines; that is we compared growth rates from 2001 and prior year with those of 2002-2004.
    - Growth rate of striped bass and delta smelt did not appear to decline after 2001.

[Figure 1 follows:]

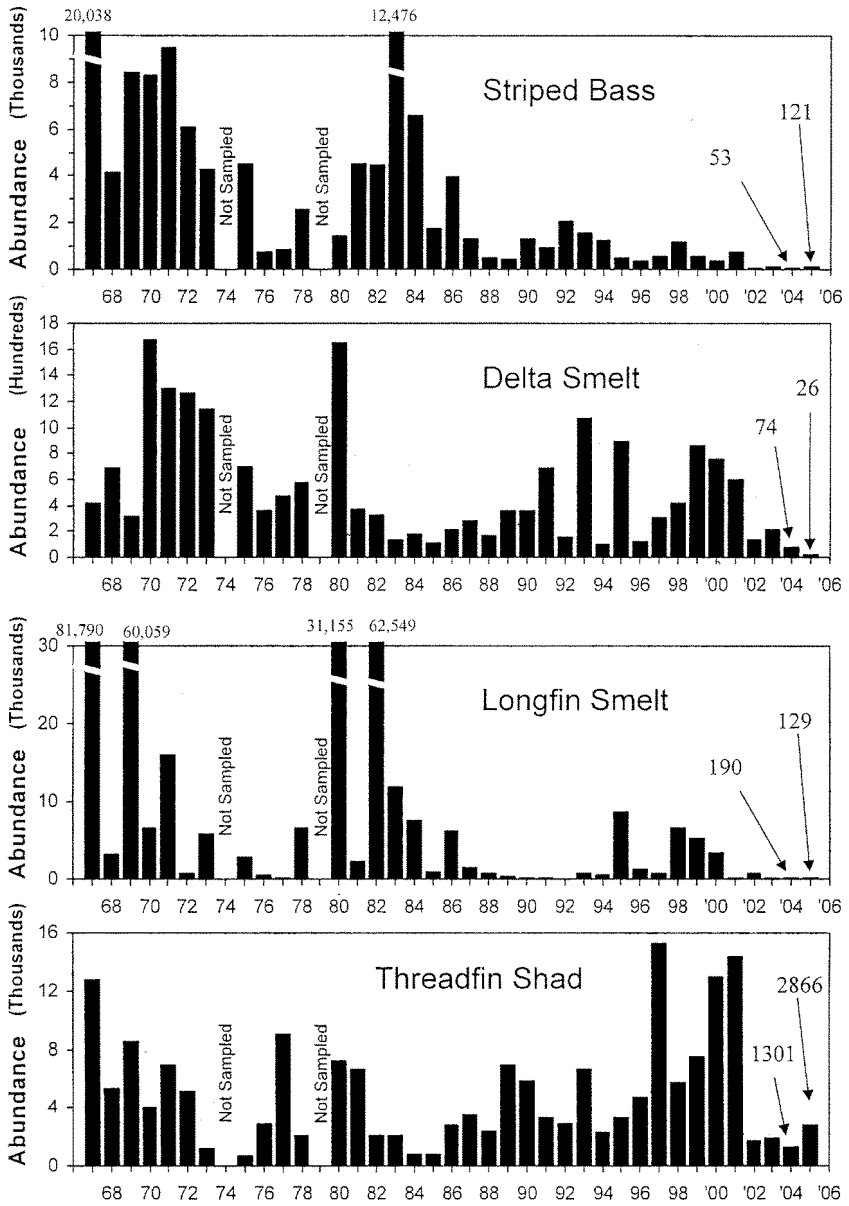


Figure 1. Fall Midwater Trawl annual abundance indices, 1967-2005. No sampling was conducted in years 1974 and 1979.

The CHAIRMAN. I'd like to recognize Mr. Nobriga for his testimony.

STATEMENT OF MATT NOBRIGA, ENVIRONMENTAL SCIENTIST, AQUATIC ECOLOGY SECTIONS, CALIFORNIA DEPARTMENT OF WATER RESOURCES

Mr. NOBRIGA. Thank you Chairman Pombo and thank you to the rest of the Committee as well.

The focus of my comments will be on briefly describing what we're calling the ''Bad Suisun Bay hypothesis'' which is our conceptual model of how the Suisun Bay region which on the map is depicted in green and sits in between San Francisco Bay proper and the Delta, has potentially become a less suitable nursery habitat for fish.

Suisun Bay was historically an important fish nursery for the estuary. And just meaning that a lot of fish used it to feed and grow. Species introductions have changed the Suisun Bay food web. A clam has had the largest known effect, greatly reducing the overall productivity for the pelagic environment, basically by stealing it for itself. Introductions of various small shrimp-like animals that are eaten by young fishes have further changed the pathways from primary algae productivity to fishes.

So the hypothesis itself is due to these known changes and possibly others. Suisun Bay is a less suitable nursery habitat than it used to be.

The written testimony includes some examples from our synthesis report this past year, showing trends in algae, mysid shrimp which is a food of young striped bass and young striped bass themselves and you can see the abundance of all of them went down considerably and has stayed down every since in the late 1980s when the clam basically carpeted Suisun Bay's substrate.

The investigation or the POD investigation is largely designed to understand this better and to understand it quantitatively. We know the clam has an effect on fish and fish food abundance and we see some fish responses. Randy mentioned condition factor which is a relative robustness versus thinness of fish.

We've seen signs of disease or malnourishment in fishes collected there. Abundances are down. The sizes of certain species in the fall are down. Those are presumed effects of the clam and possibly other things operating in the nursery habitat, but both of these effects need to be quantified and put into the big picture context in terms of synthetic analyses and mathematical models, basically to allow us a predictive ability to weight costs and benefits of alternative management strategies and we haven't developed that yet, but that is in the plan to do.

In addition, there are other facts besides the clam and other introduced species in the food web that may also be contributing to a reduced nursery value and we will investigate these as well. Toxic insults, changes in habitat area, effects of power plants that are along the shoreline in Suisun Bay, the relevance of these latter factors we don't really know. It needs to be determined before we would know whether we even need to factor them into mathematical models to predict, to accurately predict Suisun Bay fish production.

Once again, the hypothesis is pretty straight forward and simple and is a major part of our efforts and that is due to the known changes in the nursery area and possibly others. Suisun Bay is a

less suitable nursery habitat than it used to be. And once again, thank you for the opportunity to speak today.

[The prepared statement of Mr. Nobriga follows:]

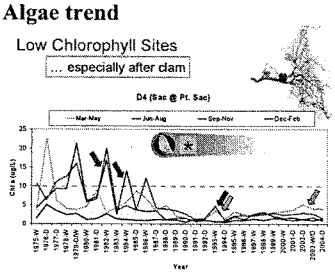
Statement of Matt Nobriga,
California Department of Water Resources

The focus of my comments will be on briefly describing the "Bad Suisun Bay hypothesis" which is our conceptual model of how this region may have become a less suitable fish nursery.

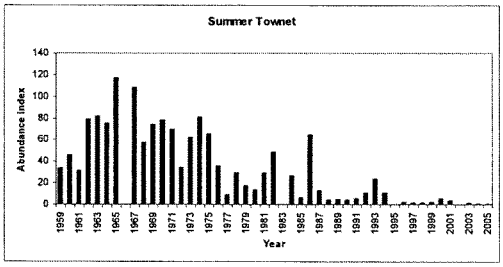
Background

- Suisun Bay was historically an important fish nursery meaning a lot of young fish used it to feed and grow
- Species introductions have changed the Suisun Bay foodweb; a clam has had the largest known effect, greatly reducing productivity. Introductions of various small shrimp-like animals eaten by young fishes have further changed the pathways from primary productivity to fish.
- The hypothesis: Due to these known changes, and possibly others, Suisun Bay is a less suitable nursery than it used to be.

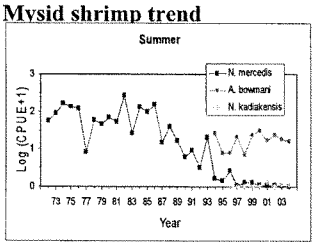
Algae trend



Young striped bass trend



Mysid shrimp trend



The investigation

- The clam has a known effect on fish and fish food abundance
- The fish responses (condition factor, histopath, relative abundance, lower fall sizes, etc.) are presumed effects
- Both of these effects need to be quantified and put into the context of synthetic analyses and mathematical models to provide a predictive ability for weighing the costs and benefits of alternative management strategies.
- There are other factors besides clams and introduced species that may also contribute to reduced nursery value. We will investigate these as well: toxins, changes in habitat area, and power plant effects. The relevance of these latter factors needs to be determined before we know whether they need to factor into synthetic analyses and models to accurately predict Suisun Bay fish production.

The CHAIRMAN. Thank you.

Mr. Breuer.

STATEMENT OF RICH BREUER, ENVIRONMENTAL PROGRAM MANAGER, CHIEF ENVIRONMENTAL WATER QUALITY AND ESTUARINE STUDIES, CALIFORNIA DEPARTMENT OF WATER RESOURCES

Mr. BREUER. My thanks to the Panel for allowing me to speak today. I'll be discussing the potential role contaminants play in the pelagic fish decline.

First, I'd like to make several points. As mentioned in the other talks, contaminants, if they do play a role in the declined, it's believed that several other stressors are working in concert to create the decline. In other words, it would not be the sole causal agent.

For the first phase of the POD investigations, the contaminant studies were the most difficult to execute due to the complexities of toxicity and tissue testing. Therefore, most of the results are preliminary or testing is still going on.

For 2005, we focused on looking at the health of the fish themselves. So we looked at the tissue analysis, specifically, histopathology which is evaluating the livers of Delta smelt and striped bass. We also performed aquatic toxicity testing, where we exposed test organisms to Delta waters. We also did literature searches on pyrethroids, an insecticide and we also on the aquatic herbicide use in the Delta. We also investigated microcystis which is an invasive blue-green algae which is known to have toxicity in certain locations. We conducted testing and also there was a white paper.

For our findings for 2005, on the fish tissue analysis, we looked at the health of the livers of captured Delta smelt as well as historical archival samples. Analysis is still ongoing, but preliminary results showed significant liver lesions indicative of an ecosystem stressor. The problem is you can't distinguish between contaminates or food limitation.

The toxicity tests, this was six months of testing at limited sites. We saw reduced growth and survival for the indicator species, hyalella azteca, but not for the water flea which is seradaphnia dubai, nor did we see effects on Delta smelt or striped bass.

Pyrethroids investigation, the use is growing in California. It's replacing the traditional organophosphates insecticides. The challenge with the pyrethroids is that they're not easily found in the water column. They bind tightly to suspended particles such that testing the water is not adequate. So the route of exposure is more challenging to understand and we'll be working on that in additional studies.

For the aquatic herbicides, our investigation showed that they are not suspected based on our preliminary investigations. There is some concerns over the additive used when aquatic herbicides are used such as surfactants. And last, microcystis, the studies are still in progress. We're waiting on a chemical analysis and tissue analysis. The consensus is no, at this point it's not a primary reason for the decline.

For 2006, 2007, we'll be focusing on a fish up approach. That means we're focusing on the toxicity tests for the fish and the indicator species. We'll be looking at hyalella. We'll be studying it over 12 months, plus more sites than we did in 2005. We'll also be looking at Delta smelt and striped bass in these aquatic tests.

If toxicity is observed, we move into what's called TIE, toxicity identification evaluation. That's a process through which we identify the contaminant or contaminants that are causing the effect.

If toxicity is observed we'll combine this effort with what we call the watershed down approach where information from Department of Pesticide Regulations, State Water Resources Control Board, Regional Boards and other researchers, help determine what contaminants could be present and what time and place.

We'll also continue the histopathology work as well as work with CALFED Science to assemble an expert panel on the use of these biomarkers such as histopathology to determine the population effects from the presence of such biomarkers.

And last, microcystis work will also continue to evaluate the spread of the algae and its possible toxicity.

That concludes my testimony. Thank you.

[The prepared statement of Mr. Breuer follows:]

Statement of Rich Breuer, California Department of Water Resources, and Chief, Environmental Water Quality and Estuarine Studies

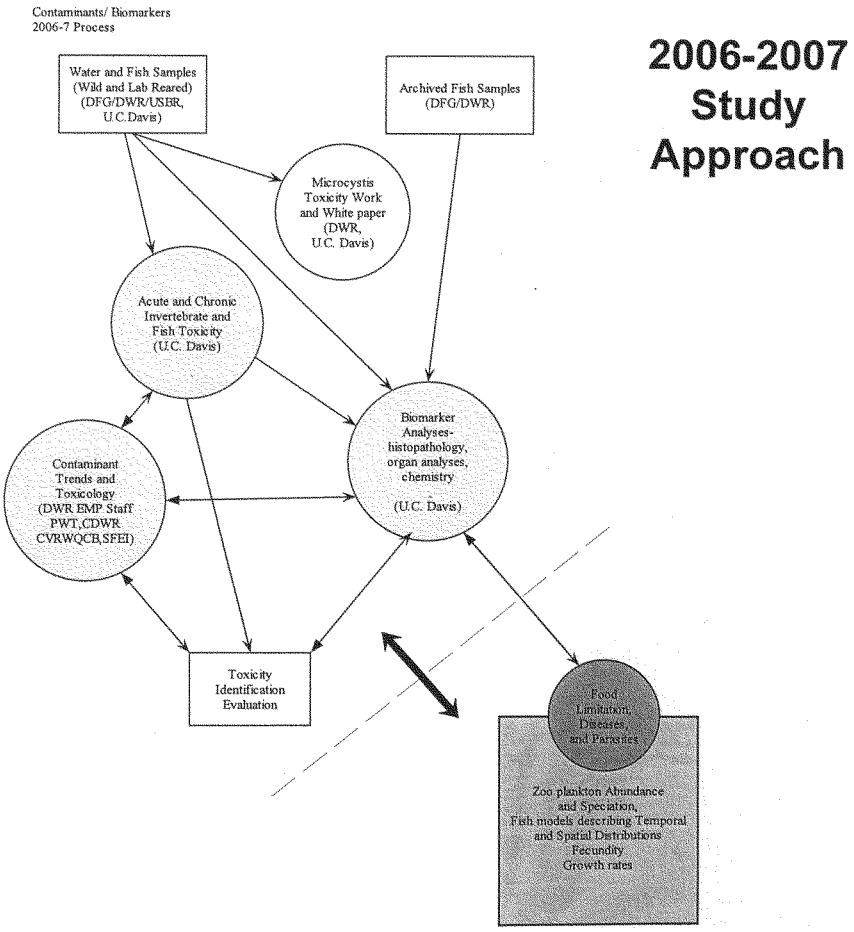
CONTAMINANTS AND THE PELAGIC ORGANISM DECLINE

2005 Studies

- Pelagic Fish Tissue Analysis (Fish Health)
- Aquatic Toxicity Testing
- Pyrethroids (Insecticide) White Paper
- Aquatic Herbicide Use and Toxicity White Paper
- Microcystis (Algae) Toxicity Testing and White Paper

2005 Results

- Fish Tissue Analyses
  Showed liver damage
- Toxicity Tests
  Reduced Growth and Survival for Indicator Crustacean
  Not for Water Flea, Smelt, or Bass
- Pyrethroids Class of Insecticides—Use Growing
- Aquatic Herbicides—
  Not Suspected
  Concern over Additives—such as Surfactants
- Microcystis—Studies in Progress



The CHAIRMAN. Thank you.

Dr. Sommer?

STATEMENT OF TED SOMMER, ENVIRONMENTAL SCIENTIST SUPERVISOR, CHIEF AQUATIC ECOLOGY SECTION, CALIFORNIA DEPARTMENT OF WATER RESOURCES

Mr. SOMMER. Thank you, Mr. Chairman, Committee Members. I'm here to talk about the winter salvage hypothesis which focuses on Delta operations and hydrology and first I want to remind everyone how complex the Delta really is. We have fairly strong seasonal and annual variation and flow. We also have pretty strong tidal effects. A lot of people think of the Sacramento River or San Joaquin as rivers in this region and they're not. They're strongly influenced by the ocean's tides.

And in addition to that, we have strong operational effects. We have upstream dam effects on Delta channels, water diversions like the State Water Project and the CVP and South Delta barriers.

In evaluating the effect of operations and hydrology, the POD team first looked at some of the patterns in tributary flows and one of the first things that we noticed was in the period since 2000, there's been relatively high Sacramento River flow and low San Joaquin River flow.

The other pattern that we noticed was that state water project and CVP exports have generally increased since 2000. They're not at levels that we haven't really seen in the past, but again, there has been a general increase in recent years.

Perhaps more interesting, the seasonal pattern of exports has changed substantially in recent years. For example, there's increased winter exports, reduced spring exports and increased summer exports. And all of these changes are consistent with the 1994 Bay Delta Accord.

And finally, the South Delta barriers have been operated for longer periods or longer duration.

So what does all this mean for fish species? It's difficult to assess for fish. One of the ways we have of measuring this is fish that are salvaged at the CVP and State Water Project fish screens. The number of fish collected at these fish screens is used as a crude measure of water project effects. We call it technically fish entrainment.

The figure I provided in testimony provides evidence of the patterns in Delta smelt salvage, particularly since 2000. And since 2000 when we look at the winter salve of Delta smelt which are the adult spawners, we see that there's been an increase in salvage of these fish.

And the high salvage levels remain high even after we correct for the higher pumping levels that I mentioned in winter. And last, winter salvage was especially high considering how low the Delta smelt population has been in the Delta.

In addition to that, we looked at similar pattern for the other pelagic species, striped bass, longfin smelt and threadfin shad and each shows a similar pattern.

So this brings us to the winter salvage hypothesis. Have increased winter exports adversely affected the pelagic fishes? We will have a lot of questions that we need to answer over the next coming couple of years. The first question is are the data that we've been looking at a result of some sort of data error?

As Randy mentioned, occasionally, there are errors in our data bases that do affect our interpretation. If this isn't an effect of data error, we need to evaluate what the mechanisms may be for increased winter salvage. Are there hydrodynamic effects? Are these the result of problems with fish health? Or has the habitat in the south or central Delta changed in some way?

We also need to do some long-term comparisons. Are the recent patterns similar to what occurred during the 1980s or early 1990s.

And finally, and perhaps most importantly, could winter fish losses at the pumps have population level effects on pelagic fishes? In contrast to the information presented on the bad Suisun hypothesis presented by my colleague, Matt Nobriga where we see very clear effects of an invasive species and previously, we've also seen clear effects with flow in the system, assessing the effects of experts is a much more difficult proposition.

Thank you.

[The prepared statement of Dr. Sommer follows:]

Statement of Dr. Ted Sommer,
California Department of Water Resources

DELTA OPERATIONS AND HYDROLOGY: THE WINTER SALVAGE HYPOTHESIS

Background

- Delta hydrology is complex
  - Inflow: Seasonal and annual variation
  - Tidal effects.
- How operations affects hydrology.
  - Upstream dam operations.
  - Water diversions.
  - South Delta barriers.

Recent Changes in Delta Operations and Hydrology

- The period since 2000 has had relatively high Sacramento River flow and low San Joaquin River flow (Figure 1).
- SWP and CVP exports have generally increased since 2000 (Figure 2).
- The seasonal pattern of exports has changed in recent years (Figure 3).
  - Increased winter exports.
  - Reduced spring exports.
  - More summer exports.
- South Delta barriers have been operated for longer periods.

Trends in Fish Salvage

- Fish are salvaged at SWP and CVP fish screens.
- The number of fish collected is used as a crude measure of project effects ("entrainment").
- Patterns in delta smelt salvage since 2000 (Figure 4).
  - Winter salvage of adult delta smelt (the spawning stock) has increased substantially.
  - Winter salvage was relatively high even after "correcting" for higher pumping rates.
  - Winter salvage was especially high considering the low smelt population in the delta.
- The other pelagic fishes (striped bass, longfin smelt, threadfish shad) showed a similar pattern of increased winter salvage.

The Winter Salvage Hypothesis

- Have increased winter exports adversely affected pelagic fishes?

Follow-Up Studies

- Are the salvage results a result of data error?
- If not, what are the mechanisms responsible for increased winter salvage?
  - Hydrodynamic effects?
  - Fish health?
  - Habitat changes?
- Is the recent pattern similar to that occurring in the late 1980s and early 1990s?
- Could winter fish losses at the pumps have population level effects on pelagic fishes?

Figure 1: Since 2000, more Sacramento River flow, less San Joaquin River flow.

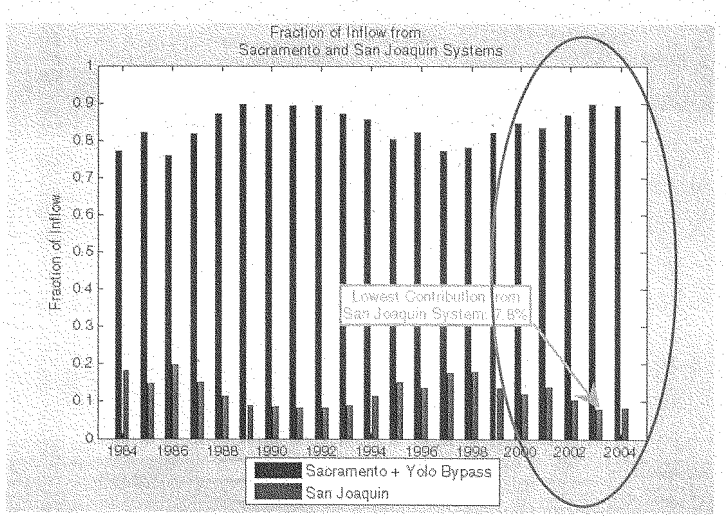


Figure 2. Generally increased exports since 2000

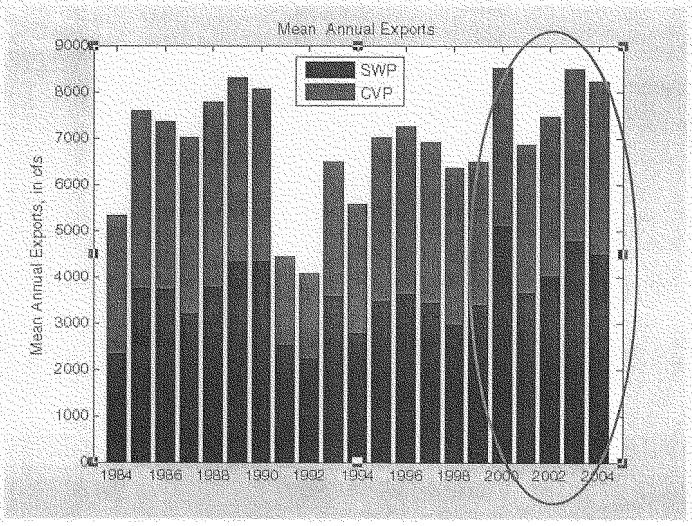


Figure 3: Changes in exports since 2000

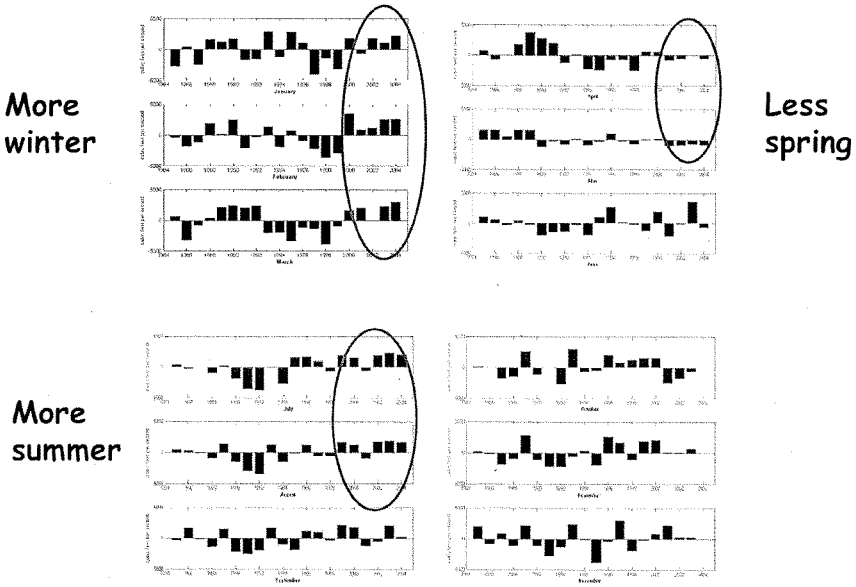
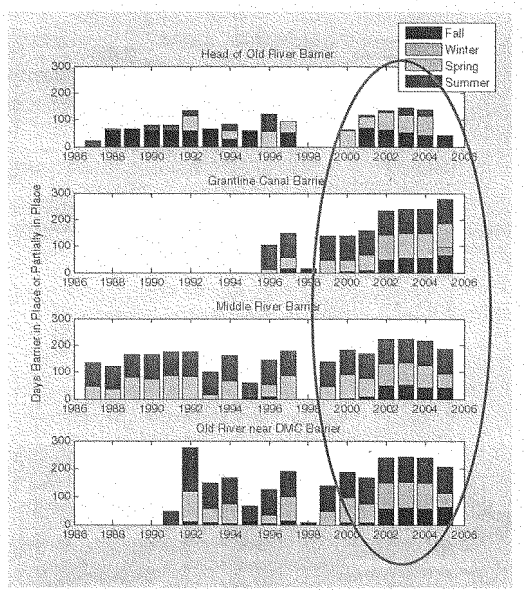
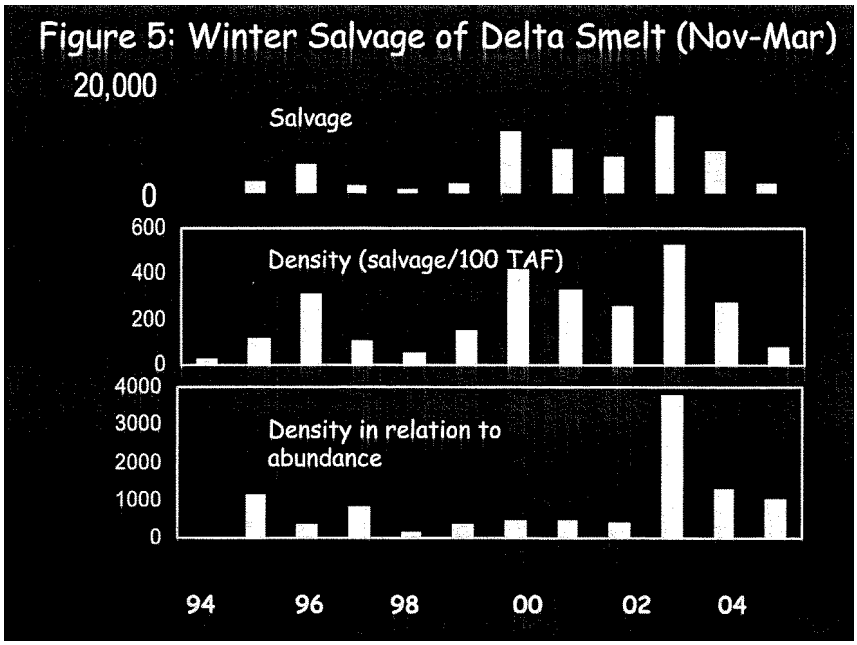


Figure 4: The Duration of South Delta Barrier Operation Has Increased





The CHAIRMAN. Thank you.

Mr. Harlow.

STATEMENT OF DAVID HARLOW, ASSISTANT FIELD SUPERVISOR, SACRAMENTO FISH AND WILDLIFE OFFICE, U.S. FISH AND WILDLIFE SERVICE; ACCOMPANIED BY MIKE CHOTKOWSKI, FISHERIES BIOLOGIST, SCIENTIFIC SUPPORT BRANCH, MID-PACIFIC REGION, U.S. BUREAU OF RECLAMATION

Mr. HARLOW. Thank you, Mr. Chairman, Members of the Committee. My name is David Harlow. I'm the Assistant Field Supervisor of the Fish and Wildlife Service, office in Sacramento, under the supervision of the California-Nevada Operations Office, which is headed up by Steve Thompson who regrets that he could not be here today.

I'm joined by my colleague from the U.S. Bureau of Reclamation, Dr. Mike Chotkowski. He is the representative from the Department of the Interior on the Pelagic Decline Work Team and is the lead for that team looking at historical population trends and fisheries.

My written testimony was submitted to the Committee so I will not repeat it this morning. Instead, I'll draw your attention to three key points I'd like to stress. First, as you've heard, the current decline of numerous pelagic organisms in the Delta is a very complex issue. Exhaustive studies are being undertaken by the gentleman at the table and many others, assisted by many knowledgeable experts from academia and the private sector. All are working very hard to determine causes and find solutions, but it

is unlikely that there will be a simple solution to the problems of such a complex ecosystem.

For this reason, my second point is the Fish and Wildlife Service is revising its Delta Navy Fishes Recovery Plan, using new information that has been developed since the approval of that plan in 1996 and is continuing to be developed.

We'll be working with many of our partner agencies to assemble a recovery team consisting of qualified, governmental agency, academia and stakeholder representatives. The scope of the revision will include at a minimum updating the biological information in the plan, reviewing and possibly revising recovery goals and identifying recovery implementation actions.

And third, I'd like to provide our perspective on the topic of the south of Delta export pumping and the effects to Delta smelt. Although the effects of entrainment losses at the pumps have been implicated in the population decline of Delta smelt, particularly in the South Delta, it is apparent that other causes, such as non-native invasive species, environmental contaminants and changes in food supply may also be a limiting species recovery. Accordingly, it is unlikely that reduction of export pumping alone would be sufficient to bring about recovery.

The Service, along with the California Department of Fish and Game, National Marine Fisheries Services, U.S. Bureau of Reclamation and the California Department of Water Resources, addressed pumping effects with an adaptive management program included within the two projects' operations. When protective actions for Delta smelt at the export pumps are undertaken by the five agencies, the actions are based on the latest hydrological conditions and fisheries status and distribution.

Results of investigations of these recent investigations are provided to agency managers on a regular basis and considered in decisionmaking. These five agencies confer at least weekly, at several different levels before making decisions. And we are in close communication with our senior management within the agencies on a regular basis.

With that, I'll conclude my remarks and save any time for Dr. Chotkowski, if you have any questions about the analyses that he's performing.

Thank you, Mr. Chairman, and Members of the Committee.

[The prepared statement of Mr. Harlow follows:]

Statement of David L. Harlow, Assistant Field Supervisor for Conservation, Restoration and Contaminants, Sacramento Field Office, U.S. Fish and Wildlife Service, Department of the Interior

Good Morning, Mr. Chairman. My name is David Harlow, and I am the Assistant Field Supervisor for Conservation, Restoration and Contaminants in the Sacramento field office of the U.S. Fish and Wildlife Service (Service). I am pleased to be here today on behalf of the Department of the Interior to discuss the status of declining pelagic fish populations, in particular the delta smelt fish population, of the California Bay-Delta.

I will focus my testimony on two areas—first, a brief overview of the status of the delta smelt, and, second, how the Service and our partner agencies are responding to the recent severe downward trend in the delta smelt's population, using the results of new research into an adaptive management approach to address delta smelt population limiting factors.

Much of the focus of my testimony is on the delta smelt, but it is important to note that while we cannot conclude definitively, we do fear that the status of this

species may be symptomatic of the condition of the Bay-Delta ecosystem as a whole. The environmental conditions of the Delta are extremely complex and, in light of this, the cause and effect relationship between and among varying factors are not well-understood at any level. As a result, the only thing we know with certainty is that there will be no simple solutions to the problems of such an important ecosystem.

Status Overview

The Service has been involved in the efforts to address the decline of the delta smelt since its listing under the Endangered Species Act as threatened in 1993. Subsequently, the delta smelt was listed as threatened under California's State Endangered Species Act on December 9, 1993.

In 1996, the Service completed the Sacramento-San Joaquin Fisheries Recovery Plan, which included recovery goals for the delta smelt. To consider delisting the delta smelt, specific abundance and distribution criteria must be met during a five year period.

On August 2003, pursuant to court-approved settlement agreements with the California Farm Bureau Federation, the San Luis & Delta Mendota Water Authority, and other groups, the Service commenced a 5-year review of the status of the delta smelt. When the Service completed a 5-year review in March 2004, we concluded that delisting was not warranted as the species continued to be threatened with extinction. However, because of information obtained during this 5-year review, the Service is undertaking a revision of the 1996 recovery plan.

Response to Recent Decline in Delta Smelt

Most of the potential threats to the delta smelt and other Delta pelagic organisms which have been identified will be addressed in detail by other speakers today. I would like to mention that exhaustive studies are being undertaken by the Interagency Ecological Program, assisted by many knowledgeable volunteers from academia and the private sector who share concerns about the status of the Bay-Delta ecosystem. Included among them are my colleague, Mike Chotkowski, Fishery Biologist with the Department's Bureau of Reclamation, who is here with me to answer question related to work he has performed as part of the 2005 Pelagic Organism Decline investigation package.

Because of the changing situation in both the condition of the delta smelt population and evolving research, the agencies responsible for delta smelt management have developed an adaptive management approach enabling us to rapidly address new information and apply it to measures aimed at addressing the decline. Also, the Service and others assisted the California Departments of Water Resources and Fish and Game in preparing the Delta Smelt Action Plan which specifically addresses actions that have been or could be taken by resource agencies which are designed to further research needs and reduce population decline. A few examples of actions to reduce population decline include planning restoration actions for the Delta, Suisun Marsh, and San Pablo Bay that are intended to improve habitat conditions for smelt and other State and federally-listed and candidate species.

We are also actively involved in efforts to identify other environmental risks and possible corrective actions. I would like to provide the Service's perspective on one topic that generates a lot of attention—water export pumping from the Delta. Although the effects of entrainment losses at the pumps have been implicated in the population decline of delta smelt, particularly in the south Delta, it is apparent that other causes such as non-native species, contaminants, and changes in food supply may also be limiting species recovery. Accordingly, it is unlikely that reduction of export pumping is sufficient alone to bring about recovery.

In 2005, the Service's biological opinion on the operations of the Central Valley Project and State Water Project concluded that, with the adaptive management program agreed to by the operating agencies, the Service, U.S. Bureau of Reclamation, California Department of Water Resources, California Department of Fish and Game, and National Marine Fisheries Service have the ability to address pumping effects within existing operational criteria and assets. The Operations Plan includes the implementation of the Delta Smelt Risk Assessment Matrix (DSRAM). This matrix guides the recommendations of the Delta Smelt Working Group, which is composed of agency scientists who are actively involved in the ongoing research and management of delta smelt. Three of the panel members here today are members of the group.

The Working Group is specifically set up to review all available information and advise the Service on implementation of actions that can be taken to minimize effects of export pumping on the species. This information, along with substantial other data and expert opinion, is reviewed by the Water Operations Management

Team (WOMT). This team is composed of management level representatives from the Service, Bureau of Reclamation, National Marine Fisheries Service, California Department of Water Resources, and California Department of Fish and Game. The team has several adaptive water management tools that can be used to help protect delta smelt including, but not limited to, the Environmental Water Account and water available from the Central Valley Project Improvement Act, commonly known as B(2) water.

With the high level of concern for the delta smelt population, the Working Group has recommended to the Service and the WOMT agencies that water management actions to protect pre-spawning adults and larvae from entrainment be given the highest priority. Export reductions taken to protect adults are intended to avoid or minimize losses of adults before they have the opportunity to spawn, typically in late winter. After the fish have spawned, subsequent reductions to protect larvae are intended to maximize recruitment by affording young fish the opportunity to move out of the Delta where they were hatched and into their rearing areas in Suisun Bay and Marsh.

Under the current adaptive management process for water project operations, decisions regarding operations must consider many factors, including public safety, water supply reliability, cost, as well as regulatory and environmental requirements. The first step is data collection, including the routine collection of hydrologic data by the California Department of Water Resources, Bureau of Reclamation, and U.S. Geological Survey. The Pelagic Organism Decline work team also provides input to the water operations decision-making process through regular updates. Using that data, the Data Assessment Team (DAT) and the Delta Smelt Working Group (DSWG) can recommend a change in Project operations, which is forwarded to the WOMT.

The decision-making agencies also try to inform and advise major interests that may be affected when they are making a particularly challenging decision about water operations. The WOMT considers the recommendation and seeks consensus on potential actions. WOMT may adopt or modify the recommendation and may direct that the Environmental Water Account and water available under the Central Valley Project Improvement Act be used to implement an export reduction. For particularly controversial recommendations, state and federal agency leaders engage in the decision-making process. Decisions regarding changes to Project operations often must be made quickly if they are to be effective. The Bureau of Reclamation and California Department of Water Resources then implement the export reduction as prescribed. Implementation can occur within a three-hour turn-around, if necessary.

Conclusion

Recovery of the delta smelt continues to be a high priority for the Service. Our knowledge of this species and its needs continues to increase almost daily. We are working closely with our partner agencies to make real-time management decisions consistent with our adaptive management approach to water operations. We intend to update our recovery strategies as quickly as the science becomes available. In particular, the Service plans to revise the delta smelt recovery plan in the near future to incorporate new scientific information that is the result of the extensive studies now underway and new information developed since the approval of the current recovery plan in 1996.

Mr. Chairman, this concludes my remarks. Thank you for the opportunity to appear before you today, and I will be happy to answer any questions that the Committee may have on this important issue.

The CHAIRMAN. Thank you. I thank all of you for your testimony.

I think to begin with, to Mr. Armor, you talked about the steps that you're going to go through in the upcoming year and one of the things you mentioned was a list of recommendations or recommendations that would be coming out.

Do you have an approximate time as to when those recommendations will be ready?

Mr. ARMOR. No, I don't. First, we have to, as you heard, we need to build models. We need to get the data so we can build models and actually suggest, if we do this, here's where we'll end up. We're not there yet. I can't tell you when those recommendations are going to be forthcoming.

I can tell you that our directors have impressed the need to get information to them so that a decision can be made to get recommendations to them as quickly as possible because there are a number of very critical water decisions, water development decisions that are in abeyance right now, waiting for us to come with stuff. So we're very cognitive of the need to move quickly. We are. But I can't say in November we're going to have recommendations because I just don't know where we're going to be with the science by then and especially with the model development.

The CHAIRMAN. Those recommendations will be the result of collaboration between all of the different agencies and stakeholders. This is a broad-based study that everyone is doing. Obviously, in a lot of different areas and whatever recommendations come out of that will be a collaboration between everybody.

Mr. ARMOR. Very much so.

The CHAIRMAN. Mr. Baxter, just so I understand what you testified to, in terms of the correlation between food availability in fish and numbers, you talked about the growth rate of striped bass and smelt and how it had not changed since 2001. Is that accurate? Did I understand that correctly?

Mr. BAXTER. It had not declined since prior to what we're calling our pelagic organisms decline. So the growth rates were as high or essentially a little bit higher in some cases.

The CHAIRMAN. So should I take from that that food availability is not part of the issue in terms of what you were looking at?

Mr. BAXTER. The growth rates that we looked at were based on survivors. So those that survived in the system, did well. We haven't identified whether there are particular times or places, for instance, in 2005, during the spring, the copepod abundance was pretty low and that's important to striped bass and Delta smelt, but we haven't determined whether that was such a low level that it caused the mortality of those fish. The fish that survived grew well. So there's a little bit of a conundrum there.

The CHAIRMAN. When you talk about declining numbers or all-time low numbers, in terms of the smelt or the striped bass, what does that mean? Do we have 50 percent less than what we had in 2000 or 10 percent less? What actually do your numbers show?

Mr. BAXTER. I think all we can say for certain is that there's a decline from a relatively high level. We've done some investigations to see whether our abundance indices, whether we're able to discriminate among them, based on the variability that we see. And these extremely low abundance levels are quite a bit less than previous abundance levels, but we don't have like a one-to-one population relationship established for these indices. So all we know really is that the trend is down and we don't know where the bottom is and we don't know whether if we fail to collect any Delta smelt, whether that's a true zero. Most likely, it's not. It's just that we've missed them. We can't sample the whole estuary. The idea is not to catch and kill every fish out there in order to track a population. So we sample a fraction and make our estimates of trends from that.

The CHAIRMAN. When you look for fish, do you go back to the same place every year and that's where you sample?

Mr. BAXTER. Correct. We have a broader array of sampling locations that are spread throughout the upper estuary and in some cases throughout the estuary and each time we go out, we're using the same gear at the same location, so our methods should not be affecting our capture or not capture of the fishes.

The CHAIRMAN. Is it possible that your numbers are skewed based on climate or runoff? Some years we have greater runoff through the Sacramento River. Other years we have greater runoff through the San Joaquin River. Is it possible that that is influencing your numbers, based on where the fish are going, based on what temperature or water amount or water quality or food sources that change, based on where we have a greater water runoff?

Mr. BAXTER. Yes, the water runoff changes the distribution of the fish and that's going to change our ability to detect them, depending upon how many sampling locations we have in the vicinity of where they end up. So yes, it's all mixed in and that's part of all our years of sampling include essentially all the variety of water years that we've seen, certainly from the runoff standpoint. There are new factors. Any increases in pumping or increases to diversion will certainly change that, potentially change fish distribution.

The CHAIRMAN. Finally, since my time is running out, I just want to go back to the question I asked you in terms of is it possible for you to say that the numbers are 50 percent less than what they were five years ago or do you just not, at this point you're not able to say that? And I just pulled 50 percent out. It could be 50 percent. It could be 80 percent. I don't know. I'm just trying to figure out.

We hear about how the numbers are at an all-time low and I'm just trying to figure out what that is. Is it one percent less than what it was and that's an all-time low or is it 80 percent less than what it was?

Mr. BAXTER. Yes, I think the only way that I can answer you is just to say we don't know what our index relationship is to the whole population and I think that's what your meaning is, is it 50 percent of the population? We don't know whether we suddenly start catching fish more poorly when the numbers are really low. It's possible that they're using other habitats that we don't sample well when the numbers are really low. So I can't answer the question.

The CHAIRMAN. Thank you very much. I recognize Mr. Miller for his questions.

Mr. MILLER. Thank you, Mr. Chairman. Mr. Harlow, in your statement on page 4, you talk about water export pumping from the Delta and in the conclusion of your first paragraph you stated "accordingly, it's unlikely that the reduction of export pumping is sufficient alone to bring about recovery." Certainly, I don't think any Members of this Panel suggested that we would do that alone.

The question is and it's been amplified here this morning that this is a very complex problem. You go on to state that—you put together in place an adaptive management program with the Bureau and with the Water Resources and Marine Fisheries Service to have the ability to address pumping effects within existing operational criteria and assets. And that the working group is specifically set up to review all available information to advise the

Service on implementation actions. It can minimize the effects of export pumping on the species. And that is reviewed by what is called the Water Operations Management Team, is that correct?

Mr. HARLOW. Yes, that's correct.

Mr. MILLER. And you later on, on page 5, you go on to say "with a high level of concern for the Delta smelt populations, the working group has recommended to the Service and to the WOMT agencies, water management actions to protect pre-spawning adults and larvae from entrainment, be given the highest priority, export reductions taken" and apparently you have recommended or the working group has recommended export reductions at various times. Is that correct?

Mr. HARLOW. That's correct.

Mr. MILLER. And that's the highest priority and to protect the larvae and intended to maximize recruitment of young fish and the opportunity to move out of the Delta where they are hatched into the marine areas of the Suisun Bay and Marsh, Mr. Nobriga's area.

I guess my question is it appears that we have a very complex system here, but one of the constants that people are recommending not be changed and this is at a policy level, is exports. And in fact, we have a series of processes under way to increase the exports from the Delta.

So one of my questions would be that you say that it's sufficient reduction export alone would not bring about recovery, what's the sense among the scientists about the increase in exports at a time when you don't know the ramifications of the clams, of pesticides, other factors?

Mr. HARLOW. I believe you're asking a question about the interrelationship between pumping and those other factors.

Mr. MILLER. I'm asking when you look at what is described as a very complex system, we have the impact of exotic species. You have the impact of some forms of various pesticides, herbicides, and we sort of have this three-legged stool here and experts. You wouldn't introduce more clams at this time, would you?

Mr. HARLOW. Correct.

Mr. MILLER. And you probably wouldn't introduce more herbicides at this time, would you?

But apparently, there's an agreement somewhere between the agencies that we will continue to place in motion those things that would lead to additional exports of water from the Delta.

Mr. HARLOW. Congressman Miller——

Mr. MILLER. And whether it's a renewal of the contracts or whether it's trying to suck every additional acre foot you possibly can for the needs of California. And I recognize that.

Mr. HARLOW. Congressman Miller, I'd like to point out that we issued a preliminary biological opinion on increased pumping and that is not final biological opinion or final agency action. Beyond that, Congressman Miller, I've been advised by legal counsel, because this is in litigation, I should not speculate on the outcomes of the further analyses that will be conducted and considered before we issue a final biological opinion.

Mr. MILLER. Let's go to that issue there and you either can respond or you can't. You make that determination. I'm not here to force you to respond if you're not comfortably legally.

But that biological opinion that you say you've come up with an adaptive management program that's agreed by the operating agencies that you can address the pumping effects within the existing operational criterion assets. Has anybody looked at whether or not the existing operational criterion assets makes sense in today's environment within the Delta or are we meeting operational criterion assets that may be inconsistent with the recovery of and the sustainable health of the Delta? Has that work been done in any of this?

Mr. HARLOW. That's part of the on-going investigation described by Dr. Sommer and others, yes.

Mr. MILLER. So Dr. Sommer, you're going directly to that operational criteria?

Because in all your testimony, everything has to fit within that operation and I just want to know whether or not if we've looked at whether the foundation is solid here.

Mr. SOMMER. We're focusing on the current criteria, what we've seen over the past five plus years.

Mr. MILLER. And what do you—that's telling you what?

Mr. SOMMER. That there has been an increase, we think, in entrainment of several of these pelagic fishes during winter and again, the big question is does that have a population level effect.

Mr. MILLER. How many of these fish do we entrain over a year?

Mr. SOMMER. The problem with entrainment is——

Mr. MILLER. Is that the same as grinding up, lost in the pumps or sending them to L.A.?

Mr. SOMMER. No, we salvage fish at the fish screens, but the challenge is the fish we salvage represents an unknown portion of the total fish that are entrained. For example, state water project has a floor bay or a reservoir before the screens and so we think the actual losses are probably substantially higher.

Mr. MILLER. So again we go back to, we have a situation where it's suggested the complexity of the problem almost defies putting your thumb on any solution and I think that may very well be justified at this point. I'm just trying to determine what's the operating parameters here?

So you have the listed species or several listed species here that are threatened, but we continue to send them through the pumps. Do you get a permit to do this? Do you get a take?

Mr. SOMMER. I'm the wrong person to ask about the——

Mr. MILLER. Who would be the right person?

Mr. SOMMER. We're here to present the science beside the fish decline.

Mr. MILLER. But I mean you've got a hole in the ship here and the question is do you fix it or not? I mean I don't understand. You have the threatened species. Does Fish and Game, do you have to get a take to entrain them? That's a delicate, wonderful word. There's two here from Fish and Game.

Mr. ARMOR. The facilities operate with a biological opinion that sets their take points.

Mr. MILLER. That biological opinion is currently being challenged.

Mr. ARMOR. Correct. And I think David Harlow can speak more to that because they issue one of the permits that they operate under down there.

Mr. HARLOW. That's correct. We do have a biological opinion that covers the current operations and that is in litigation currently.

Mr. MILLER. I'll finish here, Mr. Chairman. This system where we have this delicate complexity, we continue to allow the threatened species to be chewed or entrained somewhere. I guess they end up in Napolitano's District. It's not a great game fish, this smelt.

Ms. NAPOLITANO. They're salvage.

Mr. MILLER. They're salvage. And we also, our policymakers are deciding that they're going to export more water at a time when we're told that the dynamics here are so complex, we can get arrive at a conclusion. But some conclusions are already being pre-ordained here. But perhaps above your all grades here because these are policy considerations about renewal of contracts and how much water and all of those things that are very controversial at this dais here. But the fact of the matter some things continue to go on winter, spring, summer or fall, good year or bad year. And I'm just wondering at some point whether or not you can really talk about dealing with the complexities of the system, if you don't recognize that maybe you've got to put that on the table too, to deal with the complexities of this system.

I don't know if that clam showed up and made it inhospitable or a failure of water to flush that area, made it more hospitable, I don't know that yet. All I know is we keep sending water out.

I'll stop for the moment, I hope we'll have a second round of questions, Mr. Chairman.

The CHAIRMAN. Mr. Radanovich.

Mr. RADANOVICH. Thank you, Mr. Chairman. Now that I have Microphone 101 down I'd like to ask a couple of questions. For Mr. Chotkowski, a couple of questions. Some have called for significant reductions in the export pumps until a smoking gun can be found.

Does the science currently indicate whether pump stoppage or reductions have any impact on fish populations?

Mr. CHOTKOWSKI. Well, Congressman, I can only respond by describing the statistical research we did last year on this subject. What we did was look at the relationship between time averaged export volumes for several months of the year and the number of smelt that were taken to the fall mid-water trawl which is the index that's used for official purposes.

And what we discovered preliminarily is that exports are a significant contributor or have a significant effect on the fall mid-water trawl index, they don't have a large effect. They have a small effect. So it looks like at this point if you believe that analysis that time averaged exports are not a very good predictor of fall mid-water trawl index, we don't consider this part of the research to be done yet, so we're not certain whether it's believable. We want to look and see whether it may be the case that experts are very important under some conditions that occur infrequently but not important under other conditions.

Mr. RADANOVICH. They really don't have the science down yet on it.

Mr. CHOTKOWSKI. Yes sir, that's right. We really don't know yet. We're working on it and what I've just described is there's sort of a middle step and an on-going analysis.

Mr. RADANOVICH. OK, thank you. At other hearings, we've heard a lot about the Pacific cyclical oscillation, El Nino and La Nina, climate events and their effects on some ocean fisheries. How much of an effect has climate change had on Delta fishes. Do we know that? For you, Mr. Chotkowski or anybody else.

Mr. CHOTKOWSKI. No sir, we don't know. I don't know.

Mr. RADANOVICH. Wouldn't knowing that perhaps have a pretty good idea about why the decline of fish populations in the Delta? Do you have any idea whether you think that affects that or not?

Mr. SOMMER. We have been evaluating changes in salinity and temperature which are a direct effect of climate-related factors and how the habitat shifts with time.

Mr. RADANOVICH. That would be as to the amount of water flowing into the Delta.

Mr. SOMMER. That's right, and also air temperatures as well.

Mr. RADANOVICH. OK.

Mr. SOMMER. And there have been some long-term changes that we've detected based on that. And that's consistent with climate change, but also changes in flow patterns and exports.

Mr. RADANOVICH. In anybody's view here, is the decline in the—could the decline in the fisheries in the Delta be attributed to what might be going on out in the ocean?

Mr. ARMOR. We don't have a construct that would show us how that ocean would affect these species which are found up in the Delta. They don't connect to the ocean. They don't migrate there. Their food isn't fixed there. And so we can't say what's going on in the ocean that's affecting say Delta smelt, because they don't go there. They're disconnected.

Now with a number of the species that we do monitor down in the Bay, yes, we do see an impact of these ocean conditions and ocean impacts, but that's separate from what we're talking about here today.

Mr. RADANOVICH. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Ms. Napolitano.

Ms. NAPOLITANO. Thank you, Mr. Chair. I find this interesting, Mr. Armor, that you say that these long-term weather changes in the ocean may not affect. We were on a congressional delegation to the Amazon. Scientists there are finding changes in the Amazon River due to global warming or at least purportedly due to global warming that's affecting the fish. Fishing villages are being wiped out.

So to me, there is some, something, some correlation to the warming of the oceans to the warming of the rivers, to the warming of the climate that may be affecting. Is anything being done to study that possibility? I'm not saying it happens, but the possibility. Because if it happened in another part of the world, please.

Mr. ARMOR. One of the projects being funded by CALFED is a project that's looking at long-term scenarios in the estuary and the global warming is one of the scenarios that they're looking at. And they're using a series of models that have been developed and are

being developed but they're bringing these together to look at these large, long-term, large-scale events like that.

Ms. NAPOLITANO. Is the academia being involved? Because I don't see anybody here representing that research portion.

Mr. ARMOR. Oh, very much so. And in fact, a number of people in that proposal, actually not a proposal. They've got the grant now, are from academia. Stanford University, Louisiana State University. I'm trying to think where else. A number of research—Robert Turran Center. There's a number of folks involved there from academia.

We've involved a number of folks from academia in our work. They're doing a lot of our toxicity testing, a lot of our more state-of-the-art science is being done by academia right now.

Ms. NAPOLITANO. Now the Delta smelt is now listed as a threatened species and the declines you see, the abundance in the Delta smelt, shouldn't it be reclassified as endangered, anybody?

And we, of course—how do you make the determination and how bad does it get before that action can be taken? As we all know, we were advised and used to think that the pumping from the Delta in the winter was fine, it was OK. And now it's harmful to fish. Is there any time of year that has been determined that it might possibly be OK? Or is it for the whole year?

Anybody, please.

Mr. HARLOW. Congresswoman Napolitano, I will respond to at least part of that question. Certainly the status of the smelt will be looked at when we update the recovery plan. And that will be a key thing we'll look at is its status.

And then regarding your question about pumping, we, within the management agencies that are called the WOMT, the Water Operations Management Team agencies, clearly, we look at the hydrology that is present in the winter time and fish locations. And there are times when it is advantageous to pump south and fill San Luis when there are no fish present and the hydrology indicates there is no impact to those fish at the time.

Ms. NAPOLITANO. Well, in reading some of the testimony that has been some submitted, I find that much reference is done to small, immature fish. But the larger fish is getting fatter. What is the correlation and has there anything been done to further clarify why that is happening? Are they being—besides the pumping, entrainment, the clams and everything else, why is the issue of the non-growth of the fingerlings of the small versus the mature getting fatter?

Anybody? Hello.

Mr. BAXTER. We're currently investigating, some of the academic researchers are currently investigating growth of larval fish, Delta smelt, in particular, in a manner that's going to be a little more specific than the measures that I presented today. And we're hoping that over time that we'll be able to—in order to do that, you need to look at the ear bones and look at growth and survival that way. And it's a very time consuming process. And we're just not there with the answers yet.

Ms. NAPOLITANO. We've been funding studies now for a number of years. Nothing of this sort has ever been indicated there was a need for?

Mr. BAXTER. The striped bass data that I'm aware of, I don't know whether it identified a break point in growth or survival with any of the conditions that we're looking at right now.

Ms. NAPOLITANO. And just to add to that, you talk about pesticides, but you don't indicate anything that is connected to the use of fertilizers which also can be toxic.

Anybody?

Mr. BREUER. Where fertilizers play a role is they contribute nutrients that can add to the growth of algae and nutrients in an estuary aren't necessarily good or bad. It depends on what's benefiting from their application.

But at this point, there's no toxicity directly from fertilizers that's a concern.

Mr. SOMMER. I might add, one of the issues though that we're looking at is what's going on at the base of the food graph and one of the disturbing patterns is the increase in toxic alga blooms that have occurred over the past seven or eight years.

Ms. NAPOLITANO. Explain, please.

Mr. SOMMER. There's a blue-green alga called microcystis that has started appearing with disturbing frequency in the central Delta. It's a known toxin to fish, to invertebrates and to humans. It's fairly prevalent during summer time in key parts of the Delta.

Ms. NAPOLITANO. Is that part of the study I hope, to be able to determine whether——

Mr. SOMMER. It's a key part of the study. And it may also be related to nutrient land-use pattern and flow patterns.

Ms. NAPOLITANO. Flow patterns from ag. use, possibly?

Mr. SOMMER. Perhaps.

Ms. NAPOLITANO. All of it. OK. Thank you, Mr. Chair. I'll wait for the next round.

The CHAIRMAN. Mr. Cardoza.

Mr. CARDOZA. Thank you, Mr. Chairman. I appreciate the panel being here and the interest in this topic. I lived on the Sacramento River for three years when I was on the legislature in Sacramento and I can tell you in that period of time I saw a wide variety of conditions affect the river temperature, high and low times, and I know how difficult it must be to try and judge all these different factors that go into play.

I remember boats capsizing and God knows what were on those, the batteries and the acid and the lead could very well affect different conditions and different places. And so my question to you, Mr. Baxter, is how many years have you all been conducting these samples upon which we're trying to base the science?

When did the testing start?

Mr. BAXTER. It started for different things at different times. The fishes are back to 1959.

Mr. CARDOZA. Just counting the fish?

Mr. BAXTER. Yes, looking at censussing the population.

Mr. CARDOZA. My question also deals with methodology. Have you changed methodology and could that affect the counts?

Mr. BAXTER. We haven't changed methodology in our long-term monitoring as far as capture goes. So no.

Mr. CARDOZA. So you feel pretty good about——

Mr. BAXTER. We feel confident with the fishes. We feel pretty confident with the zooplankton. We've lost some resolution with them, but we've got other surveys that are making up for that.

Mr. CARDOZA. Right, that makes me feel better. After the '97 floods and the huge flows that we had, I recall testimony when I was in the legislature that we had an over abundance of smelt that particular year, that they just—there were just huge numbers in the Delta. Does anyone else recall that? It was so.

And then I was thinking that after this last year, we saw pretty large flows again and we saw just the opposite happen. We saw a rapid decline of the smelt.

Can anyone say why one year, large flows result in large numbers of smelt; the next year when we have large flows, we don't? Has anyone been looking into that?

Mr. SOMMER. At specifically why the alarm bells went off for quite a few of us within the past couple of years, because the pelagic species don't seem to be following their historical relationships with flow. So for each of these species we've got much less fish for a given amount of flow than we had in the past.

Mr. CARDOZA. Thank you, Mr. Sommer. I have a question back to you. Are you familiar with Mr. Brian Manley's—was a world-class statistician, with his work that was directed by the POD team to analyze the river flows and exports on Delta smelt? It's my understanding that his September report concluded export effects were not important to the changes in Delta smelt abundance.

Is that your understanding as well?

Mr. SOMMER. I think Mr. Chotkowski would be a better person to answer that.

Mr. CHOTKOWSKI. I'm sorry, that's the research I was referring to earlier in response to a previous question. I'm Dr. Manley's co-author on that study.

Mr. CARDOZA. I see.

Mr. CHOTKOWSKI. And as I said what we found was that exports are—they are statistically significant as a predictor of fall mid-water trawl numbers, but they are a small contributor. They have a small effect. That's what we found so far. But we're not done with—I have to emphasize that this is work in progress, that we were using time averaged export volumes for that study and there are a lot of scenarios that we've considered where exports might be important under certain conditions, certain hydrologic conditions, but they may be unimportant under other circumstances and when you use time averages, the way we did, you tend to underestimate the importance during the important times and over-estimate the importance during the unimportant times. And so this work hasn't reached the level of sophistication where I can tell you really what the answer is.

Mr. CARDOZA. I thank you for that and we thank you for your work.

I also want to submit into the record, if I may, Mr. Chairman, a document authored by William Miller who a consultant engineer from Berkeley's who responded to some questions that Mr. Radanovich and I have been working with. So without objection, I'd like to submit this for the record and thank the Panel for their information.

The CHAIRMAN. Without objection, it will be included.

Do you have additional questions, Mr. Cardoza.

Mr. CARDOZA. I will have, Mr. Chairman, but I thought I'd let the rest of the Panel——

The CHAIRMAN. I'm going to recognize Mr. Miller for a second round of questions at this point.

Mr. MILLER. Thank you. Mr. Harlow, I don't want you to think I'm picking on you here, but you have the most extensive statement here which kind of I think leads us through the process here and the components of it. I'm just trying to figure out the interaction of this.

As I said in my opening statement, I think all of your contributions are incredibly important to unlocking this problem. I'm also concerned how policy lays over the top of that when we get—Congress doesn't always accept the best evidence. That may be news to some people, but probably not the scientists. And so I'm concerned about those overlays.

And you say that in March 2004, you concluded that delisting was not warranted and that the species continued to be threatened with extinction and that you're revising your 1996 recovery plan. Is that still work in progress?

Mr. HARLOW. Yes.

Mr. MILLER. I assume that's being influenced by what's going on here at the table and out there in the Delta?

Mr. HARLOW. Absolutely.

Mr. MILLER. OK. The other one, you make a decision, you make a comment, I don't like to paraphrase, but on page 5 you say that your team has several adaptive water management tools that can be used to help protect the smelt, including, but not limited to the environmental water count, water available from the Central Valley Project Improvement Act, commonly known as B2Water.

What else is in that tool kit that you would summon up to use?

Mr. HARLOW. Yes, Congressman Miller, I'll try to remember all the environmental water tools that are available, but we have the ability to carry depth in San Luis Reservoir, the State Water Project will carry depth.

We have the ability to change some of the hydrology by opening or closing the cross channel gates. And we have——

Mr. MILLER. So those are operational calls that you make?

Mr. HARLOW. Operational and we can—timing shifts.

Mr. MILLER. Let me ask you, one of those obviously, I guess is you can recommend a slowing down or a timing of exports in the fall or the winter, different times, right? Is that correct?

Mr. HARLOW. Correct.

Mr. MILLER. And Mr. Chotkowski, I'll go to your paper, you made a decision I think in January '05 that there should be a slow down of the pumping at that time that the Service or the Committee made. That was not adhered to, is that correct?

It was modified from the original recommendation?

Mr. HARLOW. Probably better if I respond to that one as well. The action I think principally there was just a delay in its implementation and then by the time it was implemented——

Mr. MILLER. When the water is flowing through the pumps, delays are a big deal.

Mr. HARLOW. There are difficulties that the project agencies have to deal with in terms of setting up timing of changes in pumping and addressing power changes and the like.

Mr. MILLER. And the same true in April '05, right? Made a recommendation and that, too, was changed, correct?

Mr. HARLOW. That was May.

Mr. MILLER. Was that May? OK. I just want to go to your response to Mr. Cardoza and Mr. Radanovich that you did this time average study apparently based upon your understanding of the science at that time, you thought that that would make sense to slow down or to change the pumping regime that was called for at that period of time.

I don't quite get how we're going to determine whether or not the pumping is a problem that can contribute to the solution if we're not following the science and the current operation.

I don't know what impact that has on your study because you say you don't know the downsides of the most important periods, and you magnified the impacts of the least important areas when you do your time averaging. So we have recommendations for scientists throughout the year that maybe the pumps ought to be modified because of conditions in the Delta. Those aren't followed. How do we know then what the study tells us?

Mr. HARLOW. Actually, the first thing I'd have to say is that the recommendation you're referring to, January of '05, predates the study that I was describing, so that information was available then.

Mr. MILLER. OK.

Mr. CHOTKOWSKI. All I can say about the effects of pumping is that it's pretty clear that it's complicated and it depends a lot on a lot of small hydrological details and so I think as far as the smelt working group is concerned, any recommendations that we might make as scientists are based more in a sense of precaution about doing things that we think might be important, but which we don't really——

Mr. MILLER. I think that's the way you should operate. I mean you're here with the fish that had an indices of a thousand and it's now at 26 and you have apparently some determination within this working group that we ought to slow down the pumps for five days or we ought to delay the pumping, the increase in volumes for some period of time, some modification of that and yet policymakers, apparently override that. And yet, we're told that this is a very delicate thing and it contributes to it. We don't know how much and yet we're not following the science.

I'm just trying to determine here—we can keep talking for sound science, but then when we don't follow what may be the best available science at the time or the best hunch, if you will, based upon that science, it's not followed.

Mr. CHOTKOWSKI. All I can say is that the issues that arose in '05 predated the studies, so there isn't a question of whether this science was being followed. Other than that, I really can't comment on it.

Mr. MILLER. Well, should these recommendations be overridden, when we're in this time, when we're trying to hold on to what may now be an endangered species?

Mr. CHOTKOWSKI. I'm a scientist and I can't answer that. That's a question that should be addressed to the policymakers.

Mr. MILLER. Well, the problem is that if you continue on through your statement, Mr. Harlow, you talk about making real time decisions, that you're trying to get the science in shape so you can make some real time decisions because we know conditions change for a whole lot of external reasons within the Delta, but if you can't—if those real time decisions aren't followed, that's not going to work out very well.

Mr. HARLOW. Yes, and working with the California Department of Water Resources and the California Department of Fish and Game and the development of the Delta smelt action plan which came out, I believe, this last spring, not quite a year ago, one of the things the Department of Water Resources looked into was their ability to implement actions more quickly. And basically, they've changed the rules and they, in an emergency situation, they have committed to being able to change pumping rates at the state facility within three hours.

Mr. MILLER. If they decide to do so. I mean that's the problem. Again, you make the recommendation, they can decide to do so or not do so. It's not a binding recommendation.

Mr. HARLOW. Well, they control the pumps ultimately——

Mr. MILLER. There's big systems where there's an overriding concern. In the airline industry, it's getting the planes out on time, so you start to override. You have to have ways people can say wait a minute, we think you ought to check the engine.

In the oil business, ships leave on time, you know. In this case, obviously, the export of water that is vital to the entire State of California is a driving force. And the question here is whether or not the best science that we're developing as is determined under an adaptive management program can provide a circuit breaker at various times because the scientists determine it's critical to do that, maybe if only to learn something. But it doesn't appear that that's how this system is, in fact, really set up. It's going through modifications and I appreciate that. I think it's important and it's going through modifications because of the lawsuits or at least there's some question of whether or not that criteria was correct or not.

But if it's just going to be overwhelmed by the adherence to the export of that water without determine whether it can be modified in time and place or total amount or with the rest of it, I'm not sure you can cure these problems, whatever you find out about the clam, the herbicides and the rest of these things that are taking place.

Thank you.

The CHAIRMAN. Ms. Napolitano?

Ms. NAPOLITANO. Thank you, Mr. Chair. Mr. Harlow, your statement states that the agencies can address pumping effects within the existing operational criteria and assets.

Would you explain that, please?

Mr. HARLOW. Yes. What that means is if we have the tools that I mentioned in response to Congressman Miller, plus we have what's called the Environmental Water Account which is basically a checkbook that the fishery agencies have available to reduce

pumping rates for protection of fish and then reimburse whoever has essentially lost that water supply at a later time. And that actually is part of the reason that the timing of pumping of water that Dr. Sommer referred to has shifted is because we'll typically reduce during the springtime when there's considerable fish movement in the Delta and then reimburse that at a later time in the fall. And then there's, of course, the water available under the Central Valley Project Improvement Act, referred to as B(2), although it's a secondary purpose, we can apply B(2) at pumping reductions at the Central Valley Project facility.

Ms. NAPOLITANO. Thank you. Mr. Chotkowski, how much funding money has the Bureau asked for in the Fiscal Year 2007 budget for the work of the inter-agency ecological program and the pelagic organism decline study and who is responsible for paying for them and where does the money come from? Does it come from the taxpayer, water users, CVP restoration and does CALFED pay for any of these studies?

Mr. CHOTKOWSKI. Yes, ma'am. I don't want to be disappointing, but I don't know the answers to some of your questions. I only know how much we, as scientists, have asked for from the program.

Ms. NAPOLITANO. Which is how much?

Mr. CHOTKOWSKI. Actually, Chuck Armor can probably answer that down to the dollar.

Do you mind if I pass it off to him?

Ms. NAPOLITANO. No. Please, whoever can answer it.

Mr. ARMOR. In terms of funding coming into the program for 2006, the Bureau of Reclamation is putting in about $4,230,000 into the IEP part. They are also putting in—I'm sorry, $4,062,000 into the IEP part and $1,847,000 into the POD part.

Ms. NAPOLITANO. That's '06. What about the request for the '07 budget?

Mr. ARMOR. The '07 budget, I don't know. I am dealing, the only budgets I'm dealing with is getting the current year in and running. I think it's safe to assume they're asking for an equivalent amount and with possibly some additional on top to account for cost of living increases, but I don't know what they've asked for.

Ms. NAPOLITANO. Well, knowing full well or at least you have already signs that you're having a problem, you're not asking for an increase to be able to cover any of those cost studies for the expansion of the research?

Mr. ARMOR. The directors, when we've gone in and asked for additional funding, they have made it available and they've told us—I'm not going to say in three years I need another $10 million because I don't know if that's going to be the case. What I do have from the directors when I walked in last year and said I needed $1.7 million, it was on the table right there. When I walked in this year and said I need $3.7, it was there and they've made the commitment to us, tell us what resources you need and they will get it for us. So that's a construct under which I'm working and so far that's—now what their budget, I know on the Federal side they have to budget a number of years out. I don't know what numbers they're using there.

Ms. NAPOLITANO. Is anybody looking at the ways we can cut back on the use of the pesticides, is that a part of your study, since we know that it is toxic?

Mr. BREUER. Part of the problem is that you can determine a contaminant is toxic and its location it's being used, but our issue is how to make that connection with the pelagic fish decline. So that's why we have what we call that fish-up approach, where we're really looking to see if we see any toxicity in the Delta to not only the fish, but the smaller organisms which might give us an indication that the food chain has been impacted.

If we don't see that toxicity, there's no reason to chase after a contaminant, if we don't see the effect.

Ms. NAPOLITANO. That's interesting, because this morning there was a program in regard to water funded by many of the water agencies which was talking about the—kind of the domino effect, if you will, of the contamination being whether it's at lower level, be eaten by a larger fish who gets eaten by a larger fish and it increases the toxicity. That's an issue, is it not?

Mr. BREUER. Certain contaminants can be moved up the food chain. They accumulate within the food chain. Other contaminants have an acute effect, in other words, they basically create their effect, but are not absorbed by that lower food chain and passed up. It's very, very particular to specific types of contaminants.

Ms. NAPOLITANO. And those are?

Mr. BREUER. They can be passed up the food chain, I'm sorry? As far as our investigations, we're looking to see whether or not we're seeing toxicity to the pelagic organisms or components of the food chain in the Delta itself.

Ms. NAPOLITANO. That should be part of the study or is it?

Mr. BREUER. It is part of the study, yes.

Ms. NAPOLITANO. Will the fish be harmed even more if the pumping is increased as called for in the CALFED ROD record decision in the OECP?

Yes, no, maybe?

Mr. HARLOW. Congresswoman Napolitano, I think that's one of the three key areas that is being looked at by the group that's assembled here. We won't know the answer to that until the studies are completed.

Ms. NAPOLITANO. And the studies should be completed when?

Mr. HARLOW. Do you have a date for your analysis?

Mr. CHOTKOWSKI. There is no end date at which we can confidently predict that we're going to have the answer. We're making progress, but the nature of science is that it's got all sorts of unexpected twists and turns and there's a lot of work to do.

Ms. NAPOLITANO. Understood, but there is a crisis that this area is facing and unless we start working, seeing what the results are and taking action, as you well know, the government works very slowly in responding.

Mr. CHOTKOWSKI. We agree there's a crisis and that's we're taking a full court approach to addressing this and so far we've gotten complete support from our agencies to do as much as we think we need to do. Resources haven't been an issue up to this point.

Ms. NAPOLITANO. Again, I go back to knowing how government works and how the agencies sometimes banter back and forth to be

able to come down to the actual results and the solution. So are you working so that that can come up to the forefront as immediately as possible so that this issue can be looked at and worked on not two years from now, but rather hopefully sometime this year?

Mr. ARMOR. One thing that we've made a commitment to and I alluded to this in my testimony, is that as we learn information we're not waiting until the end of the year to put it into a report and submit it. What we're doing is as we learn things that we see will have an—that can have an impact on policy and management decisions, that will be elevated immediately. It will go through our internal review process. It may go through some peer review, but it will be made available as soon as we can get it up to our directors and out.

We're not waiting to put stuff into a big report that tells us. As we find pieces along the way that will be useful in management decisions, they will be made available.

Ms. NAPOLITANO. But who will be responsible for ensuring that action is taken, positively to change the effect of what's happening now? Because if you a higher echelon that says OK, here's the report. It got buried.

Mr. ARMOR. That's the policy and management people that are doing that. We'll provide them the science and our recommendations and they make the call on what they do with it.

Ms. NAPOLITANO. Thank you, Mr. Chair.

The CHAIRMAN. Mr. Cardoza.

Mr. CARDOZA. Thank you, Mr. Chairman. As I sit here, I have an observation that we have some of the world's experts in biology of the Delta sitting in front of us and what I take is that we know a lot more about what we don't know than what we do know exactly. And that is a very difficult position for someone like myself. It makes it easy for those on both sides of the issue, those who have had a historical perspective that additional pumping should take place, can use the lack of information to their advantage; and those folks who have historical anger about the fact that there's any pumping going on at all can make their own case that we should stop everything today until we find out exactly what's going on.

Myself, as a moderate Member, some say I'm a raging moderate, that tries to find the truth and I really appreciate the perspective and the hearing that Mr. Pombo and Mr. Miller have put together here. It's important for us to convene these and do examinations and frankly, we have to take into serious consideration both sides.

And I guess what I'm looking at now is how do we as policymakers try and figure out the correct course based on the amount of knowledge that we have in front of us today? And I'm looking back at some of your testimony, Mr. Harlow, and on December 9, 1993, you testified that Endangered Species Act was enacted and Delta smelt was listed as threatened during that period of time, around fall of 1993. And then I recalled in my previous question that in 1997 or '98, that period of time, we saw a tremendous increase of Delta smelt and to the point we were thinking hallelujah, this may not be a problem after all. We thought that for a period of time.

And then now we've seen the numbers crash back down, according to Mr. Miller's quote and some of the other testimony. I guess my question—and based on some lawsuits that took place by the Farm Bureau and San Luis Delta Mendota Water Agency, your organization is going through a five-year review of some of the listing questions and some of the processes.

Mr. Harlow, could you please inform us the process and time line of the Service's review of the recovery plan and what you see might come out of that review?

Mr. HARLOW. OK, Congressman Cardoza, our status review actually was completed.

Mr. CARDOZA. It is.

Mr. HARLOW. Yes, that was completed and my apologies, I can't remember the Court date, but it had to be submitted to the Court. That was done and we were just commencing preparation of a revision of the recovery plan.

Mr. CARDOZA. That's what my question was.

Mr. HARLOW. Right, and we don't have a specific deadline. Typically, and particularly with one this complex, we will have a number of academic members and stakeholder representatives, they take typically a couple of years.

Mr. CARDOZA. And I open this up to the Panel, do you see tremendous benefits in shutting everything down so you can study, knowing the economic costs that the community could possibly have to export Southern California to the power plant losses, and if you all could give your best guess, what's the cost?

Is anybody willing to take that?

I think by the silence, we know a lot. Thank you very much, Mr. Chairman.

The CHAIRMAN. I appreciate the testimony of the Panel in your effort to try to answer the questions that Members of the Committee have. I think Mr. Cardoza is accurate in saying that we know a lot about what we don't know, but none of you are in a position right now to make policy recommendations that would carry us from what current policy is to what a new policy would be in terms of changing the laws. I mean I look at this and I'm somewhat concerned. Over the last 15 years, we've gone through a process of changing the timing of when we pump and how the pumps work and putting in fish screens and spending literally hundreds of millions of dollars and billions of dollars in lost economic activity. And it doesn't seem that any of that has worked and I think what we need to figure out is why.

Mr. Cardoza asked kind of rhetorically about shutting down the pumps and I don't think anybody would realistically say we're going to turn off the pumps completely, but the timing of when they pump and all of that was based on what we felt was the best science then and obviously there are policy decisions that are made. There are political decisions that are made that influence the final outcome of that, but it's based on what you or your colleagues have recommended in the past and that has a big impact on the health of the Delta, but it also has a big impact on the health of the economy of the State of California what we decide to do and what we don't do.

I am enlightened somewhat and hopeful that the tenor of most of this hearing dealt with the science and our effort to move forward has to be based on the best science we have. I know that it changes every day and that you find out new things every day and that has an impact on what the final report will look like, but we do need to at least allow you the ability to give us your best recommendation based on what you know.

We are the ones that have to make a political decision based on that science, but if the science is the best that you can give us and the best information that you can provide and recommendations you can provide, we at least have a solid basis to start.

I did not want this hearing to become another round of finger pointing and have the ability of people to come up and try and push their particular point of view which is why we tried to focus on you here today and I do appreciate all that you did. As we work forward on the policy side of this, obviously you and the rest of the members of your team will influence greatly what ultimately comes out of this, but I think we all can agree that we want a healthy Delta ecosystem.

We want the Delta to be environmentally sensitive and environmentally healthy. At the same time, I think most of us agree that it is an important part of our economy of the state for a number of reasons. And we can have a healthy Delta and a growing economy at the same time. I think that's the balance that I'm trying to find and I think most of the members of the Committee are trying to find. So I appreciate your testimony. I appreciate my colleagues being here today to—did you want another round?

Mr. MILLER. Yes.

The CHAIRMAN. I thought you were finished. I'll recognize Mr. Miller for another round of questions.

Mr. MILLER. Let me just say with all due respect to my colleagues, somehow this is a contest between those who would run the pumps full open and those who would shut them down. I hope you didn't spend any time modeling those two alternatives, since they're obviously unacceptable across the state. But the question really is, how do we operate this system in a manner that will meet the requirements of numerous laws about the health of the Delta and its species? And that's the challenge and I want to join in thanking you for that—for your participation in that effort.

And for us in Congress to think that well one year we got something good and the next year we got something bad, what does that tell us? I assume what we're concerned about here is certainly the last 20 years the trend lines are not great in these species. We have ups and downs, but the trend lines worries you here.

If I might, Mr. Nobriga, if I might ask you a couple of questions for purposes of edification, you say that the Suisun area is not the nursery that it used to be and you talked about the clams and that.

Could you just, in layman's terms, tell us where you are today in terms of do we get any relief when we have these high outflows from rain? Does the water flow shrink or expand nurseries or is it salinity which moves across that sort of mixing area in the western Delta, I'd guess you'd call it or the eastern bay. What do we think we know about this, this species and its impacts?

Mr. NOBRIGA. Are you talking specifically for Delta smelts or just the ecosystem?

Mr. MILLER. I guess I would start with smelt, but obviously the impacts on other species of interest to us, too. Just in layman's terms.

Mr. NOBRIGA. To a point, speaking for Delta smelt, more flow will generate more fresh water habitat for them to be in. Too much flow can actually be a bad thing.

Mr. MILLER. Is the fresh water then impacting the clam and is the clam moving with that barrier, that interface?

Mr. NOBRIGA. Oh, you know, unfortunately from what I think we've seen in our water quality monitoring, the clam is just kind of perfectly adapted to the brackish water.

Mr. MILLER. OK, so it's——

Mr. NOBRIGA. Really, really fresh water could displace it, if it was prolonged and really, really salty water could.

Mr. MILLER. But those are subject to pulses?

Mr. NOBRIGA. Right.

Mr. MILLER. Next year's rainfall is not going to determine that?

Mr. NOBRIGA. Yes, the clam seems to just be there, whether it's a high flow year or not so much of a high flow year. Its effect might be mitigated a little bit by high flows, but it doesn't seem to come back to what it once did, even then.

Mr. MILLER. So the interface of the clam and the smelt is what?

Mr. NOBRIGA. The direct connection of the clam to the smelt hasn't been made. Smelt sizes in the fall are smaller, since the clam has been here, than they used to be, but—excuse me, than they were prior to that. But the abundance numbers haven't tracked the clam. Delta smelt seems to have declined or started declining before the clam got here. So that doesn't mean the clam didn't put a cap on it. It just means something else caused it to go down first and now you may or may not see a clam effect.

The clam effect is more obvious on long-finned smelt and striped bass which are two of the other.

Mr. MILLER. And that's caused by?

Mr. NOBRIGA. Presumably it's caused——

Mr. MILLER. Competition for food?

Mr. NOBRIGA. Yes, food. But that's an assumption.

Mr. MILLER. And that's——

Mr. NOBRIGA. Probably a decent assumption based on the data we have.

Mr. MILLER. That's why I'm asking, from what you know today, you think that's what the clam is doing is it's competing for——

Mr. NOBRIGA. Yes, stealing the productivity. Putting it into clams instead of allowing it to become fish.

Mr. MILLER. Thank you, that's helpful. On the question of exports, we used to have sort of a raging controversy over in Glen Canyon and the question is what's happening to the Colorado River and decisions were made to try some different regimes to see what the impacts would be downstream. Some of it was about sedimentation and some of it was about fish and some of those concerns that were there when we put the dam in. And we ran a number of models. They're not models. We ran big flows, small flows back and forth and tried to see what was happening down

there. It was fairly controversial, if I remember at the time with the power companies and the loss of generating capacity at that time.

Are we doing any of that kind of effort with the pumps here? When Fish and Wildlife makes the decision that it might not make sense to pump at this particular time, this number of days or this season, what have you, when that—is that studied at that time to see what's taking place as a result of that recommendation, if it's followed?

Mr. HARLOW. The recommendations are based on what we know about the fish and the hydrology at the time and we monitor that——

Mr. MILLER. It comes with the monitoring component?

Mr. HARLOW. Yes, I mean the whole program here is an on-going monitoring program and so in terms of kind of a research model like you're speaking of, I do know a little bit about that because I worked in Arizona for a number of years and I would say it's not comparable to that type, where you have extreme events that, of course, Glen Canyon, you have an advantage because you can still capture the water. So you could have extreme events and then catch it at the lower end.

Mr. MILLER. When you're monitoring this, are you building a model as you have these, make these—it's tough. I'm into deep water here. In the sense that the years are all different in what's going on in the Delta. We keep talking about this as one of the most complex hydrological systems that we're trying to deal with. Is there an ability to start to build on this knowledge, to build on these recommendations? Was that right? Was it wrong? Should it have been longer, shorter, different? Is that effort being made so we can sort of look back and see what decisions made sense or didn't make sense or is it just the water years are too different to put much stock in it?

Mr. MILLER. I think the analyses that Dr. Chotkowski and Dr. Manley are working on help with that. And all these gentlemen probably know more how to respond to you than I do from the scientific methodology, but we do have a grant that's been awarded by the CALFED Science Program to develop a Delta smelt model and I believe the data, coming from these studies can complement the model so that we can better assess what actions are most beneficial at the population level, once that model is developed and tested.

Does anyone else wish to respond to that?

Mr. SOMMER. There's a couple of things we can do. We take the data that we're observing in the field and try and make a model out of that and there are also examples of adaptive management where you do experiments with the entire Delta. That's being done right now every year for salmon with the Vernalis Adaptive Management Plan.

I think our managers would have a concern with too many experiments going on at one point. That's already a big one and we need to run that one long enough to be able to learn from that. That may be useful though for learning about Delta smelt and striped bass responses as well.

Mr. MILLER. My concern is, I obviously hope, no way believe I'm cavalier in raising the issues about exports that are alluded to in some scientific work and my concern is that, as I said, you wouldn't add more clams. Well, we have a policy decision that has the expectation of increased exports through the pumps in one form or another and so it would seem tome just as you would want to figure out what's going on down there and the complexities with the clams or what's going on with the herbicides, you've got to figure out what's going on here today, so you can make a rationale, scientifically based decision about future protocols in terms, in the terms of the exports from the Delta. And there may be a lot of other alternatives than those pumps, that configuration, whatever it is.

And I'm just trying to determine that this isn't and I recognize and I'm pretty well steeped in the politics of this, I'm just trying to make sure that this hasn't been taken out of the equation or that we raised all of the complexities and therefore it really doesn't make sense to look at this because there's all this other stuff going on out there in that system and this is just one part of it.

I'm just trying to make sure that when we're doing this investigation that one is comprehensive and that all of the questions that are being raised by you and others are subject to that full investigation. That's my concern here. And again, I appreciate that some of the policy and political concerns are made outside the realm of scientific inquiry, but it's important that these recommendations be given a chance to see whether or not they make an operational difference, they make an improvement or they diminish the health of the Delta. Otherwise, I don't know how the scientists can't do this. You can't say based on our recommendation we should go forward and look at this, how you ever get to the end of the story here with any credibility.

Mr. CHOTKOWSKI. Congressman, I just want to point something out that no one has brought up that actually is something that's going to be very helpful to all of us and that is particle tracking and other hydro-dynamic computer models of Delta operations are getting much more sophisticated and we're able to model things now that are getting progressively more able to model things in ways that we never could before.

And so it's entirely possible that some of the experiments that some of us scientists would have loved to do, greatly modifying operations in the Delta are actually going to be possible to be done in a virtual way by computer fairly soon and that should be a big help.

Mr. MILLER. Modeling is controversial in this Committee, but we'll set that aside for a moment.

[Laughter.]

Thank you and thank you for the additional time, Mr. Chairman.

I would like to reserve the right of Members of the Committee to submit some additional written questions as we look at this transcript. And I would hope that this is the first in a series of hearings about the on-going operation of this. I think everybody in this room understands how central this is. I do not believe that the people of this state, whether they're from the north or the south, we've been through some of those skirmishes, are going to make

this a national sacrifice area in its operation. I think the struggle that you're involved in is strongly supported by people who understand the ramifications of the failure, of the collapse of this system.

A couple of you have said this just isn't about this species. This is about this environment. And that environment holds a huge amount of value to this entire state and it's—that's the basis on which the laws were changed, was to make sure that we went back from a very narrow tunnel vision of responsibility of the north just to keep sending water south without looking at the ramifications.

And it was clearly a lot of agreement and that's why you have CALFED—that we had to go back and make this effort at restoration. It hasn't been perfect. It hasn't been cheap, but I'd like to—someone can look at these graphs you've brought us and look at what that trendline would be if some of these efforts weren't made on behalf of the fisheries that go through the Delta.

That's really what it's—there is a charge to put this system right side up on a sustainable basis for the environmental quality and for the species that move across it or reside in it. That's pretty clear. That's the current law. And some people want to change that and we can debate that at policy, but right now that's kind of the operational construct here that we get on an even footing here for these other values, other than just exports.

Mr. Chairman, I think this has been a good beginning, but we certainly have a ways to go and I would hope that we could work with you to try to develop other hearings that would lend to our understanding and consideration of what some of the solutions might be when they're presented to us by the scientists and others.

Thank you.

The CHAIRMAN. Ms. Napolitano, do you have any questions?

Ms. NAPOLITANO. Just to add on to what my colleague is talking about. Part of what—I've been involved with the Colorado River, the Moab issue, the salinity issue on the Colorado River. Is that—and of course, the other issue is the effluent pumped by the cities into the rivers and into the aquifers—not the aquifers, but the waterways, that does have an impact on the life and the evolvement of your fish, of the health of the fish.

Are all releases back into the river being treated before they're released? Any way to be able to gauge whether or not any of that is affecting the health of the fish?

Mr. BREUER. As we shift from agriculture to urban and our watershed, this is becoming a bigger and bigger concern for us, the expansion of waste water treatment and urban runoff is a growing concern that needs to be studied more. And that falls under the Clean Water Act and so those arms of agencies such as the State Water Resources Control Board or U.S. EPA need to address those issues so that——

Ms. NAPOLITANO. Are you working with those agencies? Because I don't see CAL EPA or the Federal EPA here.

Mr. BREUER. Yes, both the 2005 work involved both those agencies.

Ms. NAPOLITANO. What about current work?

Mr. BREUER. Yes. Both U.S. EPA and the Regional Board are represented on our project work team as well as academia.

Ms. NAPOLITANO. Is there—there's a mention in one of the reports that there may be some leakage of saltwater that may be causing some of the problem. Is that anything else going into that? I read it in one of the reports. Don't ask me where because I started last night.

Mr. BREUER. Can you give us a little more? I'm not too sure what you're referring to.

Ms. NAPOLITANO. It indicated there might be some leakage of salt intrusion into the Suisun area at least, if I remember correctly, that was in one of the reports.

No? I'll submit it to the record to you and that way you can take a look at it and work it out.

Are EPA and the agencies working together to identify any major dumping that may be causing part of the contaminants anywhere?

Mr. BREUER. Once again, under the Clean Water Act, the permitting and discharge of contaminants falls underneath, in this case, the State Water Resources Control Board and the regional boards. So to that degree, to the degree they're able to have the resources to carry that out, yes.

Ms. NAPOLITANO. Well, is this another case of agencies not talking to each to compare notes?

Mr. BREUER. Absolutely not. We coordinate with them closely and this has been a huge concern and like I said actually on the synthesis report, scientists from U.S. EPA and scientists from the regional board actually helped write the report and the work plan for next year.

Ms. NAPOLITANO. Because I'm with my colleague, Congressman Cardoza, because we both served at the state level at the same time and I can remember the Sacramento River being polluted by the discharge of the motor boats and the boats—remember that? That was an issue that was causing some of the damage.

Has part of that study been taken into consideration or is there something else that can be done to prohibit the continued use and contamination by the gasoline, the different oils that are spewed into the river?

Mr. BREUER. We've looked at hydrocarbons as an issue and after the MTBE—MTBE was a big issue with groundwater and during that same time we did a very intense study of MTBE in the surface waters and it's not a problem.

Ms. NAPOLITANO. Surface waters. What about rivers?

Mr. BREUER. That's what I mean. Within the watershed of the Delta, the surface waters including the tributaries. MTBE is not a concern.

Ms. NAPOLITANO. Thank you. Like my colleague, I would certainly like to have some questions submitted for the record.

Thank you.

The CHAIRMAN. Mr. Cardoza?

Mr. CARDOZA. Thank you, Mr. Chairman. I want to follow up just a little bit on Ms. Napolitano's comments because I remember when we were serving on the same Committee together, and the testimony at that time was that there were budget cuts at the state level that were precluding the ability to take off wrecks or different things that were getting into the river. In fact, anglers were complaining to the Committee that there would be a wreck or someone

would throw a vehicle over the levee and into the river and it would sit there for 10 years and leach heavy metals out of the batteries and all the rest.

Your information is not showing that that has any effect?

Mr. BREUER. Well, I'm trying to contain my comments regarding right now to the pelagic organisms and for example, Delta smelt has a very short life cycle. There are things that might, like a long-term contaminant concern like the old organic chlorines like the DDTs that accumulate and hang around for a long time may not necessarily accumulate an organism that has a very short life.

As you know, we've tried to, through the history of contaminants such as agricultural and chemicals, we've tried to move away from these chemicals as we've learned that they create an environmental problem. The use of pyrethroids is an example of that. We've moved away from the organophosphates such as Diazinon and chlorvirophos because of our concern over mammalian toxicity. We've gone to something—pyrethroids has a very short half life, relative life and has a very low mammalian toxicity. The problem is it can be very toxic to aquatic organisms.

The question is does that find its way down into the Delta? That's why we're asking ourselves do we see toxicity in the food chain and the fish? If we do, then we'll go back and identify the contaminant and then move our way up into—one of the tools is regulatory process to reduce the use or eliminate that.

Mr. CARDOZA. I guess I want to hone in on this a little bit because do you think that's a greater threat to fish populations than five or six junkers who lose their entire load of antifreeze in the river? And I guess those are the kinds of questions, is anyone studying the other effects because I see it happening. I see an increase in that population of problem and I wonder if those other things are being considered as part of the study.

I want to piggy back this with my second question which was really what I wanted to sort of delve into was is there any other activities that we should be looking at, is there other studies that we should be conducting to find out other potential causes? Because I really want to know the truth. I don't want to know that we're going to focus all our attention on pumping when that's a 6 percent problem and there's a 94 percent problem over here that we're not addressing.

Now if it's pumping, let's deal with it. But if it's toxins, let's focus on that. And I want to know which toxins and how to deal with it in order to make good policy decisions. And that's the frustrating part that I have most commonly is I'm not convinced that we're looking in the right areas and I guarantee you all that when we find the right areas, I'll join with whatever side it is to make sure that we have a healthy Delta. There's no question. Mr. Miller is absolutely right about that.

We, and the world, deserves a healthy Delta. The question is are we looking in the right places to find out what's making it sick?

Mr. ARMOR. I just want to follow up on one that Rich alluded to. We're doing bioassays. We're collecting water from across the Delta. And as we're looking, and we're doing this across the whole year. Last year, we were only able to do it during a short period of time. If there's a toxic event occurring in an area, hopefully, this

will pick it up and will help us go back and start pinpointing it and we will start zeroing in on that. With the use of the TIEs that will help us hopefully identify the toxicant so that we can even more zero in on it. And once we start identifying these events, we will start focusing down on them, but we're looking across the whole Delta right now to see what's going on in the broad scale and if we find stuff, yes, we're going to focus in on it and go after it.

Mr. CARDOZA. In closing, I remember when I was living on the Delta when I was living on the Sacramento River and that was particularly low one year and I blew out the propellers on my boat going across a sand bar. I spent a few hours watching the river go by that day and I will tell you that I saw on more than one occasion automobile and boat batteries sitting in the bottom of the river. And it makes me wonder if these are lead problems or it really makes you wonder as we as a society use that wonderful estuary as a dump site, is that causing problems that you're not looking at because we're so focused and all the money and the studies are going into flows or this or that.

What are we doing on those other fronts? And I just don't know that we've gotten great answers on that today.

Mr. BREUER. I'd say we're not being tunnel-visioned in our look at contaminants. I think we're tapping all of those agencies and experts, both in the bay and the Delta that have on short-term and long-term monitoring permits to try to identify these issues.

And sometimes something seems very dramatic like a car battery or whatever, but you also have to remember that even in a low-flow period, there's tremendous dilution that goes on and so an event like that may seem significant, but in the overall total volume in the Delta and the eventual concentration that might reach into the food chain or in the fish, it actually means very little.

Mr. CARDOZA. When you talk about the pyrethroids, for example, does that same dilution apply to them and what, when you're measuring the levels in fish, is it small parts per billion or are you seeing accumulations that are significant?

Mr. BREUER. As I said, one of the challenges of pyrethroids is they don't easily mix in the water column. They like to hold on to soil particles. And so we don't see, you not going to easily find that. If we just test the water, you may not see it.

Mr. CARDOZA. You're not finding them in the fish livers or in the—you reported earlier that there was damage to some of the fish livers and you're not finding that?

Mr. BREUER. What may be causing that is not clear. It could be—that's the problem with the histopathology that it could be both stress from food issue or it could be from the actual contaminant causing the acute effect, but like I said, a lot of these chemicals, especially agricultural chemicals, they don't accumulate and stay long-term in the environment. They have shorter, what's called a half life where they break down quickly into more natural or organic components as opposed to the long-chain chemicals we used to have in the organic chlorines.

The CHAIRMAN. The Members of the Committee have expressed an interest in submitting questions in writing. Those questions will be submitted to you and if you could answer them in writing so that they can be included as part of the hearing record.

We will hold the hearing record open for 10 business days to allow you the opportunity to respond to those questions in writing.

If there is further testimony, I know that a number of people that are here today had expressed an interest in commenting on the hearing and on the topic of this hearing. If anyone would like to submit testimony, written testimony to the Committee, we will hold the record open for 10 business days to allow you to opportunity to do that. If you could pleas submit those comments to the Committee on Resources, 1324 Longworth House Office Building in Washington, D.C. or fax them to 202/226-6953. But I believe the easiest thing to do would be to go on resourcescommittee.house.gov and that has all of the information on it for anybody who would like to submit testimony.

Again, I would like to thank our witnesses for their testimony today, for doing the best they could in answering the Committee's questions.

I thank my colleagues for being here today and participating in this hearing. Obviously, this is a complicated issue. It is not going to be boiled down to 30 second sound bytes, nor is it something that could be settled by going after one particular problem or another.

I think we all learned a lot here today about where we are in terms of the science that's been collected and what some of the questions are. I know I have questions in my mind that we need to pursue as we move forward on this and I'm sure the other Members of the Committee do as well.

Again, thank you. Thank the Members of the Committee.

If there is no further business before the Committee, I again thank the Members of the Committee and our witnesses and the Committee stands adjourned.

[Whereupon, at 10:30 a.m., the hearing was concluded.]

[Additional information submitted for the record follows:]

[A statement submitted for the record by the American Sportfishing Association follows:]

Statement submitted for the record by the American Sportfishing Association

The American Sportfishing Association (ASA) appreciates the opportunity to submit the following statement for the record to the House Committee on Resources at its February 27, 2006, field hearing to examine the Declining Fisheries Populations in the San Francisco Bay- San Joaquin Delta.

The American Sportfishing Association (ASA) is the National Trade Association for Sport Fishing headquartered in Alexandria Virginia. It unites more than 650 members of the sportfishing and boating industries with state fish and wildlife agencies, federal land and water management agencies, conservation organizations, angler advocacy groups and outdoor journalists. The American Sportfishing Association safeguards and promotes the enduring social, economic and conservation values of sportfishing.

The ASA appreciates the Resources Committee interest in examining the causes of the dramatic decline in the Delta fisheries. The Association is deeply concerned about the declines in these fisheries and believes that a strong commitment is required to fix the problems and begin the restoration of the resident delta fish populations including the delta smelt, striped bass, threadfin shad and longfin smelt. We believe the same commitment should cover those species of fish that migrate through the Delta and are heavily impacted by its health including the endangered winter run chinook salmon, the spring, fall and late fall runs of chinook salmon, steelhead trout, American shad and white sturgeon.

The ASA understands that there are several factors that have contributed to the decline of the Delta species. We applaud the scientific efforts to isolate these factors and to develop corrective actions. However, we believe that there is little debate that early water development did not take into account its impact on fisheries, and has therefore been a driving factor in devastating the fish runs. There has been more than forty years of fish population declines associated with water development. These declines occurred long before exotic species and other factors now affecting the Delta were in existence. One only has to examine the recovery plan for the endangered winter chinook salmon to understand the linkage between water development and fishery declines. The winter run is recovering. It is doing so primarily because those water development projects that were severely impacting the fish have been addressed. These include modifications to the State and Federal Delta pumping schedules, the repair of Shasta Dam to avoid lethal water temperatures in the spawning grounds, the opening of Red Bluff dam to allow fish passage and the screening of water diversions to avoid juvenile fish kills. These changes solved many of the fish problems with little or no impact on water deliveries for other uses. We urge that the Delta fish problems be addressed before other water development plans are considered or implemented. We are concerned that there may be attempts to abandon fish considerations as various interests move to secure water. We encourage the Resources Committee to maintain the balance so that whatever steps are taken involve the recovery of the Delta fish as an equal objective to any other considerations.

Until the last few years, a number of the Delta and Central Valley fish species were recovering from years of decline. The American Sportfishing Association credits two Federal Acts as the primary vehicles which brought this recovery about.

In 1992, the Central Valley Project Improvement Act made the maintenance of fish runs an equal objective to the other parts of the original Act which included water development for agriculture, water for municipal use and flood control. As a result, many fish runs have steadily improved. The 1992 changes had strong public support in California and we believe this support remains equally strong today.

The Endangered Species Act had a great impact in saving the Sacramento River winter run of chinook salmon. In 1992, just a few years after the fish had been declared endangered, only 191 fish returned to the upper river to spawn compared with more than 50,000 in the 1940s and 1950s. Last year, in 2005, the runs reached a modern day record of more than 15,000 fish. The Endangered Species Act resulted in modifications to several projects and led to the implementation of a number of very positive river changes that allowed improved spawning.

Fish and fishing are big business in California. At $4.9 billion dollars annually, California ranks second in the country in economic impact from sportfishing, exceeded only by Florida. California has 2.4 million anglers who fish 26.6 million angler days per year. All of this results in an economic impact of $2.4 million in direct expenditures, $1.2 million in salaries and wages, 43,130 jobs, and $456 million in state and federal taxes each year. With improved fisheries this impact would undoubtedly greatly increase.

Most of the fishing in California is in Northern California. Trout are the primary species targeted, followed by bass, salmon, striped bass, kokanee and other fresh and salt water species. Hundreds of small California coastal and mountain communities rely on fishing as their primary economic engine.

Sportfishing is the 4th most popular outdoor activity in America. It is exceeded only by recreational walking, recreational driving, swimming and picnicking. Fishing dwarfs activities like golf, hunting and motorcycling. Approximately 45 million people fish each year. One in ten Americans owns a fishing license. Given the importance of sportfishing to the American way of life, as well as its economic impact, we appreciate the attention the committee is giving these issues. We look forward to working to resolve these issues fairly for all parties.

Thank you for your consideration of our comments.

[A letter and report submitted for the record by William (BJ) Miller, Consulting Engineer, Berkeley, California, follows:]

FEBRUARY 26, 2006

The Honorable Dennis Cardoza
House of Representatives
Washington, DC 20515

Dear Congressman Cardoza,

Thank you for your interest and engagement in the important issues we're faced with in the delta. The following is a response to some of the questions that you have raised. In addition I have attached a White Paper on the decline of the Delta Smelt. For the reasons set forth below, we believe the 2006-2007 Pelagic Organism Decline (POD) Work Plan requires a sharpening of focus to increase the chances of identifying and correcting problems and to ensure cost-effective expenditure of public funds on this important problem.

The POD involves only four fish caught in the Fall Midwater Trawl survey and zooplankton in a limited range

The POD effort began with the perception of a recent ecosystem-wide decline of pelagic (open water) organisms in the Bay/Delta system. On closer inspection, there was no evidence of a recent system-wide decline in phytoplankton (small floating plants) and bacteria at the base of the pelagic food chain. Initial impressions of a system-wide decline in zooplankton (small floating animals) were based on incorrect data. There appears to be a zooplankton decline, but only in the western Delta and downstream. Data on fish abundance from the Bay Survey in San Francisco Bay did not show general declines. So, the POD problem actually involves declining abundance of four fish species (delta smelt, juvenile striped bass, longfin smelt and threadfin shad) in the Fall MidWater Trawl (FMWT) survey and zooplankton in only part of the estuary.

The POD program should focus on delta smelt as the key Bay-Delta species

The FMWT surveys most of the range of the threatened delta smelt, and everyone agrees the total population of this key species has declined. So, the POD effort should concentrate on delta smelt, the most important of the four species. As regards the remaining three species:

- Striped bass are voracious introduced predators on native species, and juvenile abundance in the FMWT does not correlate with adult abundance. So, the significance of a decline of juvenile bass in the FMWT is questionable.
- Longfin smelt range far downstream from the FMWT survey area, out into the open ocean. Abundance of longfin smelt has increased in the Bay Survey conducted downstream from the FMWT. Declining abundance of longfin in the FMWT may represent a shift in their population distribution rather than a decline in their total population.
- The introduced threadfin shad range far upstream from the FMWT survey area. Declining abundance of threadfin shad in the FMWT does not necessarily mean the total population of this wide-ranging introduced species has declined.

So, all we can say with certainty is that there has been a decline in abundance of one fish, the delta smelt, and zooplankton in the western Delta and Suisun Bay.

Success of the POD program requires a focus on factors other than water exports

In most years, some adult and juvenile delta smelt are entrained in CVP and SWP export pumps. However, despite years of effort analyzing decades of data, nobody has produced an analysis indicating that export pumping (or any measure of entrainment) and is important to the year-to-year or long-term changes in the key FMWT abundance of delta smelt.

In contrast, there is strong evidence that delta smelt are limited by inadequate food supply in late summer. At that time, the vast majority of delta smelt live near the confluence of the Sacramento and San Joaquin Rivers and further downstream. For years, there has been a mystery as to why the abundance of juvenile smelt in the summer, as measured by the Summer Townet (STN) survey, was not a predictor of the abundance of sub-adult delta smelt as measured just a few months later in the FMWT. This lack of correlation between summer juveniles and fall sub-adults means that the FMWT index is primarily controlled by events in late summer and not by factors, such as exports, acting earlier in the year. The fact that delta smelt are in areas more than thirty river miles from the export pumps at that time offers

some hint as to why water exports are not important to delta smelt abundance in the fall. In contrast, Professor Bennett (UC Davis) found that delta smelt caught in the STN have depleted levels of glycogen in their livers, indicative of starvation. Based on this information, the POD effort should concentrate on the following factors affecting delta smelt abundance in late summer:

1. Food availability

At this time, the introduced zooplankton species Pseudodiaptomus forbesii is one of the main foods of delta smelt. The core delta smelt habitat is in the Sacramento and San Joaquin Rivers near their confluence, near Chipps Island, and Suisun Bay. July STN abundance of delta smelt in those areas of the core habitat with adequate abundance of Pseudodiaptomus correlates with FMWT abundance of delta smelt better that any other variable studied to date. In fact, it is the only good correlation anyone has found between the FMWT abundance index and factors acting before the fall. In other words, if many delta smelt are in areas where Pseudodiaptomus are abundant, many smelt survive to the fall and the FMWT index is likely to be high. Otherwise, the FMWT index will probably be low. Therefore, declining abundance of Pseudodiaptomus in recent years bodes ill for delta smelt. The causes of the Pseudodiaptomus decline should be a major focus of the POD effort, because this is likely to be an important factor in the decline of delta smelt.

2. Toxic effects

In recent years, pyrethroid insecticide use has increased sharply in California. Pyrethroids, and microcystins released by the algae Microcystis aeruginosa that is increasingly common in the Delta, are both toxic to zooplankton and fish. Late summer and fall toxic effects of pyrethroids and microcystins on Pseudodiaptomus and delta smelt in the core delta smelt habitat should be another major focus of the POD program.

3. Other aliens

Other alien species are also candidates for investigation. The Amur River clam has migrated upstream and could be affecting Pseudodiaptomus in the core delta smelt habitat. Several other species have recently been discovered, and they could be competing with or preying on delta smelt.

4. Powerplant effects

Two large powerplants in Contra Costa County draw large volumes of cooling water from the estuary, right in the heart of delta smelt habitat. The associated effects of entrainment and discharge of heated, chemically-treated water on delta smelt and their zooplankton prey must be emphasized in the POD program.

The POD effort must avoid an overemphasis on export effects

Dr. Bryan Manly is widely recognized as one of the world's leading statisticians. As part of the POD program, Dr. Manly did an exhaustive series of statistical analyses under the supervision and direction of the U.S. Department of Interior. As a result of those analyses, Dr. Manly concluded, on January 25, 2006:

> "...although there are significant effects of **hydrological and export variables** on delta smelt, these seem non-linear (good and bad) and **do not seem to be able to explain the main long-term trends in delta smelt numbers.** By that I mean that the **hydrology and export effects seem to produce small wiggles on the trend lines. This is not saying that the effects are not statistically significant. It is saying that the effects don't seem to be important compared to other things going on.**" (emphasis added)

Based on Dr. Manly's conclusion, there should be concerns that continued emphasis on studies of export effects by the POD program will detract from the effort to find the true causes of the delta smelt decline and other biological problems in the Bay-Delta system. In my opinion, if exports are to continue to be one of the two primary focuses of the POD studies, someone should at least be able to produce a credible analysis, using the decades of data at our disposal, that exports have important effects on delta smelt abundance. Neither we nor Dr. Manly nor several other researchers have been able to do that.

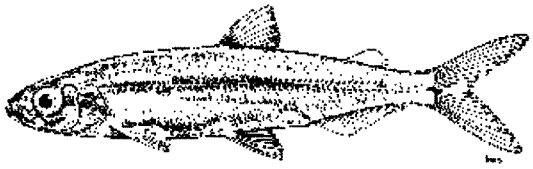
RESPECTFULLY,
DR. B.J. MILLER

[A report submitted for the record and prepared by Dr. B.J. Miller entitled "The State of the Delta: What is Killing the Delta Smelt?" dated January 2006 follows:]

Introduction

Recent declines in delta smelt, a pelagic (open water) fish of the San Francisco Bay Delta ecosystem, have generated significant interest in the scientific community. Delta smelt are designated as a threatened species under both the state and federal Endangered Species Acts. Some of these small fish enter state and federal pumping facilities in the southeastern Delta from which water is exported to farms and cities throughout California. Exports are curtailed when too many delta smelt enter the pumping plants, making this small fish among the most important in California.

The focus on the delta smelt has highlighted the fact that, despite decades of data collection by state and federal fish agencies and hundreds of millions of dollars spent on habitat restoration, we know little about the major determinants of the abundance of fish residing in the Delta. Only now, with the delta smelt abundance index[1] at its lowest point in 40 years, are we beginning to understand the interactions between flows, fish, food and water quality in the vast and complex Delta ecosystem.



What we now know, based on research described in this paper, is that the delta smelt's declining abundance appears to be closely linked to localized declines of an alien (non-native) zooplankton called Pseudodiaptomus that has been the delta smelt's primary food source in the summer. When Pseudodiaptomus are scarce in the areas of the Delta where smelt congregate during the critical late summer and early fall period, the subsequent fall abundance index is low. What causes these localized declines in Pseudodiaptomus remains unclear, although there are indications that the decline is linked to alien species, including consumption by the Amur River clam, contamination by toxins produced by an alien blue-green algae, Microcystis, or competition with another alien zooplankton, Limnoithona. Contamination by a new class of pesticides, less harmful to humans but more harmful to fish, is another possibility.

This new research further demonstrates that despite years of exhaustive research, scientists have yet to identify any link or correlation between water exports – the water sent by aqueduct to farms in the San Joaquin Valley and cities throughout California – and abundance of delta smelt.

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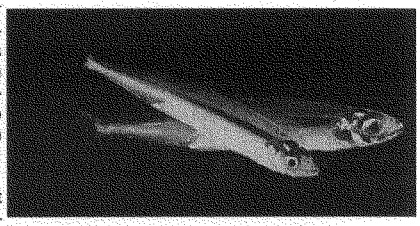
1. State and federal fishery managers do not use population estimates in connection with delta smelt. Instead, they use an "abundance index" to estimate whether there are more or less of the fish in the Delta than in previous surveys. The "official" index of abundance for delta smelt is the Fall Midwater Trawl index of sub-adult abundance, obtained from surveys made in September through December.

Delta smelt background

The delta smelt is a fragile fish that typically grows to only two to three inches as adults, although some have been recorded with lengths up to five inches. Delta smelt have a bluish hue and appear almost translucent. They are found only in the Sacramento-San Joaquin Delta and have been found as far upstream as the mouth of the American River on the Sacramento River and Mossdale on the San Joaquin River. They extend downstream into San Pablo Bay. Delta smelt live primarily in brackish water with salinity around two parts per thousand.



Delta smelt California Department of Fish& Game

During the late winter to early summer, delta smelt spawn throughout much of their range. Females produce approximately 1,000 to 2,600 eggs that sink to the bottom and attach to plants and other material. Larvae hatch 10 to 14 days after the eggs have been released. Delta smelt are fast growing with the majority of growth in the first seven to nine months of life. Most smelt die after spawning in the early spring although five percent or so survive to a second year.

Fish abundance and recent declines

Since 1967, California Department of Fish and Game biologists have conducted surveys of fish species at numerous locations throughout the Delta. These surveys provide a nearly 40-year record of abundance trends for delta smelt and several other species These surveys show wide swings in abundance from year to year, with some species showing recent declines while others appear to be doing well. Indeed, recent swings in the abundance index for delta smelt (Exhibit A), recorded in surveys between 1998 and 2003 are less dramatic than changes to the abundance index recorded in the early 1980s and early 1990s. However, because the most recent swing brought the abundance index to a historically low point, scientists have focused on determining what caused this change.

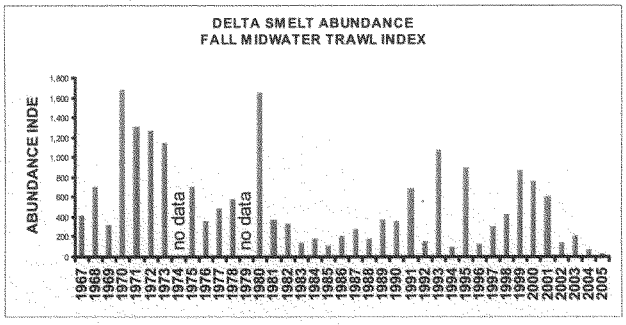


Exhibit A California Department of Fish & Game

The complex nature of the Delta ecosystem is further highlighted by the recovery that appears to be underway by anadromous salmon, also surveyed extensively by the Department of Fish and Game since 1952 (Exhibits B and C). From these data it is clear that whatever factors caused the decline in delta smelt did not have a similar effect on salmon.

The State of the Delta: What is Killing the Delta Smelt?

Salmon abundance 1952– 2004
San Joaquin River and Sacramento River

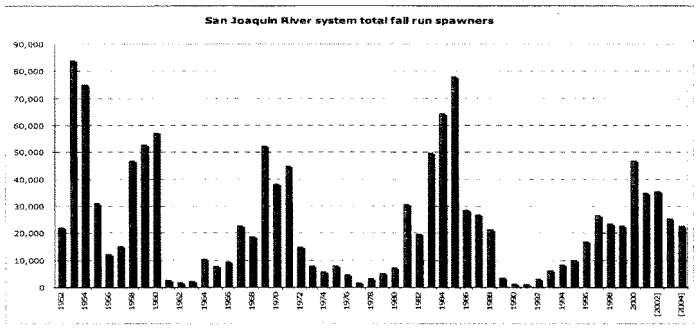


Exhibit B

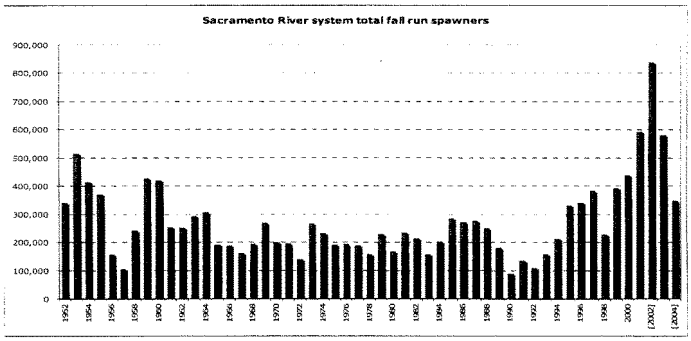


Exhibit C

Factors that influence delta smelt mortality

Export Operations

As the scientific community looked at the delta smelt's life cycle, the focus immediately turned to water export operations. For decades, water exports have been suspected as a major cause of fish mortality in the Delta, especially with regard to delta smelt. Consequently, state and federal fishery managers have regularly curtailed exports in the belief and hope that doing so would help the species recover.[2]

2. The focus on exports as a fishery management strategy has been an evolving issue within the scientific community. Once believed to have significant effects on salmon populations, exhaustive research and data analysis have led to a growing consensus among scientists that exports have very limited to no effect on salmon. Consequently, export curtailments are no longer viewed as an effective means of managing salmon populations on the Delta.

To better understand the relationship between exports and delta smelt, I and other scientists began looking for correlations to help us determine how exports affect the fish species.[3] Fortunately, there was a robust body of data to aid in this research. Since the late 1960s, the Department of Fish and Game has conducted an annual Fall Midwater Trawl survey of several pelagic fish species that make the Delta and Suisun Bay their home. Additionally, the California Department of Water Resources and the United States Bureau of Reclamation have extensive records of the amount of water exported daily from the Delta.

We first looked for a correlation between export volumes from the Central Valley Project (CVP) and the State Water Project (SWP) and the numbers of sub-adult smelt counted during annual surveys conducted each fall by the Department of Fish and Game. Surprisingly, we were unable to find any correlation between export volumes and the delta smelt abundance index (Exhibit D). In other words, in some years when exports were high, the delta smelt abundance index also was high. In other years, a low volume of exports was followed by a low fish abundance index.

Export volumes compared to delta smelt abundance index
No correlation

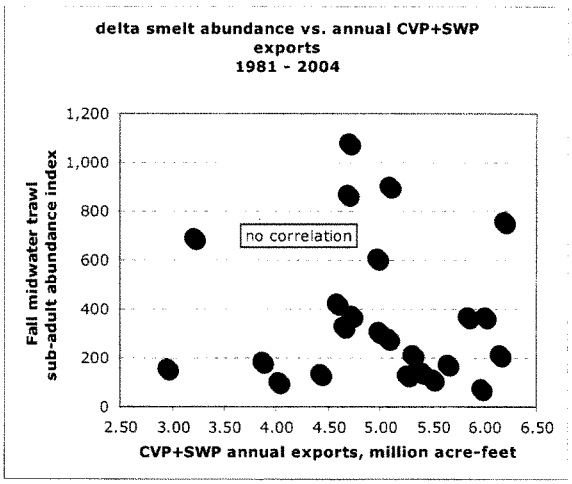


Exhibit D

We then conducted more exhaustive analysis. Rather than look only at export volumes, we looked for correlations between the numbers of adult delta smelt salvaged (or counted) at export pumping facilities and the subsequent Fall Midwater Trawl. We also looked at the numbers of larval and juvenile delta smelt entrained (or killed) at export facilities during pumping operations and the subsequent abundance index found in the Fall Midwater Trawl. This investigation followed a logical assumption that significant numbers of delta smelt, especially larval and juvenile fish, killed or trapped at export pumps during the spring when export volumes are at their highest, would result in low adult abundance indices during the following Fall Midwater Trawls.

In both adult and juvenile studies, we were unable to find any correlation (Exhibits E and F). In years when very few adult and/or juvenile delta smelt were counted or killed at export pumping facilities, there was an equally good chance that the subsequent Fall Midwater Trawl would record high abundance indices as low abundance indices.

3. While correlations do not tell the entire story, they are an important and useful indicator of the major determinants of causation. When we find correlations between actions and effects, we can and should conduct additional research to better understand how those relations should be reoriented. However, the absence of correlations or clear relationships suggests that research resource may be better focused elsewhere.

The State of the Delta: What is Killing the Delta Smelt?

Correlation analysis of delta smelt juvenile and adult salvage at export facilities 1994—2005

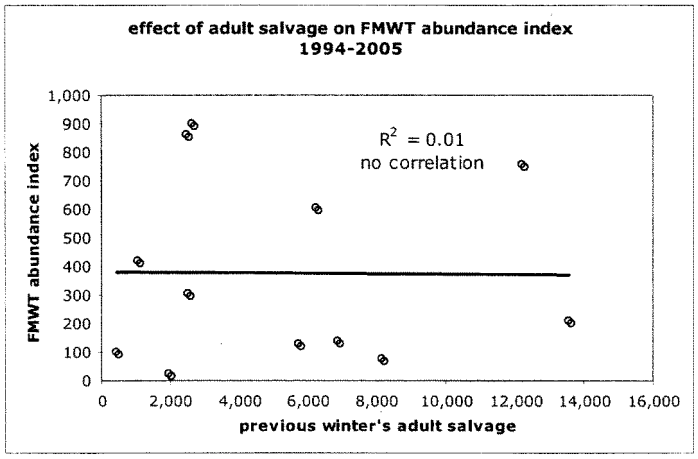


Exhibit E

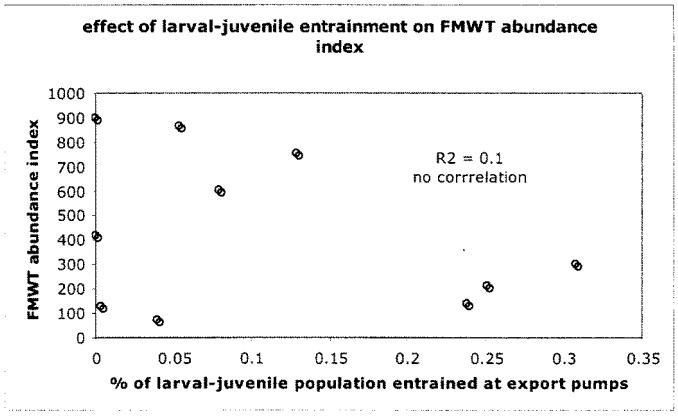


Exhibit F

Finally, we estimated the percentage of the total population of delta smelt in the Delta counted at export facilities during numerous years to determine if high percentages of fish counted at these facilities was followed by a low abundance index during the subsequent Fall Midwater Trawl. Again, we were unable to find any correlation, suggesting again that exports do not have a significant effect on delta smelt abundance (Exhibit G).

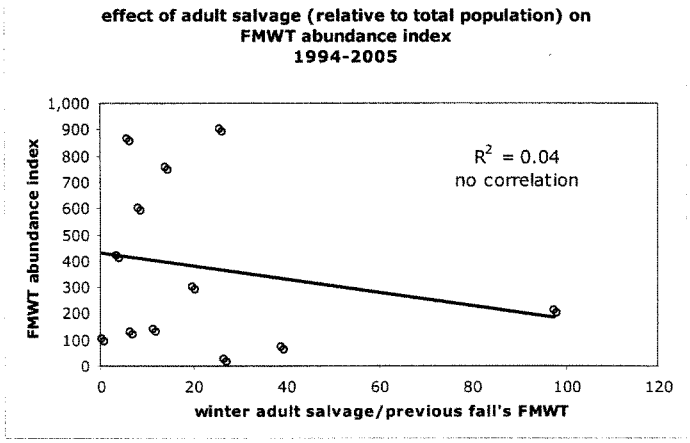


Exhibit G

Food Abundance

Having ruled out exports as a major factor in the smelt's mortality, we then turned our attention to food sources. One of the earliest indications that food deprivation is important for delta smelt occurred in 1999. Dr. Bill Bennett of the University of California at Davis, Bodega Marine Laboratory, analyzed a large number of delta smelt caught in the Delta in an effort to determine the cause of high rates of mortality between the fish's juvenile and adult stages. Dr. Bennett found large numbers of the fish with significant signs of malnourishment in the late summer and early fall. Put simply, the fish were starving to death.

With the focus shifting to food deprivation, it became important to understand what delta smelt eat. All indications are that delta smelt historically have relied primarily on two zooplankton for their food, both of them non-native or alien species.

During most of the 20th Century, the delta smelt's primary food source appears to have been *Eurytemora affinis*, a zooplankton (small floating animal). Although the origins of Eurytemora are not known, some researchers believe it was introduced into the Delta in the latter part of the 19th Century along with striped bass.

In 1986, the voracious Amur River clam (*Corbula amurensis)* was introduced into the Delta from the bilge water of ocean going vessels. Within two years, the Amur River clam took over large portions of Suisun Bay and the western Delta, and with the ability to filter nutrients from enormous volumes of water, the Amur River clam essentially eliminated Eurytemora during parts of the year.[4]

4. In the deeper water regions of the Delta, the Asian clam can filter the entire water column over the channels more than once per day and over the shallows almost 13 times per day.

Fortunately for the delta smelt, another alien zooplankton, *Pseudodiaptomus forbesi*, made its appearance in the Delta from China about the same time as the Amur River clam. As the population of Eurytemora plunged, the population of Pseudodiaptomus increased dramatically, and it rapidly became the delta smelt's primary food source (Exhibit H).

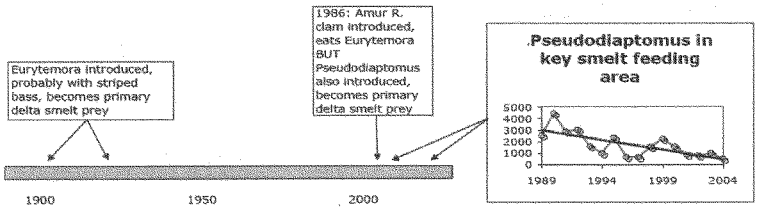


Exhibit H

For many years, biologists from the Department of Fish and Game have sampled the Delta in numerous locations and recorded the presence of zooplankton and other fish food sources in the water. Again, this survey data going back many years provides a rich resource to help us determine when and where the delta smelt's main food supply is found in the Delta.

It became clear to us that the abundance of delta smelt in the fall (as measured by the Fall Midwater Trawl abundance index) did not depend simply on their abundance in the summer. Nor did it depend simply on the summer abundance of prey (primarily Pseudodiaptomus). It seemed that abundance in the fall depended on the right combination of delta smelt and prey in the summer. In other words, it did no good to have lots of smelt where there was little prey or lots of prey where there were no smelt. Delta smelt juveniles and their prey had to co-occur in the summer to produce high abundance of delta smelt sub-adults in the fall.

Following this line of reasoning, we found an excellent correlation between the co-occurrence of smelt juveniles and their prey in July and the subsequent abundance of sub-adults in the fall (Exhibit I). As of now, this is the only correlation that anyone has found between the Fall Midwater Trawl index and any other factor using data from the last quarter of a century.

We also found that the three areas where delta smelt and prey typically co-occurred in July were the lower Sacramento River, from just upstream of Threemile Slough to the confluence with the San Joaquin River, the area around and just downstream of the confluence of the two rivers, and farther downstream in Suisun Bay. The lower Sacramento River area was by far the most important.

What has been going on with delta smelt prey in those areas? What factors control prey abundance there? We have an answer to the first question: Prey abundance has been declining and is trending down toward zero. As for the second question, we have not been able to identify the cause of the decline in prey abundance.

We found no correlations between prey abundance and either river flow, salinity, water clarity, or water temperature. We and others continue to search for the cause of the prey decline in the key areas of co-occurrence in the summer.

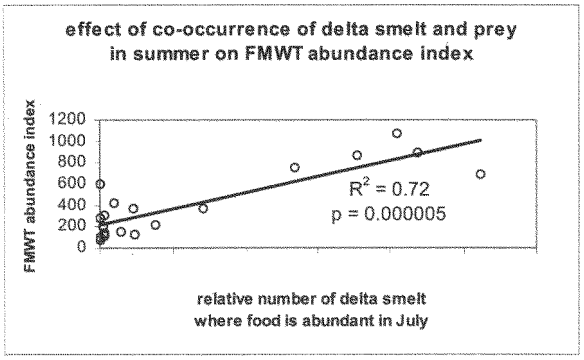


Exhibit I

Export operations and food supply

A logical question that arises from these findings is, to what extent do export operations effect Pseudodiaptomus in the Delta. While this may be an area worthy of additional research, the co-occurrence analysis suggests it

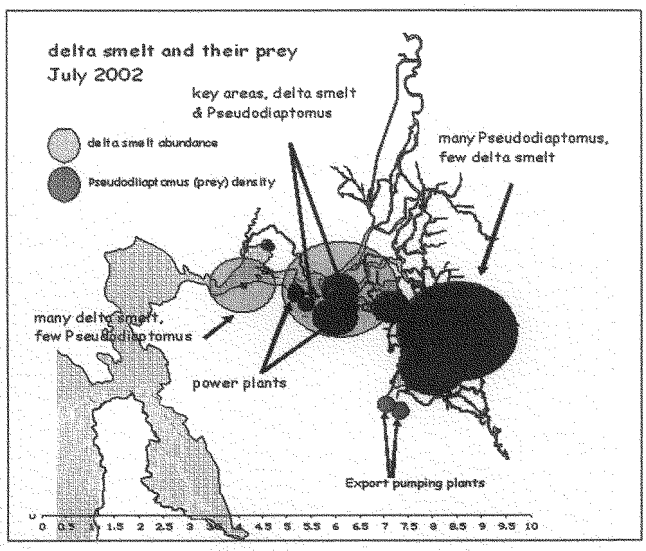


Exhibit J

would be unlikely we would find a cause-and-effect relationship. This is because the areas of the Delta with the highest co-occurrence of fish and food are far from the export facilities – 40 miles or more away. These distances make it highly unlikely export pumps play any significant role in the availability of Pseudodiaptomus in the locations where delta smelt are concentrated during the summer and fall (Exhibit J).

Conclusion

The Delta appropriately continues to occupy a central position in state and federal efforts to protect and restore endangered fish and wildlife. But recent and emerging science suggests strongly that efforts to manage and restore the delta ecosystem by continuing to focus on water exports are not likely to result in positive outcomes. Despite long-held and fervent beliefs that exports are a significant contributor to the decline of key fish in the Delta, there is little evidence to support those beliefs. In fact, continued emphasis on exports will likely divert attention from more promising research and restoration efforts. In the case of delta smelt, the data we have now indicate that abundance fluctuations and recent population declines are not a story of water exports, but rather a story of the dominant role of successive waves of alien species that have colonized this estuary and radically altered its ecosystem

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About the Author

B.J. Miller is a consulting engineer with a Ph.D. in Environmental Engineering from the University of California at Berkeley who has conducted extensive research on the Bay-Delta fishery. He is a former Vice Chairman of the California State Water Resources Control Board, was involved in the creation of the CalFed Bay-Delta Program and instrumental in the formation of the San Francisco Estuary Institute that conducts research and monitoring of San Francisco Bay. Dr. Miller has consulted for the CalFed Bay-Delta Program, the San Luis and Delta-Mendota Water Authority, the Santa Clara Valley Water District, Delta Wetlands Properties and the State Department of Water Resources.

[A letter submitted for the record by Daniel G. Nelson, Executive Director, San Luis & Delta-Mendota Water Authority, follows:]

MARCH 9, 2006

The Honorable Dennis Cardoza
House of Representatives
Washington, D.C. 20515

Dear Mr. Cardoza,

Thank you for the opportunity to submit the following comments as a follow-up to the February 27 meeting of the House Resources Committee in Stockton, CA. Testimony presented during the hearing revealed that from a purely scientific perspective, very little is known about the cause or causes of declining abundance of some pelagic species in the Sacramento-San Joaquin River Delta. The hearing also revealed that an inordinate amount of money has been spent on actions taken to force curtailment of water exports.

What is known is that export curtailments have accounted for approximately 100 times more spending than that which has been spent for studies/remedies of other noted potential factors in the decline of the Delta smelt.

See attached table:

Water & Dollar Investments for Delta Smelt Recovery (1999-2006)

Exports		1999	2000	2001	2002	2003	2004	2005	*2006	Total
Pumping Curtailments	EWA	0	0	290,000	285,000	316,000	124,000	335,000	216,000	1,566,000
In Acre-Feet	B2/ESA	500,000	344,000	168,000	247,000	206,000	198,000	184,000	200,000	2,047,000
Total Acre-Feet Export Reductions		500,000	344,000	458,000	532,000	522,000	322,000	519,000	416,000	3,613,000
**Dollar Value of Export Reductions		$30,000,000	$20,640,000	$27,480,000	$31,920,000	$31,320,000	$19,320,000	$31,140,000	$24,960,000	$216,780,000
* Projected										
**Water value assumed to be $60 per acre-foot										
Toxics		$0	$0	$0	$0	$0	$0	$591,000	$543,000	$1,134,000
Food Deprivation		$0	$10,000	$174,000	$97,000	$221,000	$104,000	$199,000	$363,000	$1,168,000
Delta Power Plants		$0	$0	$0	$0	$0	$0	$0	$35,000	$35,000

After the expenditure of millions of dollars and the dedication of millions of acre-feet of water through pumping curtailments, it has become evident that past finger-pointing at water exports being the major cause of declining abundance of some pelagic species has done little, if anything, to promote the recovery of these species. Unfortunately, monies spent in attempting to validate water exports as the culprit can never be recovered, and on February 27 Dr. Bryan Manly, an expert statistician working for the pelagic organism decline (POD), reported that the information derived from this focus on exports has been "unimportant."

It is important to recognize that the cost has been high in insisting that exports were the cause. In addition to the cost of conducting research focused on exports, millions of dollars have been spent by the Environmental Water Account (EWA) for Delta smelt protection. The EWA is a program whereby water is purchased (by the State and Federal governments) to repay the State Water Project (SWP) and the Central Valley Project (CVP) for exports foregone to protect Bay-Delta fish. Since 2001, the SWP and the CVP exports have been reduced by about 1.4 million-acre-feet by the EWA for Delta smelt protection.

When water exports are reduced to provide protection for the Delta smelt under previous scenarios, the effect has been serious for our water users. In addition to the EWA export reductions, the Federal Central Valley Project has also foregone additional exports through the Central Valley Project Improvement Act "B2" provision. Since 1999 the CVP has lost over 1.4 million-acre-feet of water to protect the Delta smelt. Unlike the EWA program, this lost water is not repaid. Consequently, there have been almost 3 million-acre-feet of export reductions made to protect Delta smelt during this time. Efforts by these water users to make up a portion of this lost water supply results in higher water costs that create a domino effect on the economic livelihood of all Californians. Any delay in redirecting science-based research will only serve to continue this crippling effect on all Californians.

A summary of costs dictated as a result of export curtailments is startling. A conservative combined total of over $217,000,000 in expenditures was required by water users and State and Federal agencies for a theory that has proved questionable. During this same time, a relative meager amount of attention and money was being spent on studying / remedying other factors such as toxics, food deprivation and power plant operations.

Serious questions must be asked and answered if a resolution to this crippling issue of a declining abundance is to be reached. We can no longer afford to chase a "preferred" solution, such as reducing or eliminating water exports, when the science does not support such an approach.

Why has it taken so long to determine that the availability of food, especially during the summer months near the confluence of the Sacramento and San Joaquin rivers, is a limiting factor for at least one pelagic species, the Delta smelt? These data have been available in various studies for a number of years, yet those coordinating efforts to find a solution have ignored this valuable information.

A closer look at the food limitation issue reveals a serious decline in a small floating animal, Pseudodiaptomus forbesi, which is a key food source for the Delta smelt. We do not know the effect of possible contaminants in the waterway to this valuable food source because no one has researched the issue. Isn't it time that such a directive be given?

Another potential limiting factor that has been ignored is the diversion of water by power plants located on the edge of the estuary. The water is an integral part of the power generating process but to allow this action to take place without documenting any affect it might have on smelt populations is unacceptable. A thorough study should be undertaken immediately to determine the effect these power plants have on smelt populations.

Focusing on water exports as the major cause of declining abundance of some pelagic species has served no purpose other than to demonstrate that the problem lies elsewhere. This agency-directed research indicates, contrary to what many had hoped, that water exports are not the culprit.

Tough questions must be asked in your quest to find out why so much time and money has been spent on attempting to place the blame on water exports as the leading cause. More important, however, is the need to find what is causing the Delta smelt decline.

California water users join with you in searching for the cause and in asking these tough questions:

1. When will studies be initiated to determine the true status of the smelt's food supply—-Pseudodiaptomus forbesi?
2. What effects, if any, do suspected contaminants and other factors have on the smelt food supply?
3. What effects, if any, does the operation of power plants in the Delta region have on the smelt population?

Again, thank you for your commitment to finding the solution to the declining population of the Delta smelt.

SINCERELY,

DANIEL G. NELSON
EXECUTIVE DIRECTOR

cc: Board of Directors & Member Agencies

[A letter submitted for the record by Spreck Rosekrans, Senior Analyst, Environmental Defense, follows:]

ENVIRONMENTAL DEFENSE
finding the ways that work

March 1, 2006

Honorable Richard Pombo
Chairman, House Committee on Resources
1324 Longworth House Office Building
Washington, DC 20215

Re: Committee hearing on *"Scientific Assessments of Declining Pelagic Fish Populations in the California Bay-Delta"* (February 27, 2006)

Dear Chairman Pombo:

Thank you for holding a committee hearing on the recent alarming decline of fishery populations in the California Bay-Delta estuary and for inviting the public to submit written comments. Please accept this letter and the attached report, *Finding the Water* (Environmental Defense, 2005), as comments for the hearing record.

Testimony at the hearing was limited to four government agencies: the California Department of Fish and Game, the California Department of Water Resources, the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service. The agencies' testimony summarized ongoing research efforts and presented various scientific views in a collaborative and constructive way. In this respect the testimony was useful.

Overall, however, an important fact was inexplicably and inexcusably omitted from the hearing testimony: the level of protection for the Bay-Delta's fisheries provided by the Environmental Water Account and the "Tier 1" baseline level of protection, as described in the CALFED Record of Decision (2000), has been significantly diminished.

Less than six years after the CALFED Plan was signed, the populations of several Delta fish species have declined to the lowest levels ever recorded and the volume of fresh water exports has increased to the highest level ever. During this time environmental water supplies have often not been available, leaving fishery biologists unable to take necessary action to protect sensitive species as anticipated by the CALFED Plan. As documented in *Finding the Water*, the combined shortfall in the EWA and CVPIA environmental water supplies ranged from 420,000 to 460,000 acre-feet during the period 2002-2004.

We concede that it is unlikely that the absence of these environmental water supplies is the sole cause of the recent decline in Delta fisheries. We support the ongoing scientific inquiry into the roles played by a variety of potentially contributing factors, including

toxics chemicals, exotic species and project exports. Nonetheless it is unfathomable that the testimony presented at the hearing did not include any mention whatsoever of the environmental water supplies, which State and federal agencies supported as a key element of the CALFED Plan, that have not been available.

In addition to documenting the shortfall, *Finding the Water* includes a number of opportunities for securing the additional needed environmental water supplies. We urge the Committee on Resources to seek additional information from federal and State agencies regarding the environmental water promised in the CALFED Plan as an important element in the restoration of Delta fish populations to sustainable levels.

Environmental Defense will continue to work with these agencies, as well as with elected officials at the local, State and federal level, to protect and restore the San Francisco Bay-Delta estuary as we meet water supply needs in California. Please feel free to contact us if you have any questions.

Sincerely,

Spreck Rosekrans
Senior Analyst

CC: Honorable Dennis Cardoza
Honorable George Miller
Honorable Grace Napolitano
Honorable George Radanovich

W/ attachment

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