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IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF CALIFORNIA

NATURAL RESOURCES DEFENSE COUNCIL, et al.

Plaintiffs,

v.

DIRK KEMPTHORNE, Secretary, U.S. Department of the Interior, et al.

Defendants,

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY and WESTLANDS WATER DISTRICT; CALIFORNIA FARM BUREAU FEDERATION; GLENN-COLUSA IRRIGATION DISTRICT, et al.; CALIFORNIA DEPARTMENT OF WATER RESOURCES, and STATE WATER CONTRACTORS,

Defendant-Intervenors.

Case No. 05-CV-01207 OWW (TAG)

DECLARATION OF JERRY JOHNS IN SUPPORT OF THE CALIFORNIA DEPARTMENT OF WATER RESOURCES' INTERIM REMEDY PROPOSAL

Hearing: August 21, 2007
Time: 9:00 a.m.
Courtroom: 3
Judge: The Honorable Oliver W. Wanger

DWR G

I, Jerry Johns, declare as follows:

1. I am Deputy Director for the California Department of Water Resources ("DWR"), having been assigned as acting to this position in January 2004 and appointed to it in August 2004. My educational background includes a Bachelors degree in Zoology and a Master degree in Freshwater Ecology from the University of California at Davis.

2. I was Chief of DWR's Water Transfers Office from June 2001 to January 2004. As Chief of the Transfers Office I coordinated many water transfer programs for DWR including the CALFED Environmental Water Account ("EWA") established in 2000. In this position I oversaw the implementation of adaptive management measures that relied on the use of about 320,000 acre-feet of water (termed EWA assets) that enabled DWR and U.S. Bureau of Reclamation ("USBR") to take actions to improve conditions for Delta fish, including delta smelt, beyond the regulatory baseline.

3. I am familiar with the operations of the State Water Project ("SWP") and have a working familiarity with the Delta operations of the federal Central Valley Project ("CVP"), particularly as they relate to SWP operations. My area of management responsibility includes DWR's participation in the Water Operations Management Team ("WOMT"). The WOMT consists of directors or regional managers who designate management level participants from their agencies of USBR, DWR, U.S. Fish and Wildlife Service ("USFWS"), National Oceanic and Atmospheric Administration National Marine Fisheries Service ("NMFS"), and the Department of Fish and Game ("DFG"). These representatives meet weekly for purposes of oversight and timely decision-making regarding CVP and SWP Delta operations that must occur in response to real-time fish monitoring and changing Delta hydrology. The WOMT relies on information from technical staff from each of the agencies.

4. From 1974 -2001, I was employed at the State Water Resources Control Board ("SWRCB"). During most of that time I either worked on or oversaw the SWRCB's development of water right decisions and water quality control plans for the San Francisco Bay/ Sacramento – San Joaquin Delta (Bay/Delta) including the regulation of the operations of the SWP and the CVP. For 16 years at the SWRCB I was Assistant Chief of the Division of Water Rights where I supervised the development of numerous complex water right decisions and orders throughout California dealing with fishery and water management conflicts including the 1994 Mono Lake Decision and subsequent orders.

5. The facts set forth herein are based on my knowledge, familiarity and involvement with the programs discussed herein. All opinions expressed in this declaration are based on my professional judgment. If called as witness, I could and would testify consistently with this declaration.

DEVELOPMENT OF INTERIM REMEDY PROPOSAL

6. I participated with managers and scientists from the DFG, USFWS, NMFS, and USBR to help the USFWS develop actions to minimize and prevent adverse impacts to delta smelt and its habitat from SWP and CVP operations during the interim period pending completion of the consultation on the delta smelt with USFWS. I am informed and believe that the USFWS can complete the consultation and issue its biological opinion before August 2008.

7. The actions have been developed using the best scientific data available. DWR will do its proportionate share to the extent possible to implement the actions, which consist of adjusting SWP and CVP operations to maintain prescribed flows in the south delta channels of Old River and Middle rivers. The actions are described in the attached Exhibit A, a matrix prepared by USFWS and titled "Delta Smelt Action Matrix for Water Year 2008"

("Action Matrix"). The Action Matrix includes footnotes and Attachments A and B that explain specifics of implementing the actions and the scientific basis for the actions.

8. During the USFWS consultation, DWR will not make any irreversible or irretrievable commitments of resources that have the effect of foreclosing any reasonable and prudent alternative measures. During this time, DWR will continue SWP operations described in the USFWS 2005 delta smelt Biological Opinion, including the transfer of water for the EWA, that are not inconsistent with the court's orders.

9. The operations of the SWP and the CVP are separate but interdependent and are coordinated through a federal-State agreement called the "Coordinated Operations Agreement." DWR intends that the proposed Action Matrix will be coordinated with USBR operations because the actions would require changes in export operations by the SWP and CVP to achieve the prescribed flows in Old and Middle rivers. DWR proposes that the water supply impacts of these actions be split equally between the SWP and CVP as has been the recent practice for such mandated changes in combined export operations, or as otherwise agreed upon by DWR and USBR. DWR submits that compliance with the Action Matrix is not a joint and several obligation on the two Projects but is a shared obligation as described above.

OVERVIEW OF ACTION MATRIX

10. The Action Matrix includes five actions within a prescriptive framework. Actions 1 and 2 prescribe specific combined flow in Old and Middle rivers. Action 3 and 4 prescribe a combined flow that is determined on a real-time basis using survey data of fish and monitoring of Delta habitat and hydrologic conditions. Action 5 prescribes constraints on installation and operation of the fish and agricultural seasonal rock barriers in the south Delta.

11. DWR will use response variables, or performance measures, to help assess

the degree to which the actions produce the intended benefit to delta smelt. These response variables include analysis of the delta smelt salvage at the SWP and CVP south Delta fish facilities, and of data from delta smelt surveys, such as the Fall Mid-Water Trawl and Summer Tow Net, including changes in the size distribution of delta smelt in these surveys. The analysis in future years of the effect of an action based on the response variables can be used to adjust subsequent actions and improve their benefit to delta smelt and to more effectively use the water resources needed to provide the expected benefits of the actions.

DELTA SMELT LIFE HISTORY

12. Delta smelt are slender-bodied, translucent fish that typically grow to 60-70 mm in length from tip of snout to end of tail.[1] Delta smelt typically live for only one year but some can live for two years.[2] At all life stages they are found in greatest abundance in the top two meters of the water column and usually not in close association with the shoreline, inhabiting open surface water of the Delta and Suisun Bay.[3] Critical thermal maximum for delta smelt, the temperature at which smelt can no longer survive as determined by laboratory studies, is 25.4 degrees Celsius (plus or minus 1.7 degrees Celsius).[4]

13. Before spawning, adult delta smelt tend to concentrate in the brackish

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[1] USFWS. Feb. 16, 2005. Reinitiation of Formal and Early Section 7 Endangered Species Consultation on the Coordinated Operations of the CVP and SWP and the Operational Criteria and Plan to Address Potential Critical Habitat Issues ("Bio Op"). p. 117; DFG. April 2005. Project Review Guidelines for Delta Smelt, Winter-run Chinook Salmon, and Spring-run Chinook Salmon Protection in the Sacramento-San Joaquin Estuary, p. 11.

[2] William A. Bennett. 2005. Critical assessment of the delta smelt population in the San Francisco Estuary, California. San Francisco Estuary and Watershed Science. Vol. 3, Issue 2 (September 2005), Article 1, p. 1 and 22. http://repositories.cdlib.org/jmie/sfews/vol3/iss2/art1

[3] Bio Op, p. 117.

[4] Swanson, C.; T. Reid; P.S.Young; and J. J. Cech Jr. 2000. Comparative environmental tolerances of threatened delta smelt (*Hypomesus transpacificus*) and introduced wakasagi (*H. nipponensis*) in an altered California estuary. Oecologia 123:384-390, 384.

water near where incoming salt water and out flowing fresh water mix (mixing zone). Adult delta smelt move from brackish to fresh waters to spawn. Specific spawning locations and seasons vary from year to year. They usually begin migrating to upstream spawning areas in late December or early January and February. In late February and March, spawning begins when water temperatures reach about 12 degrees Celsius and peaks from 15-20 degrees Celsius.[5]

14. Delta smelt lay adhesive eggs that are believed to attach to tree limbs or small rocks. Eggs hatch after 11-13 days and smelt become free-floating larvae. The larvae are difficult to detect with fish sampling gear and are not detectable in the standard fish salvage sampling at the SWP and CVP fish facilities.

15. During April, May and June, larval fish increase in size and develop greater swimming ability. They are distributed generally in the western Delta and in Suisun Bay where they are associated with the landward margin of the low salinity zone. Older juveniles are more widely distributed but also maintain an association with the low salinity mixing zone.[6]

MONITORING OF DELTA SMELT

16. DFG conducts four types of monitoring surveys through the year to determine distribution of juvenile, sub-adult and adult delta smelt. In two cases abundance indexes have been calculated historically. These indexes provide an indication of general trends in smelt abundances over years. The abundance indexes also provide an indication of the year to year trends in the smelt abundances based on the number of fish caught in each survey.

17. Two of these monitoring surveys, the Fall Mid-Water Trawl (FMWT) and the Summer Tow Net Survey (STNS), have been conducted since the 1960's. These surveys are done in a consistent manner each year which allows the data to be used to determine trends in the

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5 Bennett. p. 1 and 17; DFG Project Review Guidelines, p. 11.

6 DFG Project Review Guidelines, p. 11.

relative abundance of delta smelt over the years. However, these indexes should not be confused with actual estimates of the smelt population, which would have to make assumptions about the effectiveness of the sampling gear to capture the fish, the distribution of the smelt in the water column, the volume sampled by the gear at various depths of the water column and other factors. It has been difficult to obtain scientific consensus on these assumptions.

18. In addition to the surveys, the number of fish salvaged at the SWP and CVP facilities may indicate the presence of smelt in the south Delta channels. However, the SWP has the 31,000 acre-foot maximum capacity Clifton Court Forebay in front of its Harvey O. Banks (Banks) Pumping Plant[7], while the CVP William Jones (Jones) Pumping Plant and salvage facilities divert directly from the south Delta channels. Therefore, the CVP Jones facilities are a more reliable "sampling devise" of the southern Delta channels than the SWP, especially in June and July as was apparent this year. Delta smelt may spawn in the Clifton Court Forebay or juveniles may move into the Forebay earlier in the year and therefore the juveniles salvaged at the SWP in June and July may reflect those fish already in the Clifton Court Forebay and not those from the south Delta channels.

19. The surveys and the SWP and CVP delta smelt salvage data are tools used to help assess the effects from the actions in the Matrix and adjust the actions when appropriate.

Spring Kodiak Trawl

20. In the Spring Kodiak Trawl survey, DFG samples adult delta smelt from mid-January into April or May, depending on the time the smelt spawn that year. DFG conducts the survey every other week, taking four to five days and sampling 39 stations (from the Napa River to Stockton on the San Joaquin River, and to Walnut Grove on the Sacramento River). The

[7] DWR. June 1999. California State Water Project Atlas. p. 76.

sampling is done using a standard quantitative method every month. In between the time of the standard quantitative sampling, DFG conducts more intensive sampling in areas where smelt are more populous.[8] Graphic plots summarizing the relative distribution of adults are posted on the Internet on a real-time basis.

20-mm Survey

21. DFG's 20-mm survey provides information of the distribution and relative abundance of post-larval and juvenile delta smelt at up to 41 locations throughout their historical spring range from March through June or July. The actual number of sampling locations and duration of the survey depend on the spring runoff and timing of spawning in that year. DFG conducts eight to ten surveys that each take six days and are conducted every two weeks. The fish sampling gear is designed to detect juvenile smelt between 20 mm and 50 mm in length. Graphic plots summarizing the relative distribution of the 20-mm surveys are posted on the Internet on a real time basis.

Summer Tow Net Survey (STNS)

22. In the STNS, DFG determines relative abundance and distribution of juvenile delta smelt and provides data on the recruitment potential of the species. DFG samples at 31 stations six times a year from early June through late August. The STNS provides an abundance index that is considered to be a more representative index than others because the data has been collected over a wide geographic area and for the longest period of time.[9]

Fall Mid-Water Trawl (FMWT)

23. In the FMWT survey, DFG samples late juvenile and adult delta smelt from September through December. DFG surveys 116 locations through the entire delta smelt

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[8] DFG Project Review Guidelines, p. 8.

[9] Id.

distribution range (San Pablo Bay, upstream to Rio Vista on the Sacramento River and to Stockton on the San Joaquin River). The FMWT provides a measure of pre-spawning adult relative abundance and distribution. A FMWT index is calculated based on pre-spawning adults and provides an estimate for delta smelt stock and recruitment.[10]

Delta Smelt Salvage at SWP and CVP Fish Facilities

24. DFG monitors the salvage of delta smelt at the SWP and CVP fish screening facilities. During this process, periodic sampling is conducted to quantify the total number of fish salvaged each day. Salvage of adult smelt typically occurs January though March and salvage of juveniles larger than 20 mm typically occurs May into July. Once delta smelt near 20 mm in length they are detectable in the fish salvage. In the summer and fall delta smelt reside in the saltier, cooler water of the western Delta and Suisun Bay as they grow into adults.[11]

DESCRIPTION OF MATRIX ACTIONS 1 through 5

Action 1 – Winter Pulse Flow And Adult Spawning

25. Actions 1 through 4 of the Matrix will require changes in export operations by the SWP and CVP. These changes will lessen or avoid net upstream Old and Middle river flows. The SWP and CVP have reservoirs north of the Delta. The movement of this water across the Delta and its diversion at the SWP and CVP south Delta facilities can change the net daily direction of flow in Old and Middle rivers. This flow reversal can occur when the San Joaquin River flow is low, Delta hydrologic conditions favor a southerly flow, and in-Delta diversions are high. Scientists from the U.S. Geological Survey ("USGS") and DWR analyzed historical Old and Middle rivers flow rates and salvage in January and February. They found a statistical relationship in flow and salvage indicating that controlling net flow in the Old

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[10] DFG Project Review Guidelines, p. 9.

[11] Id.

and Middle rivers may reduce entrainment of delta smelt at the SWP and CVP pumps, as cited in Footnote 5 of the Action Matrix.

26. Action 1 is designed to reduce the number of adult smelt migrating into the south Delta to spawn where they and their progeny have a high risk of being entrained. The Action is based on the observation that adult delta smelt salvage typically begins after the first large storm event in the basin in or after late December. This pulse of fresh water, the turbidity that it carries into the Delta or some other factor or factors closely associated to the flow pulse appear to stimulate the movement of the adults to upstream spawning areas. Adult delta smelt are associated with turbid water: they are never found during the surveys in clear water. As the adult smelt migrate upstream they may follow this turbidity as it flows towards the south Delta pumps and become dispersed in the central and southern Delta where they become more susceptible to entrainment by the SWP and CVP. The conceptual model for this action was developed by scientists in the Delta Smelt Working Group and Dr. Mike Chotkowski of USBR, as explained in Footnote 4 of the Action Matrix.

27. Action 1 proposes reductions in SWP and CVP pumping in winter over a 10-day period after the first pulse flow to reduce movement of adult smelt into the central and southern Delta. The action would be triggered on or after December 25 based on when turbidity reaches a threshold at specific locations. The threshold is measured by a scientific method using Nepthelometric Turbitidy Units (NTU). The action is for ten days to allow the turbidity plume to pass out of the Delta and hopefully not disperse within the central and southern Delta. This action may help shift the distribution of adult delta smelt into the classically more turbid Sacramento River system, where they would be less vulnerable to entrainment.

28. The action is not begun if there are high enough flows on the

Sacramento River System at Freeport to move adult smelt into Suisun Bay away from the effects of the SWP and CVP (flow measures as a 3-day average of greater than 80,000 cfs).

29. The action ends when there is high Freeport flow, delta smelt spawning begins, or water temperatures reach 12 degrees Celsius. Footnotes 2 and 3 of the Action Matrix define when the onset of spawning occurs and the method to measure temperature. Spawning is known to typically begin when water temperatures become 12 degrees Celsius.

Action 2 - Adult Salvage Minimized

30. Action 2 is designed to maintain flows in Old and Middle rivers that create protective habitat conditions for adult delta smelt, or induce their movements into channels of the lower Sacramento River, where the smelt are substantially less at risk of entrainment at the SWP and CVP south Delta pumps. This Action would protect adult delta smelt during January, February, and possibly March, depending on when spawning begins. Spawning typically occurs when water temperatures reach 12 degrees Celsius.

31. Similar to Action 1, Action 2 is not needed if the flows in the Sacramento River are high enough to push the delta smelt into Suisun Bay. Therefore, the action is not begun or it ends if the 3-day average flow on the Sacramento River at Freeport exceeds 80,000 cfs. Action 2 ends if spawning begins or the water temperatures reach 12 degrees Celsius, at which time Action 3 begins.

32. Action 2 requires changes in SWP and CVP operations to maintain a net upstream flow towards the SWP pumps on Old River and Middle river that will not exceed a 14 day running average of 4500 cfs. A 7-day running average that does not exceed 5000 cfs is also required to maintain consistent Project operations and prevent wide fluctuations from the

target flow. The averaging period begins on the initiation of the action. On the 7th day, the 7-day average is calculated from the preceding 7 days. It is recalculated each day in 7 day rolling blocks moving forward in time. On the 14th day the 14-day average is calculated from the preceding 14 days. It is recalculated for each day in 14 day rolling blocks moving forward in time until the end of the action.

33. The averaging periods of 14 days and seven days are needed to account for the natural tidal action in the Bay/Delta Estuary. The Bay/Delta Estuary is a tidal body of water where tides can exert large influence over the instantaneous magnitude and direction of water flow. There are two high (flood) and two low (ebb) tides each day. In addition, the lunar cycle (28 days) affects the magnitude of these tides and cause the filling and draining of the Delta with water beyound the mean tidal volumes. The Delta experiences two spring tides (filling tides) and two neap tides (draining tides) each month. One spring/neap cycle takes 14 days. In addition to the effects of the sun and moon, the tides are sometimes affected to a greater degree by meteorological conditions such as winds, barometric pressure, and storm surges. Compliance with measured flows in the Delta must take into account these natural tidal cycles and meteorological factors which overwhelm water project operational changes on a daily basis. Delta hydrodynamics is complex and mathematical models have been developed and are continued to be refined to assist in understanding these hydrodynamic effects on salinity and fish movement. However, professional judgment is necessary when applying these results to biological systems.

34. As discussed above in paragraph 25, this action is based on analysis by USGS and DWR of the relationship of Old and Middle rivers flow to delta smelt salvage. As noted in Footnote 5 of the Action Matrix, the USGS found a relationship between the winter

upstream flow in Old and Middle rivers and the salvage. DWR has found a more robust relationship when the data is analyzed for each month, especially for January and February, as shown Exhibits B and C. The graphs in these Exhibits demonstrate that as upstream flows exceeds 6,000 cfs in Old and Middle rivers, the salvage of delta smelt can significantly increase. The inflection point on the curve in the graph of salvage and Old and Middle rivers flow is between 6000 and 7000 cfs. The shape of the curves for January and February are similar but the predictive power of the February curve is less than January. Therefore, maintaining Old and Middle rivers upstream flow to less than 5000 cfs throughout the winter adult period would be expected to minimize adult smelt entrainment and salvage.

Action 3 - Larval and Juvenile Protection

35. Action 3 is intended to benefit larval and juvenile delta smelt during the spring. It is similar to Action 2 in that flows are prescribed for Old and Middle river and the 14-day and 7-day running averages are used in measuring the flow. The prescribed Action 3 net upstream Old and Middle rivers flow is targeted at a typical range of zero to 4000 cfs. The Action 3 prescribed flow allows some flexibility in the targeted flow based on real-time monitoring data, as explained below.

36. The scientific basis for the flows on Old and Middle rivers to protect larval and juvenile smelt is similar to that described for adults in Action 2. Because the action is to benefit larval and juvenile smelt, however, it is also based on recent analyses by Dr. Bennett of the U.C. Davis Bodega Marine Lab. Dr. Bennett's analyses indicate that adult smelt recruiting to adult population as detected in the FMWT survey (based on back-calculated birthdates) over the last few years mostly originated from cohorts hatched during the Vernalis

Adaptive Management Program (VAMP) or low export periods.[12] VAMP is a period of controlled San Joaquin River flow and reduced SWP and CVP exports that occurs mid-April to mid-May. Delta smelt cohorts that would have originated from periods outside of the VAMP period are not being detected in the FMWT surveys. Dr. Bennett's hypothesizes that these early cohorts were entrained by the exports and subsequently lost from the population. Typically exports are high during the period prior to VAMP. The Action 3 flows are intended to help protect these early larvae and juveniles as well as later cohorts.

37. Action 3 will be implemented during March, April, and May, Beginning with the onset of spawning (also defined by a temperature criteria of 12 degrees Celsius) and ending when the risk of entrainment is abated or by June 1, whichever is earlier. USFWS determines if the risk of entrainment is abated and the Action can be ended by following the process described in Attachment B to the Action Matrix.

38. As described in the Action Matrix and Attachment A of the Matrix, the target flows on Old and Middle rivers will be determined based on real-time data estimating spawning distribution and the susceptibility of a substantial portion of the delta smelt population to the effects of SWP and CVP. The survey data showing distribution and relative abundance of delta smelt from the Spring Kodiak Trawl and the 20-mm Survey will used to estimate spawning and juvenile delta smelt distribution. The Particle Tracking Model (PTM) that uses real-time data will help determine susceptibility of the smelt to SWP and CVP operations on a real-time basis. Attachment A provides some hypothetical examples of implementing Action 3 to demonstrate how the process in Attachment A will determine the prescribed Old and Middle rivers flow. A more robust method may be developed using PTM results during the year.

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[12] Dr. Bennett's presentation can be found at http://science.calwater.ca.gov/workshop/ewa.shtml).

39. The PTM is a computerized model of the Delta river system that is used to evaluate the movement of particles in the Delta channels. The PTM shows the movement over time of computer-generated particles that are inserted at specific locations in the modeled channels. The PTM is used to simulate the movement of turbidity or other free floating particles in the water like young larval smelt. The PTM simulations of particle movements help estimate how changes in SWP and CVP pumping operations affect delta smelt movement through Delta channels. Since young delta smelt act less and less like free floating particles as they grow older, the PTM likely overestimates the effects of the SWP and CVP operations on delta smelt.

Action 4 - Juvenile Protection

40. Action 4 will continue protections of juvenile delta smelt in the same manner as Action 3 based on delta smelt surveys and real-time monitoring of delta conditions. An evaluation of real-time data used to determine the prescribed Old and Middle rivers flow will begin on May 15. This evaluation for implementing Action 4 is described in Attachment B of the Action Matrix. Action 4 begins on June 1 and ends when USFWS determines the risk of entrainment of juveniles has been abated, as described in Attachment B.

41. Historical records show that juvenile delta smelt have been salvaged at the SWP and CVP facilities in June. Real-time monitoring will be used as described above in Action 3 to determine Old and Middle rivers flow needed to protect juvenile smelt from the risk of entrainment. However, Action 4 also considers other factors affecting smelt at this time, including rising water temperatures in the southern Delta and local Delta diversions that could capture delta smelt even if the SWP and CVP stopped pumping.

Action 5 – Head of Old River Barrier and Agricultural Barriers

42. Action 5 requires that DWR not install the Head of Old River Barrier (HORB) in the spring. It also requires that DWR open the tidal flap gates on rock barriers installed by DWR each spring to increase channel water elevations in the south Delta to benefit agricultural diverters. This Action will occur during the time with the Vernalis Adaptive Management Plan (VAMP) is occurring, a period of 31 days from about mid-April to mid-May.

43. The basis for Action 5 is from PTM data. PTM data shows that when the HORB is installed, the CVP and SWP pumping of exports draws more water from Old and Middle rivers than from the San Joaquin River.

44. The HORB forces a greater proportion of the San Joaquin River water to remain in the main stem of the San Joaquin River. Without the barrier, about 55% of the San Joaquin River naturally flows into Old River. In the spring, from about mid-April to mid-May, DWR installs the HORB as part of the VAMP, a study testing the combined affects of the HORB, prescribed San Joaquin River flows, and CVP/ SWP exports. The VAMP is intended to evaluate how these factors effect the downstream migration of Chinook salmon smolts.

45. Typically, juvenile smelt salvage is higher when the HORB is installed when exports are high. The removal of the HORB would increase the proportion of San Joaquin River flowing into Old River and improve conditions to decrease smelt entrainment.

STRESSORS IN THE DELTA AFFECTING DELTA SMELT

46. In early 2005, the Interagency Ecological Program (IEP) scientists first brought to the attention of the DWR, DFG, USFWS, NMFS, and USBR, a decline in abundance indices during the last few years of four pelagic fish species. This decline in delta smelt, long fin smelt (both native species), striped bass and threadfin shad (both introduced species) is

demonstrated by data from the DFG Fall Mid-Water Trawl survey. Exhibit D shows graphs of survey data of the four species from 1967 to 2006, with the left vertical axis showing catch per trawl and the right vertical axis showing the FMWT abundance index. The graphs show the steep decline beginning in 2001 of these species.[13]

47. In 2005, DWR and the other IEP agencies initiated extensive and expensive studies to determine causes for the changes in pelagic fish abundance. This work to study the changes is referred to as the Pelagic Organism Decline Investigation (POD).

48. As part of the POD, factors, referred to as stressors, are being investigated to determine the possible cause of the decline in delta smelt. Besides the effects from SWP and CVP operations, invasive species and toxics in the Delta are believed to be major stressors on delta smelt. The probable interaction of the multiple stressors affecting delta smelt emphasizes the need for a holistic approach to protect Delta species. This approach should be based on an understanding of these major stressors.

<u>Invasive Species</u>

49. The Asian clam *Corbula* is an invasive species that became established in Suisun Bay in the 1980s. This clam feeds by filtering water through its system. The clam's filtering is so effective it appears to be effecting primary production of phytoplankton in Suisun Bay. Exhibit E shows the change in primary production in the Suisun Bay (shown as Chlorophyll A (Chl -A) on the left axis) compared to the time in 1987 when the population of

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[13] Exhibit D is Figure 4 from the article "The collapse of pelagic fishes in the upper San Francisco Estuary" by Sommer, T., C. Armor, R. Baxter, R. Breuer, L. Brown, M. Chotkowski, S. Culberson, F. Feyrer, M. Gingras, B. Herbold, W. Kimmerer, A. Mueller-Solger, M. Nobriga, and K. Souza. 2007. Fisheries 32(6); In press.

Corbula increased in the Bay (shown on the right axis as number of clams per square meter).[14]

50. Studies of primary production in other estuaries compared to the Suisun Bay helps to understand the concern over the clam's introduction. Exhibit F from the USGS shows the relationship between primary production and fisheries yield in three estuaries, the Hudson, Chesapeake, and Narragansett.[15] The line graph in Exhibit F shows that as primary production (i.e., the amount of Carbon "C" representing primary productivity per square meter) in a year on the horizontal axis decreases, the yield in fisheries declines (i.e., the weight of the fish yield per year) as shown on the vertical axis. Exhibit G shows a similar graph of fisheries yield compared to primary production in the Suisun Bay. The large solid circles labeled with dates of 1980 and 1988 shows the reduction in the primary production in the Bay during this time. The change in annual productivity from about 100 grams per square meter in 1980 to about 20 grams per square meter in 1988 represents an 80 percent reduction. Comparing the estuaries in Exhibit F to Suisun Bay in Exhibit G shows that primary productivity of Suisun Bay is about five to ten percent of that of the Chesapeake and lower Hudson estuaries. The rapid growth in the population of *Corbula* in Suisun Bay may explain the reduction in primary production. The Bay-Delta's decline in pelagic fish abundance could be related to this dramatic reduction in primary production.

51. We see this kind of decline in two representative pelagic fish for which we have the longest historical record in the Bay/Delta system. This kind of change

[14] Exhibit E is a figure from a presentation given on 3/1/2007 at the Annual IEP Workshop in Asilomar, California, by James Cloern USGS.

[15] This figure is modified from Figure 6 in Nixon, Scott W. 1988. Physical energy inputs and the comparative ecology of lake and marine ecosystems. Limnology and Oceanography 33(4, part 2): 1005-1025.

could be an indication of similar affects for other pelagic fish including delta smelt. Exhibit H shows the change in the historic relationship between the abundance indexes of long-fin smelt and stripped bass and amount of water flowing out of the Delta (Delta Outflow). Historically there was a fairly good relationship between Delta Outflow and the abundance indexes of these two pelagic fish. The higher the Delta Outflow, the higher the abundance index. This relationship has been used in the past to justify the development of standards by the State Water Resources Control Board to protect these flows and provide protection to these fish species and other pelagic fish. As seen in Exhibit H this relationship shifted downward after the introduction of *Corbula* showing that Delta Outflow has less affect on improving these indexes than it did before *Corbula* was introduced. It also shows another shift downward in the POD years indicting that another shift in historic relationships has occurred recently to the point that there is no longer a reliable relationship between changes in Delta Outflow and abundance indexes for these two representative pelagic fish species. Whether this is due to the continued invasion of *Corbula* into the Bay/Delta Estuary in either numbers or extent, or some other factor has yet to be determined. The continued decline in these historic relationships between outflow and pelagic fish abundance is another example that the Bay/Delta Ecosystem is changing. Ecosystem changes are affecting pelagic fish abundance, likely including delta smelt.

52. In the late 1990s a new zooplankton *Limnoithona* invaded the estuary and quickly became the most abundant zooplankton in the estuary. Exhibit I shows graphs and pictures of different zooplankton that live in the Bay-Delta.[16] The bottom picture on the far right

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[16] Exhibit H is a figure produced by Anke Mueller-Solger, DWR, with data collected by the IEP Environmental Monitoring Program. These data are available upon request from April Hennessy, DFG, AHennessy@dfg.ca.gov.

is of the new zooplankton *Limnoithona*. Above the pictures is a line graph showing the introduction and increase of *Limnoithona* beginning about 1994. From 1994 the line steeply rises, to the right, and peaks in 2003 with over 15,000 counted , as shown on the right vertical axis. The *Limnoithona* population is replacing other zooplankton that have been the food source for delta smelt. *Limnoithona* does not appear to be a good food source for many important pelagic fish like delta smelt and the replacement of the prior zooplankton with *Limnoithona* may be affecting delta smelt survival.

53. There are a host of additional invasive species that are affecting the Bay Delta Estuary including introduced fish, invertebrates, aquatic weeds and blue-green algae. They all play a role in upsetting the natural ecological functioning of the Delta that could be factors in the decline of the pelagic fishes in this system.

<u>Toxics</u>

54. Since 2005, scientists as part of the POD investigation, have conducted toxicity tests of Delta water. This is done by taking large volumes of water samples from various locations in the Delta and Suisun Bay and placing test organisms in these samples to screen for evidence of toxicity. This type of toxicity testing is known as bioassay. If toxicity is found, then a series of chemical tests are conducted to identify the likely compounds that could be contributing to this toxicity. In the above average water years of 2005 and 2006 the bioassays did not find evidence of reduced survival in the test organisms from Delta samples.

55. In January 2007, a hydrologically dry year, Dr. Inge Werner, UCD's Principle Investigator, conducted bi-weekly sampling and aquatic toxicity testing. Dr. Werner's 2007 testing indicated evidence of toxicity to an aquatic invertebrate exposed to waters taken

from several locations in the Sacramento River portion of the Delta at four times in February though April 2007. Exhibit J shows the sites where the water samples showed evidence of toxicity in Cache Slough (circle at top of map), the Sacramento River Deep Water Ship Channel and the lower Sacramento River near Sherman Lake (circles at number 711 and 704).

56. Also in 2007 the WOMT agencies took actions in winter and spring similar to those in the USFWS matrix of actions discussed above. The actions were taken to encourage adult delta smelt to stay in the Sacramento River system and away from the central and southern Delta where they are more susceptible to the effects of SWP and CVP operations. Exhibit K shows results of the DFG Spring Kodiak Survey #4, initiated on April 2, 2007, and the distribution of pre-spawning adult females in Cache Slough and the Sacramento River. Exhibit K also shows results of the 20 mm survey #3, initiated April 9, 2007, and the distribution of juveniles in the same areas.

57. The April 2007 Surveys show distribution of spawning and juvenile smelt in areas where Dr. Werner found toxicity. These are the locations where most of the adult smelt congregated to spawn in 2007 and where most of the young were found but in very low numbers. The toxicants involved are still being evaluated but they are within the class of pesticides known as organophosphates and pyrethroids. Both are used as a dormant spray on trees. These chemicals can either directly affect delta smelt or their food sources.

58. Even though the number of adult delta smelt this year was a little larger than last year (as shown by the FMWT survey indices), the number of young smelt collected this year was about one-tenth the number of those collected last year (as shown by the 20 mm surveys). This dramatic drop in Juvenile smelt was a great concern to DFG and USFWS this year and heightened their concern about any further impacts to this reduced population this

year.

59. The toxicity seen in the Delta this year in the areas where adult smelt spawned and where the early life stages of smelt were feeding and growing could have caused direct mortality to smelt or affected their food availability this year and thus contributed to increased mortality of juvenile smelt. Such effects, if not corrected, could occur in the future thus rendering any actions by this court to improve the conditions for delta smelt ineffective.

CONCLUSION

60. Based upon the above, it is my professional opinion that if the Action Matrix as described is adopted by this court and the actions are adaptively implemented, the operation of the SWP and CVP during the consultation will not likely jeopardize the continued existence of the delta smelt or adversely modify its critical habitat. Furthermore, the proposed remedy will not result in any irreversible or irretrievable commitments of resources that have the effect of foreclosing any reasonable and prudent alternative measures and DWR will continue SWP operations as described in the 2005 delta smelt Biological Opinion that are not inconsistent with the court's orders.

I declare under the penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Dated: July 9, 2007

JERRY JOHNS

EXHIBITS

Exhibit A

USFWS Delta Smelt Action Matrix for Water Year 2008 (7/3/07)

Action #	Timing	Life stage	Action	Triggers	End of Action	Benefits to delta smelt
1	Winter	Adults	Within 3 days of the trigger, achieve an average net daily upstream Old and Middle River (OMR) flow not to exceed 2,000 cfs for a 10-day period (one time action).[1]	On or after December 25 contingent on when turbidity threshold is greater than 12 Nephelometric Turbidity Unit at Prisoners Point, Holland Tract, or Victoria Island unless the three-day average Sacramento River flow at Freeport is greater than 80,000 cfs during the period	After 10 days or if the three-day Sacramento River flow at Freeport increases to greater than 80,000 cfs during the 10 days, or the onset of spawning[2] or when water temperature reach 12°C[3]	Pulse flow for pre-spawning adult smelt to minimize movement into the south delta where they would be entrained and their offspring would also be entrained.[4] The goal is to maximize the number of smelt that spawn north of the confluence where their offspring are less susceptible to entrainment at the facilities.
2	Winter	Adults	Daily net upstream OMR not to exceed 4,500 cfs[5]. The flow will be a 14-day running average. Simultaneously, the 7-day running average will not exceed 5,000 cfs.	Immediately following action #1 or beginning January 15 unless the three-day average Sacramento River flow at Freeport is greater than 80,000 cfs	The onset of spawning[2] or when delta water temperatures reach 12°C[3]	To minimize the number of pre-spawning adult smelt entrained at the facilities and to avoid spawning in the south delta where their offspring could be entrained.
3	Winter/ Spring	Larval/ Juvenile	Target daily net upstream OMR flow of 0-4,000 cfs[6]. As described in Attachment A to this Exhibit, actual flow to be determined based on the real-time data estimating spawning distribution and the susceptibility of a substantial portion of the population to the effects of Project operations based on particle tracking model results or other real time data. The flow will be a 14-day running average. Simultaneously, the 7-day running average shall be within 500 cfs of the applicable 14-day running average	Initiate the action at the onset of spawning[2] or when water temperatures reach 12°C[3] This action may be modified or unnecessary if the distribution of spawning delta smelt, larvae and juveniles is not occurring south or east of Frank's Tract and flows in the Yolo Bypass have reached the lower end of the Bypass.	Until entrainment risk is abated (see Attachment B to this Exhibit) or June 1, whichever occurs first[7]	To minimize the number of larval smelt entrained at the facilities.
4	Spring/ Summer	Juvenile	Evaluation of real-time delta smelt data to recommend an action to protect juvenile smelt.	Based on real-time information, starting June 1. Evaluation of conditions to start Action 4 will begin May 15.	Until entrainment risk abated (see Attachment B to this Exhibit) or June 30	Potentially provide additional protections to delta smelt. Effects to listed salmon, steelhead and green sturgeon will be incorporated into the decision making process
5	Spring	Larval/ Juvenile	No installation of Spring Head of Old River Barrier and flap gates tied open on south delta agricultural barriers	31 day period of increased San Joaquin River inflow and reduced export pumping outlined in Water Rights [illegible]	End of VAMP[7]	To allow a greater proportion of the San Joaquin River to contribute to a more positive OMR flow to allow smelt to move to the confluence[8]

Exhibit A

USFWS Delta Smelt Action Matrix for Water Year 2008 (7/3/07)

Footnotes:

1 Action #1 may be the first action or it may follow or be concurrent with Action #2.

2 The onset of spawning is indicated by the presence of spent females collected in Spring Kodiak Trawl OR at the salvage facilities.

3 Delta water temperature will be determined based on a three station average of the water temperatures at the Mossdale, Antioch and Rio Vista monitoring stations.

4 A pulse flow based on the "first flush" conceptual model, developed by the DSWG in meeting notes from 10/10/06 but based on salvage triggers (an analysis prepared by Dr. Mike Chotkowski, USBR unpublished data available from the author or from the Service) and Particle Tracking Modeling (PTM).

5 Net upstream OMR flow is based on Peter Smith's (PE, USGS) relationship (unpublished data available from the author or from the Service).

6 Typically, the range of 0 to 4,000 cfs would be the net upstream OMR flow.

7 VAMP conditions as described in Water Rights Decision 1641 are assumed to occur during this period.

8 Based on PTM produced for the DSWG by DWR modeling staff-see DSWG notes 3/26/07 at http://www.fws.gov/sacramento/es/delta_smelt.htm

Attachment A of Exhibit A
Process for determining target Old and Middle River flow for Action #3

In order to determine the appropriate target between 0 and 4000 cfs Old and Middle River (OMR) net upstream flow to protect delta smelt under Action #3, the following process will be followed:

1. The Service will convene the Delta Smelt Working Group (DSWG) to provide biological information, including a preliminary recommendation, to the Service.

2. The DSWG will examine real time information on delta smelt and delta environmental conditions to determine what OMR flow would be adequate to protect delta smelt. The real time information to be considered will include:

a. Real time delta smelt distribution data from Spring Kodiak Trawl Survey sampling, 20 mm Survey sampling or other monitoring data,
b. Salvage information from the CVP and SWP facilities,
c. Particle tracking models based on delta smelt distribution as inferred from the most recent monitoring surveys, and the best available forecast of Delta hydrology, including projected river flows and export rates,
d. Delta temperature data: When delta water temperatures reach 12° C, this serves as an indicator of the onset of spawning. The time period that water temperatures are between 12° C and 18° C can give an indication of the length of the spawning window. The expected number of delta smelt cohorts for the year can be inferred from an examination of survey and temperature information,
e. Number and pattern of delta smelt collected in the monitoring surveys,
f. Other biological data not described above.

The DSWG will determine based on this information where the majority of delta smelt are most likely to occur and the net OMR flow to avoid or minimize entrainment of delta smelt and provide a preliminary recommendation to the Service.

3. The Service will provide its preliminary recommendation to the Water Operations Management Team (WOMT) as to what OMR flow or other protective actions that would be needed to protect larval and juvenile delta smelt for discussion at WOMT. The WOMT includes the Department of Water Resources, the U.S. Bureau of Reclamation, the California Department of Fish and Game, and the National Marine Fisheries Service, and the Service, that are represented by each agency's director. Additional biological or hydrological information not described above may also be considered useful to the decision-making process by the Service in development of its preliminary recommendation to WOMT.

4. If WOMT agrees with the Service's recommendation, the Project Agencies implement the Service's recommendation. If WOMT does not agree with the Service's recommendation, WOMT will propose an operational response.

In the event of disagreement, the Project Agencies will provide additional information about operational constraints to the Service. Any WOMT agency can provide additional information to the Service.

The Service either concurs with the Project Agencies' proposed operations or notifies the Project Agencies that implementation of the Service-proposed modification of operations is necessary to adequately protect the delta smelt.

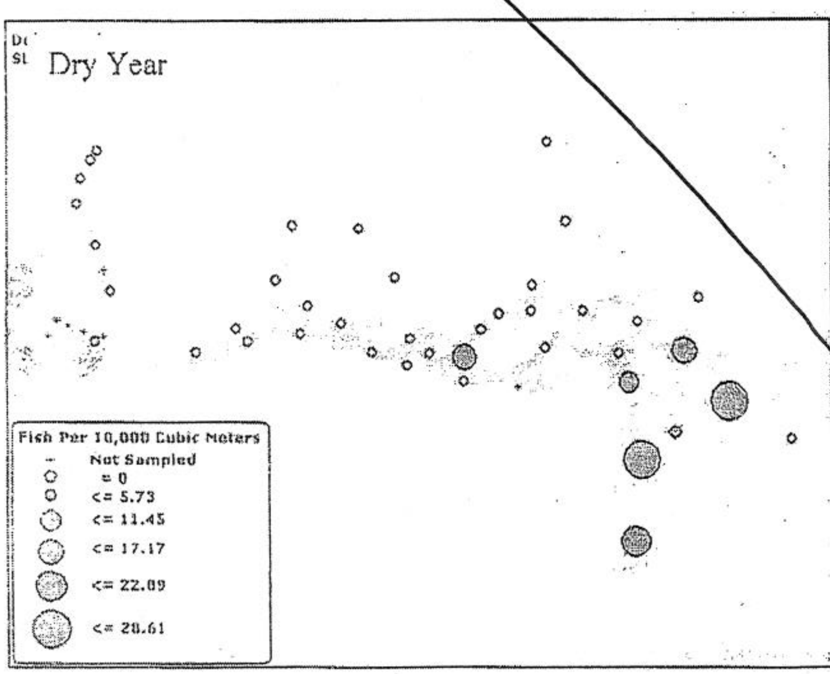
The Service retains the right to recommend additional actions based on real time conditions.

5. As conditions change, the DSWG and the Service will continuously evaluate conditions and reassess the operative OMR flow and the Service will adjust the requirement if it is determined that additional protection is needed or if less protection is warranted.

6. The following examples show three different distributions of delta smelt and generalized hydrologic conditions that illustrate the process for determining the approximate OMR flow necessary to avoid or minimize entrainment. The examples approximate a dry year, a moderate water year and a wet year. Please note that these examples are hyothetical and do not constitute an exhaustive description of conditions and recommendations that could be expected to occur.

Examples for Action 3

Example 1

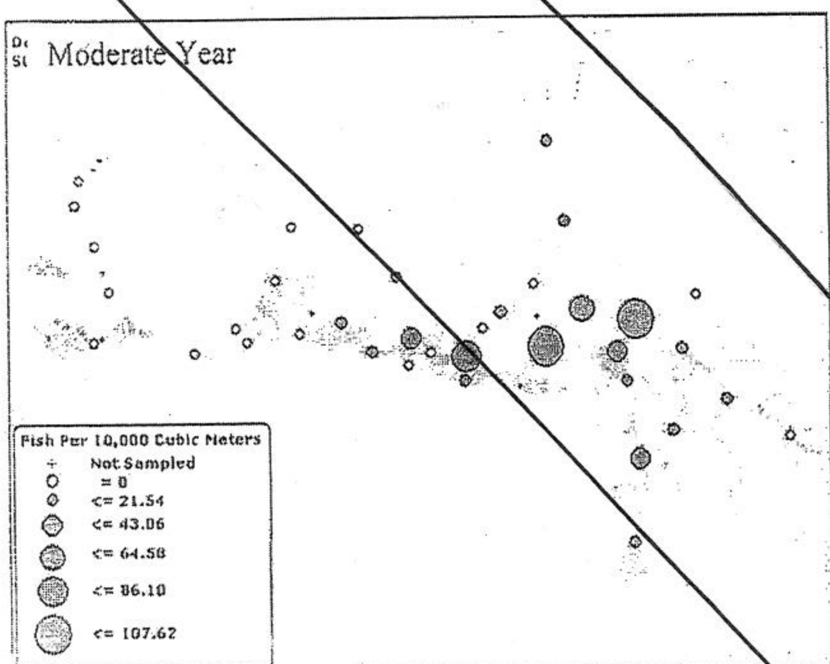


Hydrology:
Sacramento River Flow of 15,000 cfs
San Joaquin River Flow of 900 cfs

Assumptions:
Pumping rate of 6,000 combined exports
Previous fall midwater trawl recovery index: 45

Potential Actions:
Under this example, with a distribution centered in the central and south Delta and a low previous year's fall midwater trawl index, concern would be extremely high. Particle tracking modeling would likely predict a very high risk of entrainment at the facilities under these conditions, and a net upstream OMR flow closer to 0 would likely be recommended to avoid or minimize entrainment. Operational and hydrological limitations may limit the ability to fully meet this recommendation.

Example 2

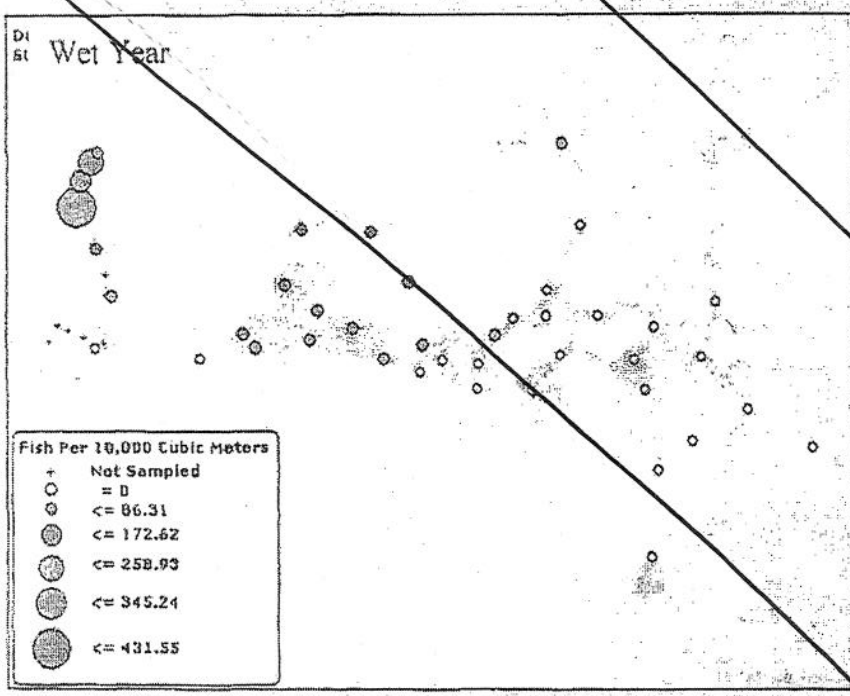


Hydrology:
Sacramento River Flow of 30,000 cfs
San Joaquin River Flow of 5,000 cfs

Assumptions:
Pumping rate of 8,000 combined exports
Previous fall midwater trawl recovery index: 45

Potential Actions:
Under this example, with a distribution centered in the central and south Delta and a low previous year's fall midwater trawl index, concern would be high. Particle tracking modeling would likely predict a moderate risk of entrainment at the facilities under these conditions, and a net upstream OMR flow around 0-2000 may be recommended to avoid or minimize entrainment. Another concern would arise if indirect effects of the export facilities resulted in the redistribution of delta smelt into the less productive south Delta. Although the Projects would be expected to entrain relatively fewer fish under this example, extending holding of delta smelt in the poorer habitat conditions in the south Delta would likely be of concern.

Example 3



Hydrology:
Sacramento River Flow of 80,000 cfs
San Joaquin River Flow of 8,000 cfs

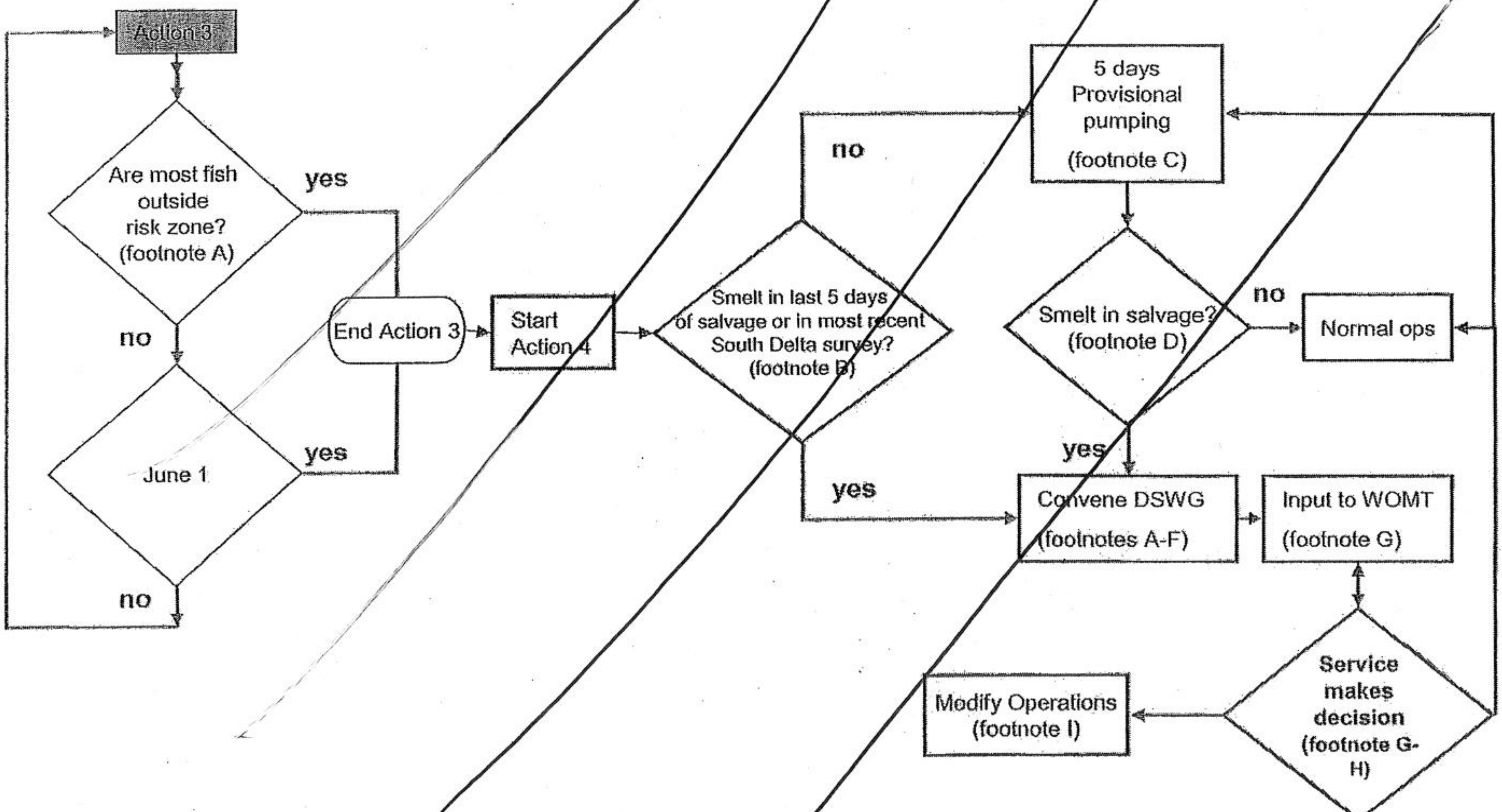
Assumptions:
Pumping rate of 10,000 combined exports
Previous fall midwater trawl recovery index: 45

Potential Actions:
Under this example, with a distribution centered in Suisun Bay and a low previous year's fall midwater trawl index, concern would be low, relative to drier year types. Particle

tracking modeling would likely predict a low risk of entrainment at the facilities under these conditions and a net upstream OMR flow closer to 4,000 may be sufficient to protect delta smelt. Under this example, net upstream flows may be positive due to hydrology, and may end the action.

Attachment B of Exhibit A

Process for ending Action 3 and Implementing Action Number 4.



See footnotes on next page

Footnotes for Attachment B of Exhibit A

A. Particle tracking modeling will be used to estimate the intensity and spatial extent of the water export facilities' hydrological influence within the Delta at expected OMR flows under normal operations (i.e., "estimated risk zone"). Distribution of delta smelt will be estimated by using near real time data from delta smelt surveys, e.g. Spring Kodiak Trawl (SKT) and 20-mm surveys. Overlap between the "estimated risk zone" and the delta smelt distribution will then be used to evaluate potential larvae exposure to entrainment. See examples in Attachment A to Exhibit 2.

B. Delta smelt occurrence in the salvage or at any south Delta sampling stations for the most recent 20-mm or Summer Townet surveys.

C. Increased exports would be provisional based on continuing re-evaluation of the data at hand, which are the data evaluated for Action 3.

D. Observation of one (1) delta smelt in salvage at either water export facility will trigger a meeting of the DSWG.

E. Using data from surveys, the DSWG will draw preliminary conclusions regarding the relative abundance of delta smelt and their approximate distribution. This information will be used, along with the factors set out in Attachment A to Exhibit 2, to evaluate the potential for adverse effects to the year's delta smelt population from diversions by the projects and develop modifications to the projects' operations as necessary to minimize adverse effects upon the smelt population.

F. Historically, smelt were not found in the south Delta at surface temperatures above 25.6° C (CDFG) Also, salvage of delta smelt typically drops off after mean size ~40mm FL (based on review of historic 20-mm survey and/or Summer Townet survey data). DSWG will assess conditions using the data generated in the processes outlined in the above notes.

G. WOMT and Service decision process:

   a. DSWG provides biological information and analysis of condition of delta smelt to WOMT

   b. If WOMT agrees with the Service's recommendation, the Project Agencies implement the Service's recommendation. If WOMT does not agree with the Service's recommendation, WOMT will propose an operational response.

c. In the event of disagreement, the Project Agencies provide additional information about operational constraints to the Service. Any WOMT agency can provide additional information to the Service.

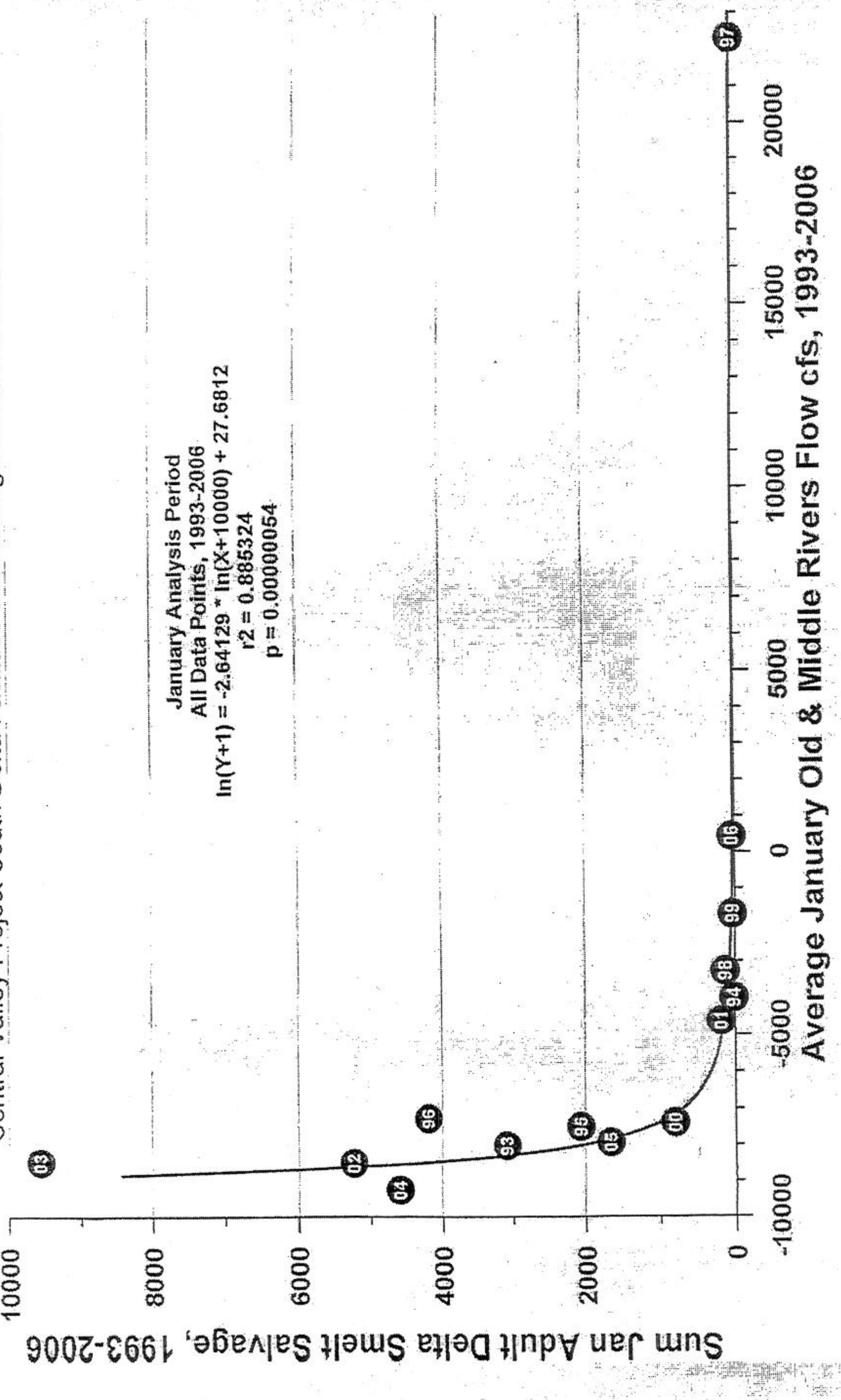
d. The Service either concurs with Project Agencies' proposed operations or notifies the Project Agencies that implementation of the Service-proposed modification of operations is necessary to adequately protect the delta smelt.

H. The Service retains the right to recommend additional actions based on real time conditions.

I. Operations of the two water export facilities will be modified in a manner similar to what is described in Action 3 of Exhibit 2. Other actions may be taken that are found to appropriately avoid or minimize entrainment effects at the water export facilities.

Exhibit B

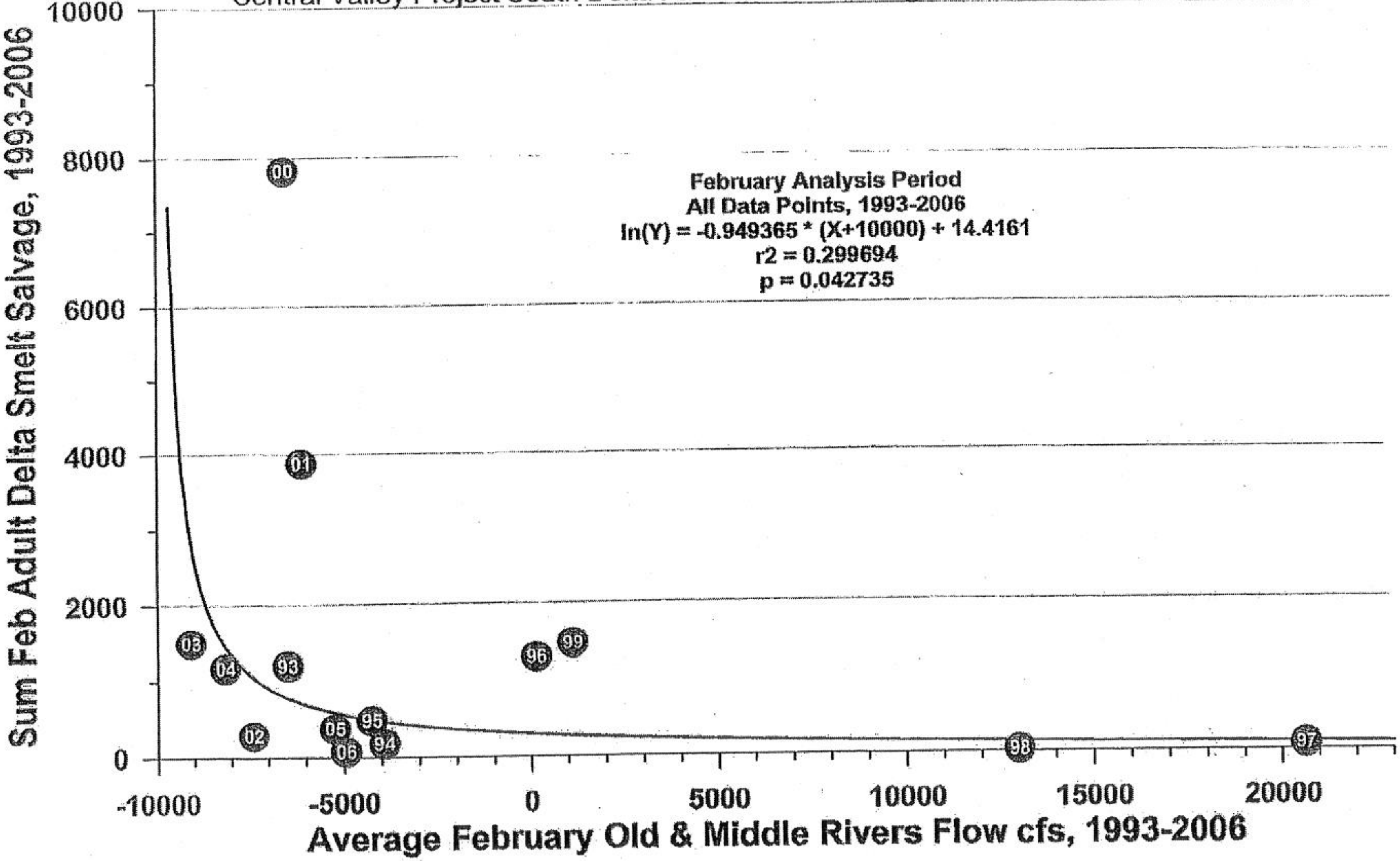
January Total Delta Smelt Salvage at the State Water Project and Central Valley Project South Delta Facilities and Average Old and Middle River Flows



Notes: Negative numbers indicate net upstream flow.
Prepared by DWR adapted from analysis performed by USGS.

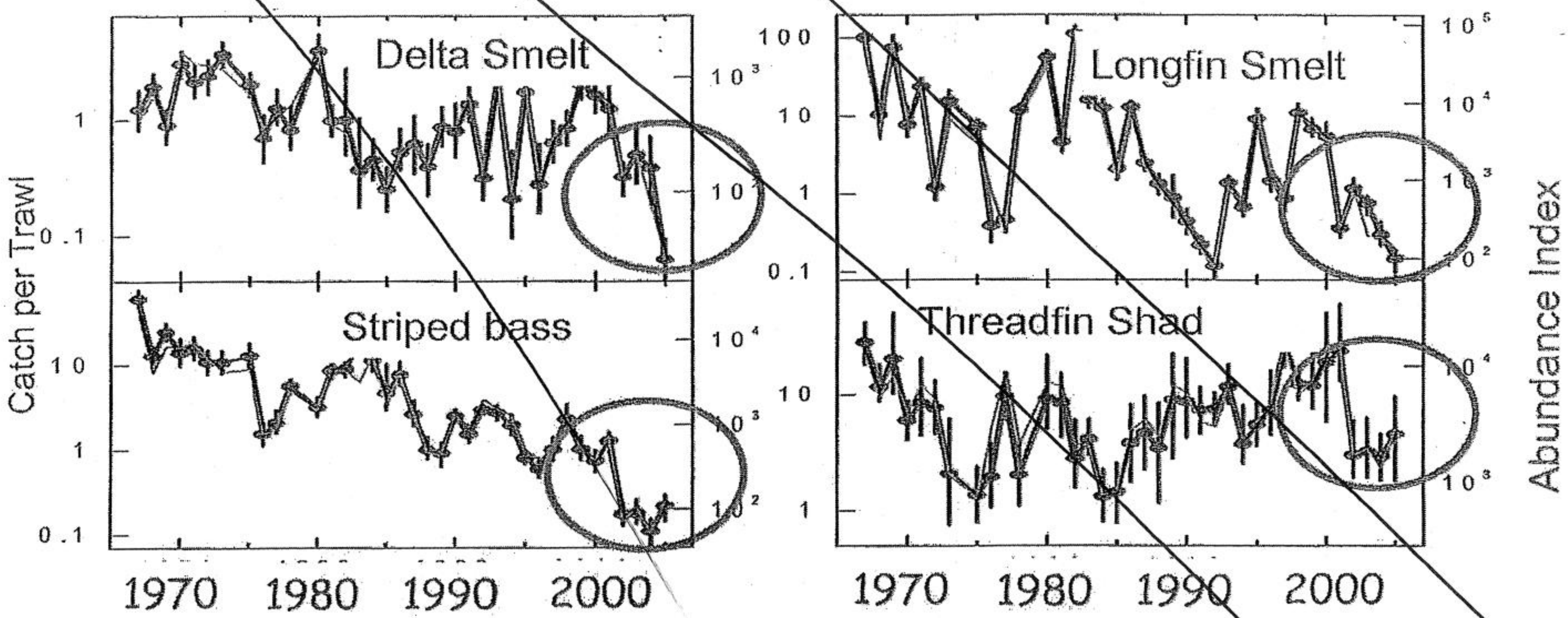
Exhibit C

February Total Delta Smelt Salvage at the State Water Project and Central Valley Project South Delta Facilities and Average Old and Middle River Flows



Notes: Negative numbers indicate net upstream flow.
Prepared by DWR adapted from analysis performed by USGS.

Exhibit D
The Pelagic Organism Decline

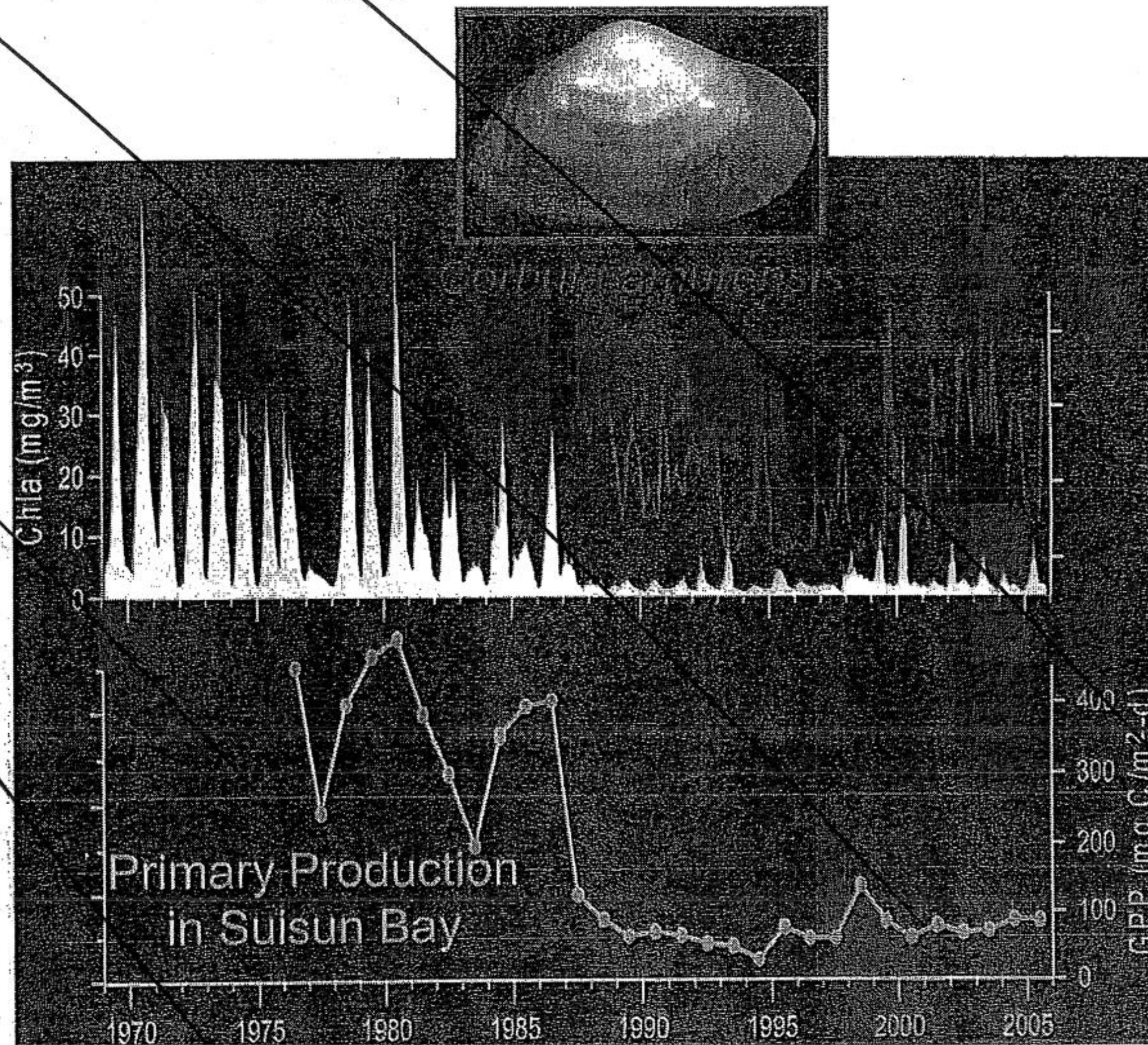


Source: Kimmerer and Nobriga (2005); Sommer et al. (In Press, Fisheries 32(6))

Exhibit E

Phytoplankton Primary Production

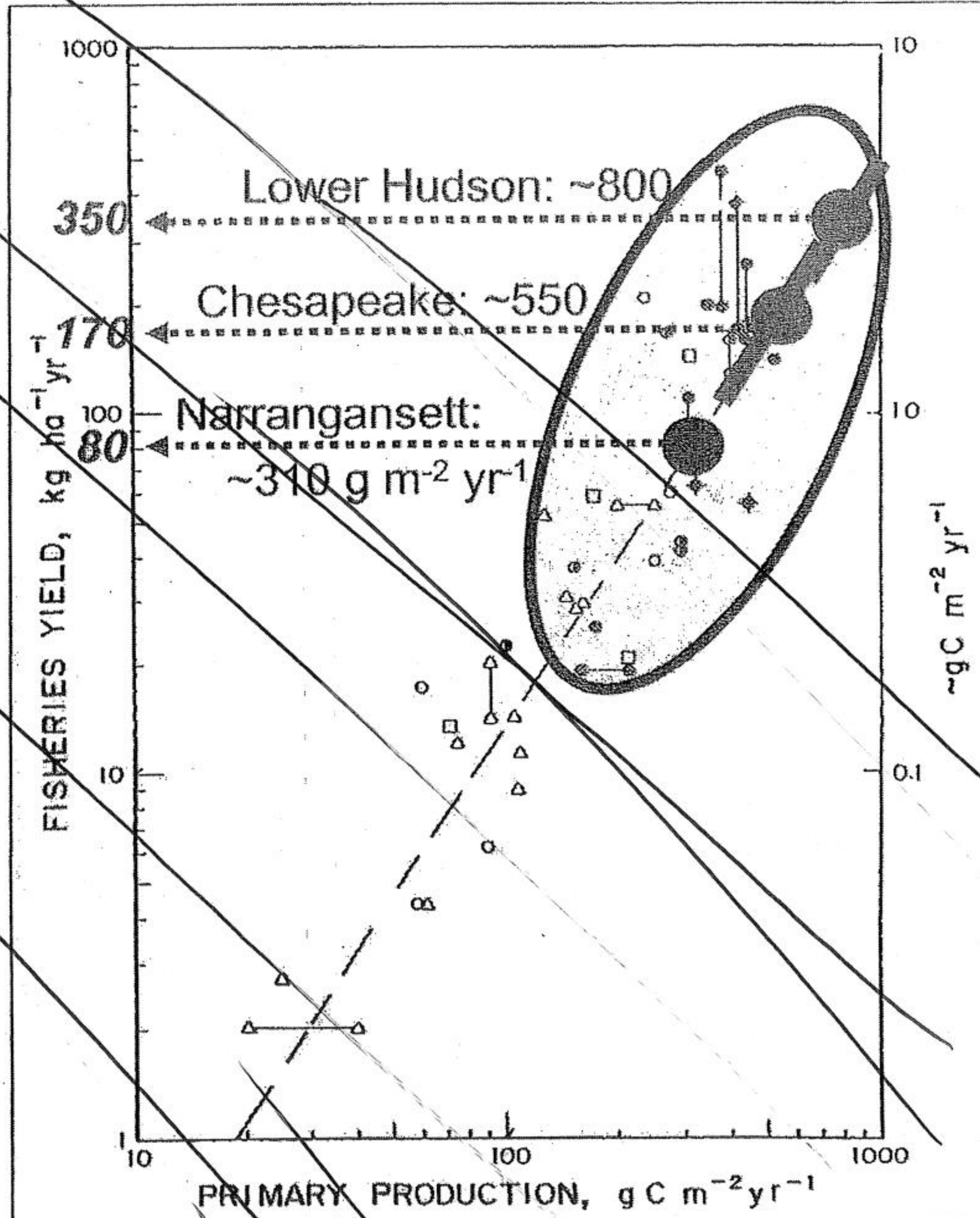
... CRASHED in Suisun Bay right after the 1987 *Corbula* invasion



Source: J. Cloern (USGS): Oral presentation at the 2007 Annual IEP Workshop, Asilomar, CA

Exhibit F
Phytoplankton Primary Production

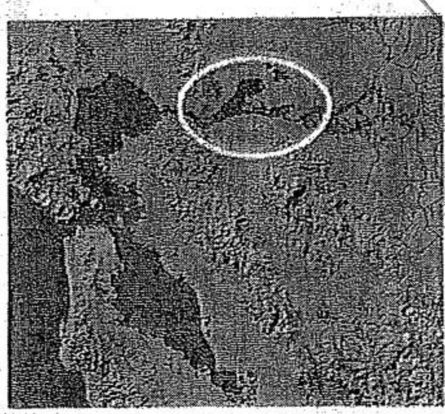
... in Estuaries is typically very HIGH

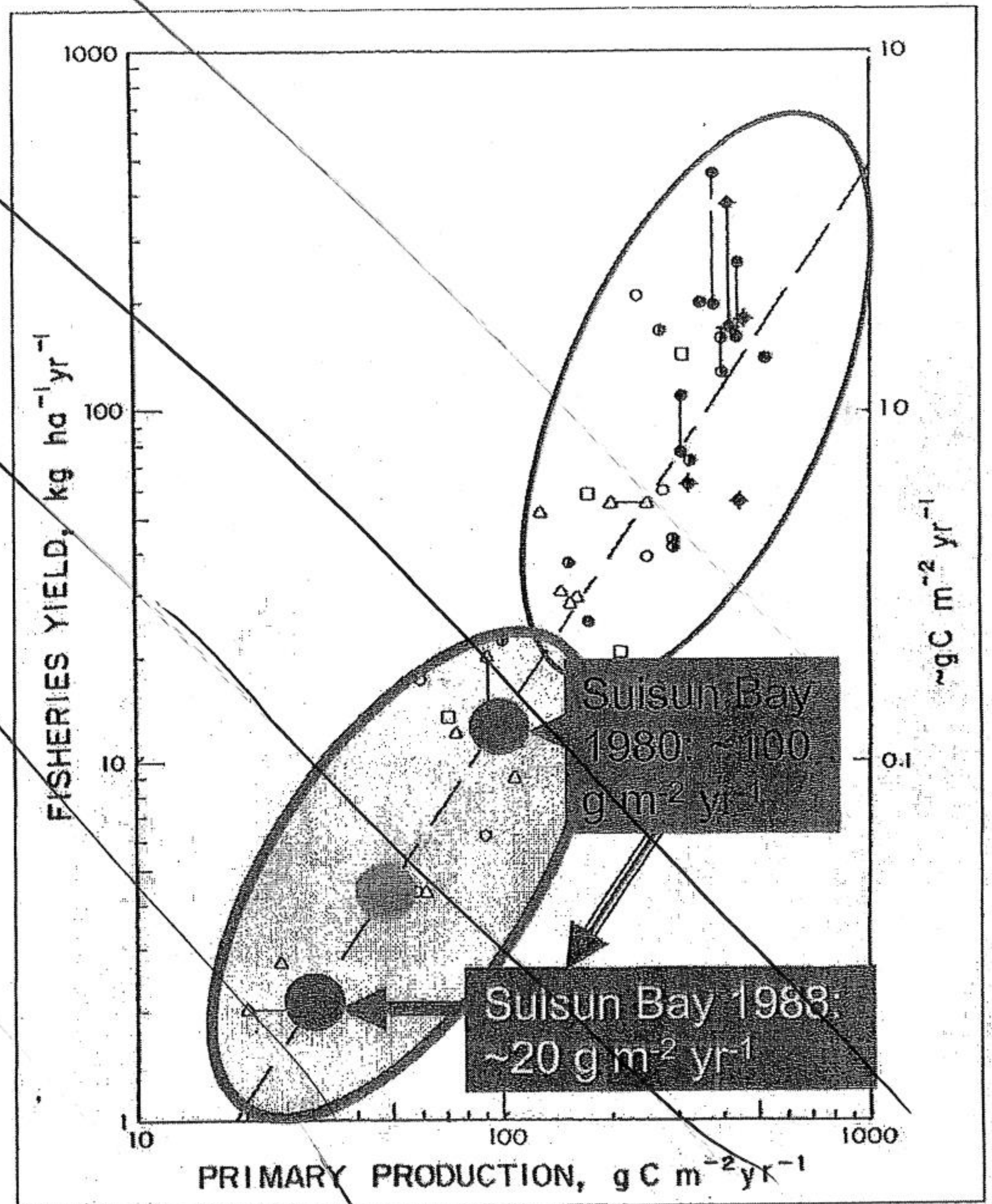


Source: S. Nixon, Limnology and Oceanography 1988

Exhibit G - Phytoplankton Primary Production

... CRASHED in Suisun Bay right after the Corbula invasion

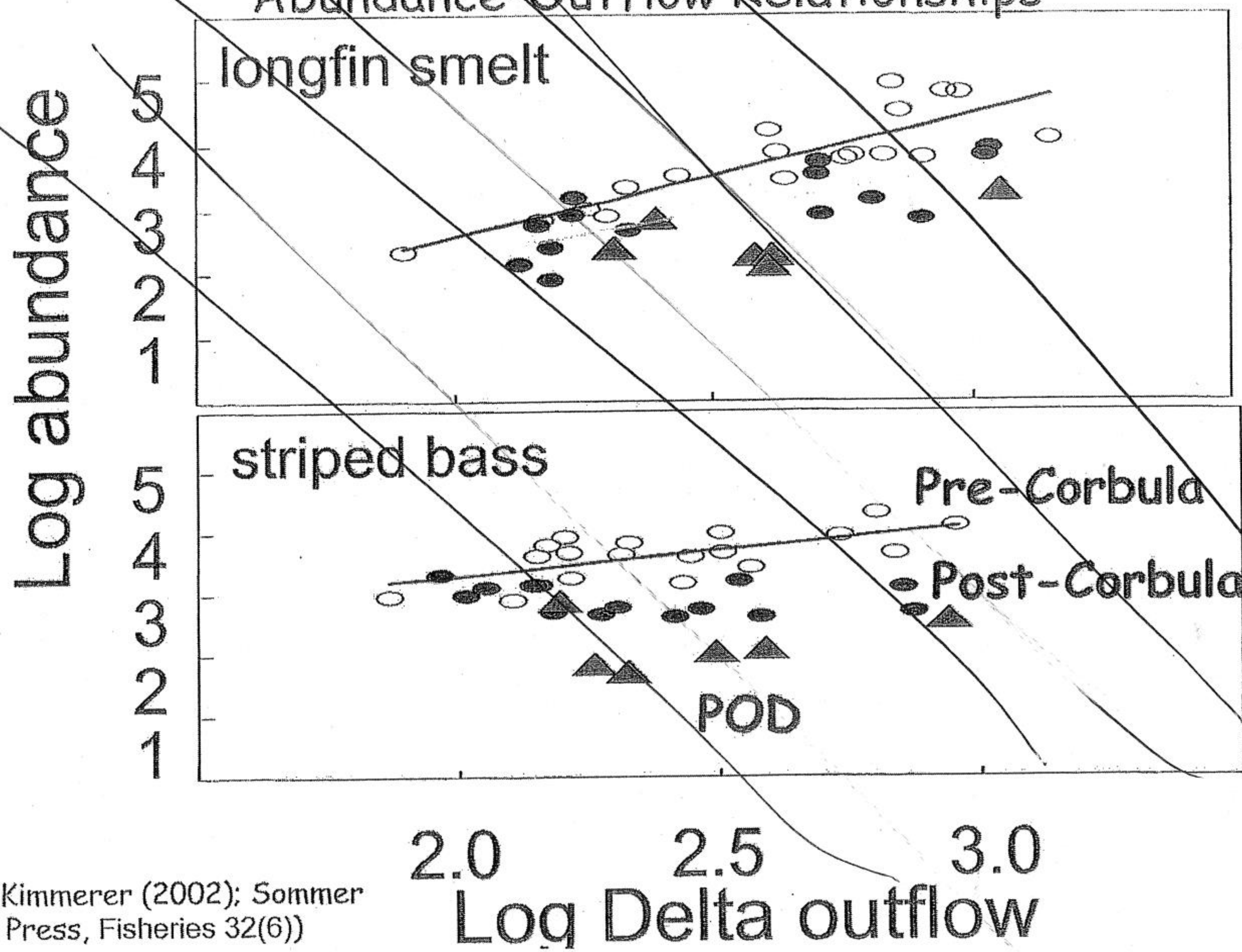




Sources: J. Cloern (USGS) & A. Jassby (UCD): Oral presentations at the 2007 Annual IEP Workshop, Asilomar, CA

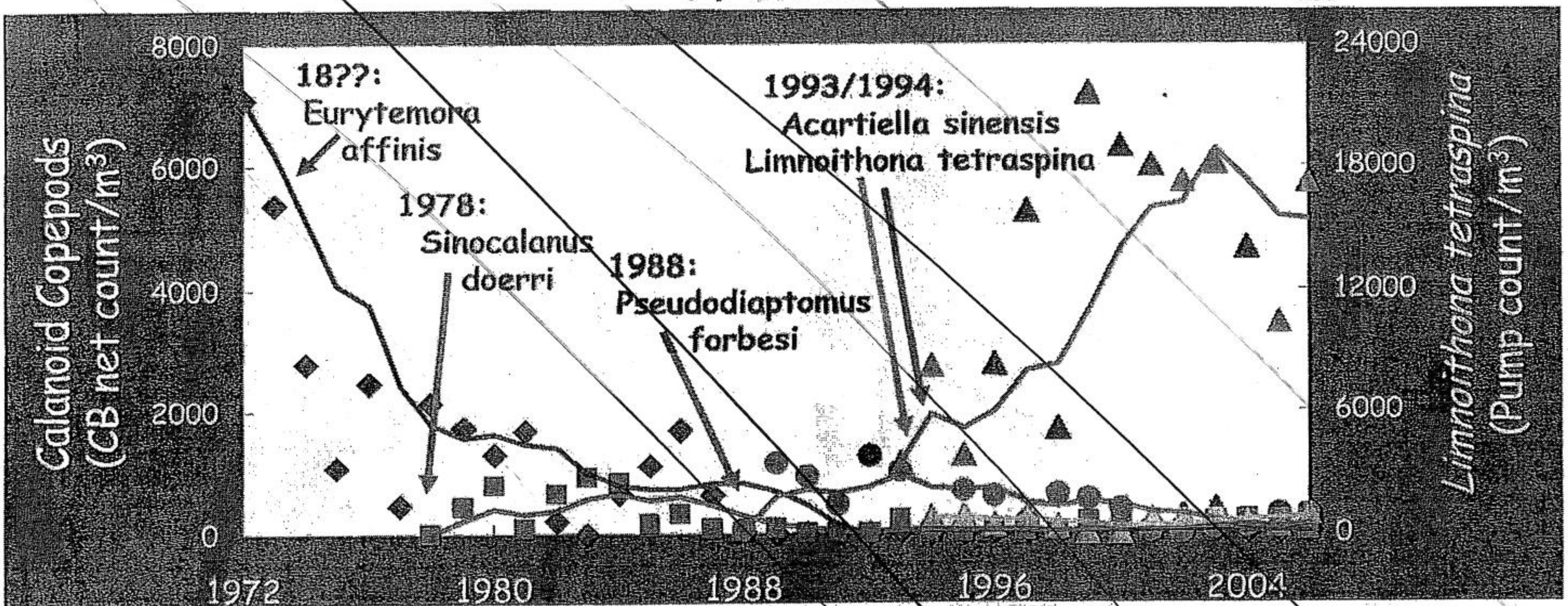
Exhibit H

POD Has Further Shifted Abundance-Outflow Relationships



Source: Kimmerer (2002); Sommer et al. (In Press, Fisheries 32(6))

Exhibit I - Zooplankton Species Invade in "Waves"



Adult copepods at Chipps Island, yearly average densities with 5-year moving average lines

Source: A. Mueller-Solger, DWR; IEP data

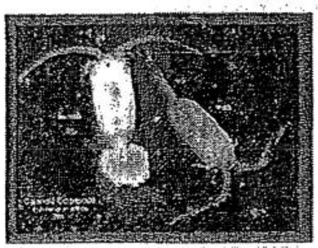
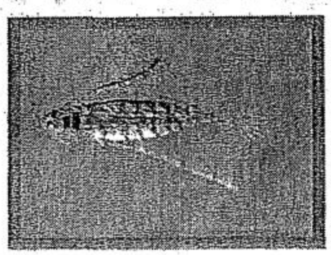
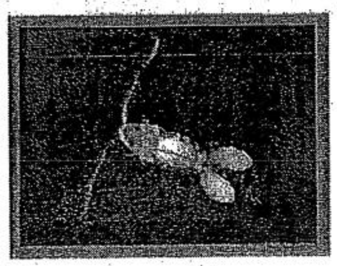
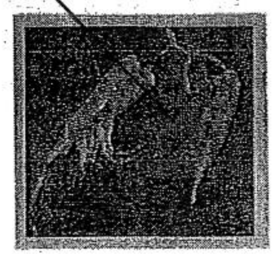
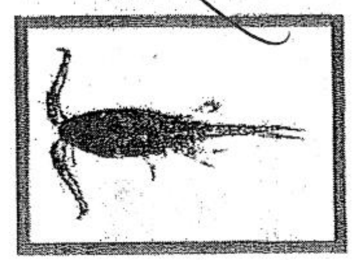
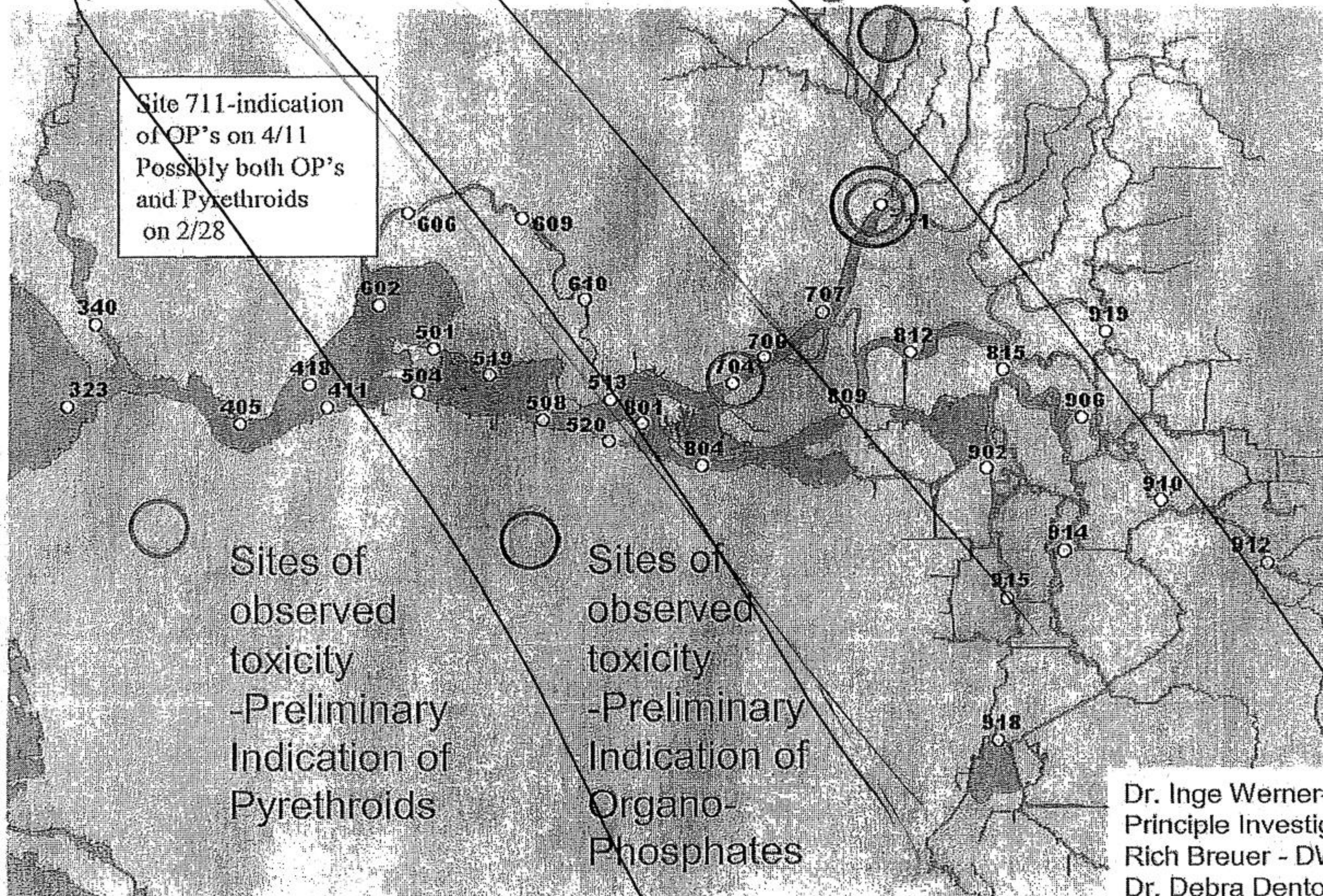






Exhibit J

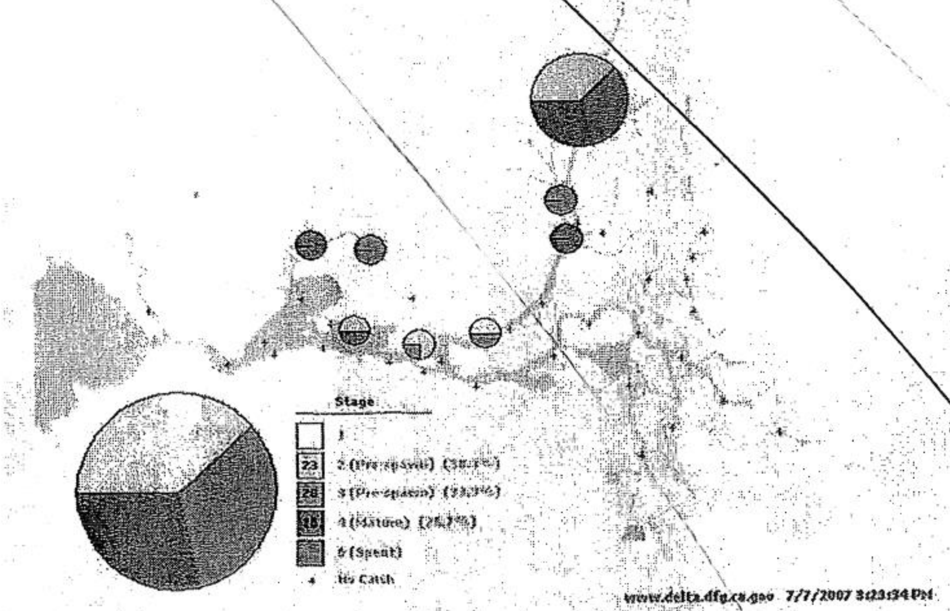
Synopsis of Toxicity Test Findings Four Dates Feb through April 2007



Dr. Inge Werner-UCD-Principle Investigator
Rich Breuer - DWR
Dr. Debra Denton-USEPA

Exhibit K
Distribution of Adult and Young Smelt in April 2007

Spring Kodiak Trawl Survey #4 of 2007
Distribution of Female Delta Smelt
(4/2/2007 - 4/5/2007)



Delta Smelt 2007
SURVEY 3 (4/9/2007 - 4/14/2007)