

United States Department of the Interior



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DEPARTMENT OF WATER RESOURCES
Division of Operations and Maintenance
3310 El Camino Avenue, Suite 300
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CT#5176
~~Thompson~~
Whitney

Expedite
to DWR
Control - due
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In Reply
Refer To:

DEC 26 2006

CVO-400
WTR-1.10

Mr. Tom Howard
Acting Executive Director
State Water Resources Control Board
Post Office Box 2000
Sacramento, California 95812-2000



Subject: Revised Fishery Protection Plan for Joint Point of Diversion

Dear Mr. Howard:

By letter dated November 20, 2006, we submitted for your approval our Protection Plan for Fish, Wildlife, and Other Legal Users of Water (Fishery Protection Plan) required for Stage 2 Joint Point of Diversion operations. Since that time we have received additional comments from the fishery agencies. Attached is the revised plan dated December 21, 2006, that incorporates those comments received and supersedes the earlier submittal. The Bureau of Reclamation and the Department of Water Resources request your approval of this revised plan as required by Water Rights Decision 1641.

If you have any questions regarding this Fishery Protection Plan, please contact Paul Fujitani at (916) 979-2197.

Sincerely,

Ronald Milligan
Operations Manager
Bureau of Reclamation

David Roose
Chief, SWP Operations Control Office
Department of Water Resources

Enclosure

Subject: Revised Fishery Protection Plan for Joint Point of Diversion

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Continued from previous page.

cc: Jim White

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**Plan for Protection of Fish, Wildlife, and Other Legal Users of Water
During Stage 2 Joint Point of Diversion**

Introduction

Water Rights Decision 1641 (D1641) authorizes the diversion of water by the U.S. Bureau of Reclamation (Reclamation) and the Department of Water Resources (DWR) through each other's Delta pumping plants as long as certain conditions are met. This authorized change of the point of diversion for the projects is known as Joint Points of Diversion, or "JPOD."

D1641 authorizes three stages of JPOD, each carrying successively more restrictive conditions for use. For Stage 2 JPOD uses, Reclamation and DWR are required to develop, in consultation with the California Department of Fish and Game (DFG), the U.S. Fish and Wildlife Service (FWS), and NOAA Fisheries (NMFS), an operations plan to protect fish and wildlife and other legal users of water.

This document describes the essential elements of a "fishery protection plan" for JPOD to avoid or minimize adverse fish and wildlife impacts of Stage 2 JPOD. This plan is designed to protect fish and wildlife under the current conditions, operations requirements, and regulatory environment. It is consistent with 2004 biological opinions on the long term Central Valley Project and State Water Project Operations Criteria and Plan (2004 OCAP BO) for fish species of concern. Conditions for JPOD use will be reassessed when new or revised biological opinions on CVP and SWP operations are issued. This plan may be amended, but only with written approval from the Executive Director of the State Water Resources Control Board (SWRCB). Should conditions for JPOD use change significantly, a revised plan to protect the fish, wildlife and other legal users of water would be submitted to the Executive Director for approval.

This plan relies on an existing network of monitoring, data collection, and processing, and its implementation uses an effective process of coordination, data evaluation, and decision-making which is already in place and has evolved subsequent to the adoption of D-1641. Fish protection actions are based on real-time assessment of biological and hydrologic conditions both prior to, and during, JPOD actions. Specific criteria define conditions suitable for JPOD use and serve as triggers or action levels. Any proposed actions related to Stage 2 JPOD operations that deviate from those outlined in this fishery protection plan will be submitted to the Executive Director for approval.

Once it has been determined that the monitoring or conditions have triggered a required change to JPOD operations, Reclamation and DWR will implement the required actions as soon as possible. Due to scheduling constraints, a change in JPOD operations may take as long as three days to implement, but if DFG, FWS, and NMFS (collectively designated as the fishery agencies) determine that the action is an emergency or it requires immediate attention Reclamation and DWR will make every effort to implement the change in as little as three hours and within 24 hours after notification.

ELEMENTS OF THE FISHERY PROTECTION PLAN

The following elements, (a)-(f), are required by D1641 for Stage 2 JPOD. Measures to address each requirement follow each item.

Element (a):

Specific measures to avoid or minimize the effects of export operations at Banks/Tracy Pumping Plant on entrainment and through-Delta survival of Chinook salmon. Monitoring of environmental conditions and fish abundance at upstream locations, as appropriate, to determine vulnerability of Chinook salmon to entrainment at Banks/Tracy Pumping Plant. Monitoring of entrainment at Banks/Tracy Pumping Plant, including frequency and method of data collection.

Salmonid Monitoring

Measures to avoid or minimize the effects of export operations at Banks and Tracy Pumping Plants on entrainment and through-Delta survival of Chinook salmon include a monitoring network, already in place, to determine when Chinook salmon are migrating from tributaries and down the Sacramento River and San Joaquin River and when they are present in the Delta and vulnerable to the effects of export pumping, including JPOD. Historically, migrating fish are not present upstream of the Delta during the June through September period and there is no regular scheduled monitoring in the Sacramento River or San Joaquin River. There is continued monitoring of fish in the Delta throughout the year.

Sacramento River Basin Chinook Salmon

The DFG operates rotary screw traps on the Sacramento River at Knights Landing 24 hours a day throughout the period of Chinook emigration, October through May. The data obtained from the screw traps indicate the downstream movement of juvenile salmon from the upper Sacramento River and tributaries (upstream of the Feather River) toward the Delta. The number of salmon captured in the traps is converted to a catch index (catch per unit of trapping effort, i.e. fish per trap per 24 hours of sampling or fish per trap-day). The catch index is a factor in decisions on Delta Cross Channel (DCC) gates operations to protect fish. Closing the gates reduces the number of Chinook salmon that enter the central Delta where they have a higher chance of swimming to the pumps and survival is lower than for those that remain in the Sacramento River.

The flow gauge on the Sacramento River at Wilkins Slough is operated by the United States Geologic Survey (USGS) and DWR. The gauge takes a reading every 15 minutes, and the real-time data is posted on the California Data Exchange Center (CDEC) website. A 20% increase in flow during a 24-hour period is associated with a potential increase in the number of juveniles emigrating past Knights Landing and to the Delta. This serves as an indication for Reclamation and DWR to follow salmon monitoring data more closely but does not specifically trigger protective actions.

San Joaquin River Basin Chinook Salmon

The Mossdale trawl is operated by the FWS three days per week, October through May. FWS

and DFG conduct additional trawling during the April and May peak outmigration period. The trawls detect salmon moving down or rearing in the lower San Joaquin River and indicates the pattern of occurrence of salmonids in the southern Delta near the pumping plants. The trawl catches emigrating salmon produced in the Stanislaus, Tuolumne and Merced rivers and hatchery-raised salmon from the Merced River Fish Facility. Data are reported as the daily catch of unmarked and marked salmon in ten tows.

Delta Monitoring

The FWS conducts beach seining at sites in the north, central, and south Delta throughout the year. This monitoring detects salmon presence in the Delta.

The FWS operates a trawling operation in the vicinity of Chipps Island a minimum of three days a week, year round. This operation detects salmon downstream of the Delta.

Continuous monitoring of entrainment (including frequency and methods) at Banks and Tracy pumping plants is conducted per ongoing procedures established by the 1993 NMFS Winter-Run Biological Opinion and the 2004 OCAP BO and as described in Attachment 2.

Many of the upstream salmon monitoring projects cease to operate during the June through September period because too few salmon have been caught in the past to justify the effort. When this is the case, the B2 Interagency Team (B2IT, established to manage water dedicated under the Central Valley Project Improvement Act Section 3406(b)(2)) will monitor results from those sampling programs that continue through the summer for indications of older juvenile salmon movement. (The term "older juvenile" is defined for this purpose as salmon larger than the minimum size defining the winter-run size range. This designation will include any late fall-run, yearling spring-run, and yearling fall-run Chinook that may be present, as well as the winter-run Chinook.) These programs typically include salvage monitoring, the lower Sacramento River beach, seine trawl, as well as beach seining in the north, central, and west Delta. If the Sacramento Catch Index of older juvenile salmon is greater than 3 during this period, the B2IT will evaluate the information, then identify and implement measures to avoid or minimize any impacts of JPOD on salmon survival. If the B2IT cannot reach agreement on implementing mitigation measures, they will elevate the issue to the CalFed Water Operations Management Team (WOMT) for further discussion. (The Sacramento Catch Index, or SCI, is the combined catch of one day of seining the mainstem between Verona and Garcia Bend, and one day of trawling the mainstem near Sacramento, normalized to a standard sampling effort for the preceding two days of sampling, or three days if sampling with either gear missed a day)

Salmon-related Criteria for Element (a) of Stage 2 JPOD, October-June:

- i) Reclamation and DWR will ensure that the aforementioned monitoring components—Knights landing rotary screw trap, Mossdale trawl, beach seining, trawling in the vicinity of Sacramento and Chipps Island, fish facilities operations and entrainment monitoring at Banks and Tracy pumping plants—are in place for JPOD to occur.
- ii) If the appropriate monitoring and data processing do not occur, then Stage 2 JPOD diversions will discontinue until the monitoring and data processing are resumed.
- iii) Unless otherwise approved by the Executive Director of the SWRCB, JPOD operations will not begin or, if ongoing, will cease if any of the following conditions occur:
 - a) Daily State Water Project (SWP)/Central Valley Project (CVP) loss density of older juvenile salmon is greater than eight per thousand acre-feet (8/TAF); or
 - b) For specified groups of Coleman National Fish Hatchery coded wire tag (CWT) late fall-run salmon cumulative loss is greater than or equal to 0.5%; or
 - c) Daily SWP/CVP loss density of older juvenile salmon is greater than or equal to 2% of the winter-run Chinook juvenile production estimate divided by 2000 (minimum=2.5); or
 - d) Daily catch of juvenile salmon in trawling (standardized to 10 tows) at Mossdale on the San Joaquin River is greater than or equal to 5; or
 - e) Daily catch index of juvenile salmon at Knights Landing and/or Sacramento Trawl on the Sacramento River is greater than or equal to 5.

Element (b):

Minimum survival levels for Chinook salmon, which shall be used to trigger consultation with fishery agencies regarding data evaluation and decision making to minimize or avoid the impact of pumping at Banks/Tracy Pumping Plant. Identify the consultation process that will be used if triggers are hit and identify the parties who will consult, how they will be notified, and a time schedule for decision-making.

Chinook Salmon

Because methods for directly measuring the abundance or survival rate of Chinook salmon in the Delta have not been devised, survival levels for Chinook salmon will be based on population estimates in the upstream areas with allowances for direct loss in the Delta as a percentage of the upstream population. These survival levels are consistent with the allowable loss levels identified in the 2004 OCAP BO terms and conditions.

During October through June, the Chinook Decision Process (see Attachment 1) will take effect, and the salvage criteria of eight older juvenile salmon per thousand acre-feet of exports (8/TAF) will serve as a protective trigger for JPOD.

Winter-Run

The loss number of juvenile winter-run Chinook triggering reconsultation will continue to be determined by NMFS each year based on winter-run escapement and/or juvenile passage past Red Bluff.

An estimate of winter-run Chinook juveniles entering the Delta is calculated annually from the adults salmon escapement estimate in the upper Sacramento River. NMFS determines the incidental take level for the CVP/SWP Delta pumps based on certain percentage (less than 2 percent of the yearly juvenile production) of the population being exposed to the influence of Delta export pumping.

Reclamation and DWR will monitor the loss of juvenile Sacramento River winter-run Chinook salmon (identification based on size-at-date criteria) at the CVP and SWP Delta pumping facilities and will use that information to determine whether the anticipated level of loss is likely to exceed the authorized level of 2%, cumulatively, of the estimated number of juvenile Sacramento River winter-run Chinook salmon entering the Delta annually. If either agency or NMFS determines the cumulative loss of winter-run Chinook has exceeded 1%, Reclamation and DWR shall immediately convene the WOMT to explore additional measures which can be implemented to reduce the rate of take and ensure the identified 2% level of take is not exceeded. If either agency or NMFS determines the rate of loss is sufficiently high that the estimated loss will likely exceed the 2% identified level or if the cumulative loss exceeds 2 %, consultation shall be reinitiated immediately. Once the 2% loss level for winter-run salmon is exceeded, JPOD will not occur as long as winter-run salmon continue to be salvaged at either facility.

Spring-Run

NMFS will identify the specific surrogate release group(s) to be used each year for the 1% loss level trigger. Reclamation and DWR will monitor the loss of identified Central Valley spring-run Chinook salmon surrogate release groups at the CVP and SWP Delta pumping facilities and use that information to determine whether the cumulative estimated level of loss is expected to exceed 1%. If the estimated cumulative loss of the release group approaches 0.5%, Reclamation and DWR shall immediately convene the WOMT to explore additional measures which can be implemented to reduce the rate of take. If either agency or the NMFS determines that the rate of loss is sufficiently high that the estimated loss will like exceed the 1 % level or if the cumulative loss exceeds 1%, consultation shall be reinitiated immediately and members of the WOMT notified immediately by email, telephone, or fax. Once the 1% loss level for a spring-run surrogate group has been exceeded, JPOD will not occur as long as spring-run Chinook surrogates (or spring-run Chinook if identification becomes feasible) continue to be salvaged at either facility.

During the July through September time-frame, salmon entrainment is expected to be negligible. No SWP/CVP take limits for salmon exist for this period, and the fish agencies do not foresee

any circumstances that would require action to modify or terminate JPOD to protect Chinook salmon. However, salmon loss data from the SWP and CVP fish facilities will be evaluated routinely and FWS, NMFS, and DFG consider the loss of five older juvenile salmon per thousand acre-feet (TAF) of exported water as a trigger for consideration of actions to avoid or minimize impacts of JPOD on salmon survival.

In the event that the July through September trigger is hit, JPOD will cease and shall not resume until the daily loss density falls below the triggering level or unless an appropriate action to reduce the rate of loss is agreed to by the FWS, NMFS and DFG and is implemented.

The WOMT agencies (Reclamation, DWR, DFG, FWS, & NMFS) will confer via the CalFed Operations Group Data Assessment Team (DAT), B2IT, or WOMT within 24 hours. A subsequent DAT conference will be used to inform and exchange information between the WOMT agencies and with stakeholders. Notification for these DAT conferences shall be via email, phone, or fax. WOMT agencies shall have a maximum of an additional 24 hours to reach decisions on mitigation measures and to develop recommendations on continuation of JPOD.

Salmon-related Criteria for Element (b) of Stage 2 JPOD:

- i) If Reclamation, DWR, or NMFS determines the rate of salmon loss has exceeded a specified trigger, Reclamation and DWR shall immediately convene the WOMT to identify and implement measures to reduce the rate of take. The agencies (Reclamation, DWR, DFG, FWS, and NMFS) will use the DAT/WOMT process to notify stakeholders and to develop recommendations on continuation of JPOD.
- ii) If either agency or NMFS determines the rate of loss is sufficiently high that the estimated loss will likely exceed an incidental take level, consultation shall be reinitiated immediately and members of the WOMT notified immediately by email, telephone, or fax. If the loss of either juvenile winter-run Chinook salmon or Central Valley spring-run Chinook salmon surrogates at the export facilities necessitates consultation with NMFS, JPOD diversions will cease.
- iii) From October through June, the Chinook Decision Process (see Attachment 1) will take effect. If the daily SWP or CVP loss density of older juvenile salmon is greater than eight per thousand acre-feet of exported water (8/TAF), JPOD operations will not begin or, if ongoing, will cease until the loss rate subsides.
- iv) From July through September, if the loss of older juvenile salmon is greater than five per thousand acre-feet of exported water (5/TAF), JPOD operations will not begin or, if ongoing, will cease unless an appropriate action, approved by DFG, FWS, NMFS, and the Executive Director is implemented.

Delta smelt

The period of concern for JPOD impacts to delta smelt is primarily from December through July. Specific monitoring requirements and CVP and SWP operational requirements to protect delta smelt are contained in the 2004 biological opinion for delta smelt from FWS on the long term Central Valley Project and State Water Project Operations Criteria and Plan (FWS 2004 OCAP BO). Actions to protect delta smelt from impacts of JPOD operations will be evaluated similar to other CVP and SWP operations in accordance with the FWS 2004 OCAP BO. The FWS 2004 OCAP BO relies on an adaptive management process facilitated through the CalFed Ops Group, Operations and Fishery Forum (OFF), DAT, B2IT, Environmental Water Account Team (EWAT), and the Delta Smelt Working Group (Working Group).

The groups that are responsible for monitoring the delta smelt population and assessing project effects on the population use the Delta Smelt Risk Assessment Matrix (DSRAM) (Attachment 3) to determine a concern level and potential actions appropriate to protect the delta smelt. The DSRAM consists of month-by-month criteria which, when exceeded, will trigger a meeting of the Working Group. The purpose of the DSRAM is to take actions to protect delta smelt in a proactive manner prior to salvage events. Reclamation and DWR are responsible for monitoring the DSRAM criteria and reporting back to FWS and the Working Group. Should a meeting of the Working Group prove necessary, the Working Group will decide whether to recommend a change in exports, South Delta barrier operations, San Joaquin River flows, or Delta Cross Channel gate operations, and the extent and duration of the recommended action. The potential actions are listed in the DSRAM by month.

The operations and monitoring groups utilize a number of monitoring and survey programs and the DSRAM to determine if triggers are met requiring specific operational actions. The FWS 2004 OCAP BO contains a requirement that the following surveys continue to be conducted to determine abundance and distribution of delta smelt: Spring Kodiak trawl, 20mm survey, summer townet survey, and fall midwater trawl survey. Monitoring also includes sampling delta smelt salvaged at Tracy and Banks pumping plants fish facilities.

To ensure that the Working Group closely monitors the effects of entrainment on the delta smelt population, the FWS 2004 OCAP BO specifies an adult salvage concern level based on the median predicted salvage at Tracy and Banks fish facilities as an indicator of the need for convening the Working Group. While the DSRAM is intended to reduce the frequency with which real-time salvage exceeds the median predicted salvage, the exceedence frequency could be as high as 50%. When the DSRAM adult salvage concern level is reached or exceeded, the Working Group will convene a meeting to discuss and recommend what actions, if any, should be taken to reduce salvage. Under this condition, JPOD may only be used with specific approval of the DFG, FWS, NMFS and the Executive Director.

When the allowable level of incidental take specified in the FWS 2004 OCAP BO is met or exceeded, FWS will determine whether reinitiation of consultation is warranted. JPOD will not occur in the event that the authorized incidental take is exceeded.

The monthly incidental take by water year type as specified in the FWS 2004 OCAP BO is as follows:

Month	Wet or Above Normal Year Incidental Take	Below Normal, Dry, or Critical Year Incidental Take
October	100	100
November	100	100
December	700	400
January	3,000	1,900
February	2,300	1,700
March	1,300	1,300
April	1,000	1,100
May	37,800	30,500
June	45,300	31,700
July	3,500	2,500
August	100	100
September	100	100

Newly hatched delta smelt larvae are not effectively sampled at the SWP or CVP fish facilities or in current surveys in the Delta. Their presence can be inferred from the appearance of spent female smelt in samples at or in the vicinity of the SWP/CVP diversions. Ripe female smelt indicate larvae will be present soon. Because these larvae are highly susceptible to the flow effects of export pumping, increased pumping using JPOD will not be approved by the fish agencies when the presence of small larvae in the southern Delta can be reasonably inferred from available information. An exception may be made if there is adequate net downstream flow in Old and Middle rivers.

The FWS OCAP BO notes that most JPOD pumping occurs in the summer and fall, when delta smelt are not likely to be present in the southern Delta. When this is true, delta smelt entrainment at the export facilities is not likely to increase as a result of the JPOD pumping. Nevertheless, JPOD pumping will not occur unless FWS, DFG, NMFS (Management Agencies) (and Working Group, as necessary), through the WOMT, determine that fish in the Delta would not be harmed.

Delta Smelt-related Criteria for Element (b) of Stage 2 JPOD:

- i) JPOD will only occur when the Management Agencies determine that delta smelt in the Delta would not be harmed. When the DSRAM adult salvage concern level is met or exceeded, the Working Group will convene a meeting to discuss and recommend what actions, if any, should be taken to reduce salvage. If the concern level has been exceeded, JPOD may only be used with specific approval of the DFG, FWS, NMFS and the Executive Director.
- ii) In the event that the delta smelt incidental take is exceeded, JPOD operations will not begin or, if ongoing, will cease.

Element (c):

Specific measures at Trinity, Shasta, or Folsom reservoirs to avoid or minimize adverse effects to Chinook salmon if upstream or Delta monitoring indicates that such impacts are occurring.

Potential adverse effects to Chinook salmon upstream include: reduction in reservoir cold water supply when river water temperature is or subsequently could be above the preferred range for various life stages, early emigration of fry, increased predation rates, and de-watered redds or stranded fish when flows fluctuate. (Salmon entrainment is discussed in Elements (a) and (b), above.)

The existing flow and temperature requirements for salmonids on the Trinity, Sacramento, and American and Stanislaus rivers remain in effect during JPOD operations. Operations forecasts will be updated on a monthly basis to determine the likelihood that adverse temperatures or flow fluctuations will occur when JPOD is occurring or is proposed. Modeling of project operations and temperature operations will be discussed among the project agencies and management agencies at the weekly B2IT meetings. Mitigation to reduce potential impacts includes halting the use of JPOD, rescheduling JPOD, or not starting JPOD. If unforeseen impacts were to result from JPOD, then mitigation could include seining fish from stranding areas and returning them to the river, maintaining releases to the affected river to avoid stranding, or using a power bypass if JPOD were to adversely affect Shasta or Folsom Reservoirs' cold water pool and Reclamation's ability to meet the temperature objectives.

Water temperature objectives for salmonids in the Sacramento and American rivers include potential adjustments to the river reach where the target temperature is to be achieved (compliance points). If temperature modeling indicates that the temperature objectives established for operations without JPOD cannot be achieved through the temperature control season with JPOD, JPOD will not occur. An exception may be allowed if the fishery agencies conclude, based on the current fish status and habitat conditions, that any expected increase in water temperature due to the proposed JPOD operation will not adversely impact aquatic resources in the affected river reach.

It is not anticipated that Stage 2 JPOD operations by the SWP will affect operations at Oroville Reservoir or Feather River flow since it is not expected that DWR would release water from SWP storage to export utilizing Stage 2 JPOD.

In the lower Sacramento River and Delta, criteria defined by the Chinook Decision Process will be followed if fish monitoring indicates that significant numbers of juvenile salmon are present in the lower Sacramento River or in the southern Delta. If the "Decision Process" criteria are approached or exceeded, the B2IT or the DAT will be convened within 24 hours to discuss and recommend appropriate measures to avoid or minimize impacts on Chinook salmon. The WOMT will act on any such recommendations as soon as possible but within 72 hours.

Responses to salmon monitoring in the Delta are contained in Elements (a) and (b) above.

Criteria for Element (c) of Stage 2 JPOD:

- i) If modeling or monitoring indicates that the use of JPOD would adversely affect the ability of the coldwater pool in Trinity, Shasta, or Folsom reservoirs to meet the needs of Chinook salmon or steelhead then JPOD operations will not occur. An adverse impact will be defined as the inability to meet the temperature objectives established for operations without JPOD or a change in the temperature objective (temperature target or compliance point) due to JPOD within habitat occupied by Chinook salmon or steelhead in the Sacramento, American, or Trinity River. JPOD may proceed under this condition only if the change in the temperature objective due to JPOD operation is determined by the fishery agencies not to be significant.
- ii) If modeling predicts that JPOD will result in flow fluctuations that result in significant loss of Chinook salmon or Central Valley steelhead, then JPOD will not occur.

Element (d):

Operating criteria to insure that JPOD does not significantly impact aquatic resources in upstream areas due to changes in flow, water temperature, and reservoir water levels.

As noted in Element (c) above, during JPOD operations the existing flow and temperature requirements contained in the OCAP BO for CVP operations on the Trinity, Sacramento, Stanislaus and American Rivers will remain in force.

Water Rights Order 90-5 (WR 90-5) also contains water temperature, monitoring, and flow requirements for the Sacramento River and Trinity River. An operations plan is prepared and submitted to the SWRCB each year detailing the Sacramento River temperature operations and designating the appropriate temperature compliance point.

Reclamation will meet the temperature and ramping requirements in the OCAP BO on the Sacramento, Trinity, Stanislaus and American Rivers (see Attachment 2) and the requirements in WR 90-5. Per the OCAP BO, Reclamation will target daily average water temperatures in the Sacramento River between Keswick Dam and Bend Bridge as follows: Not in excess of 56 °F at compliance locations between Balls Ferry and Bend Bridge from April 15 through September 30, and not in excess of 60°F at the same compliance locations between Balls Ferry and Bend Bridge from October 1 through October 31, provided operations and temperature forecasts demonstrate the capability to achieve and sustain compliance. During periods outside of flood control operations and to the extent controllable during flood control operations, Reclamation shall ramp down releases from Keswick, Nimbus, and Goodwin dams in accordance with ramping requirements.

On the American River, Reclamation will develop a water temperature control plan for review and approval by NMFS. The draft annual temperature control plan will be submitted by Reclamation for review by NMFS not later than May 1 of each year. In the development of that annual temperature control plan, Reclamation will seek input from the American River Operations Group (AROG).

Due to the relatively small capacity and the limited cold water pool at Folsom Reservoir, Shasta

Reservoir will typically be the primary source of water for the CVP's use of JPOD in most years during balanced conditions. Releases from Keswick Reservoir will be adjusted to support the changes in export pumping due to the increment of JPOD pumping at Banks, with travel time considered. Nevertheless, it should be noted that changes in accretions/depletions, temperature operations, and applicable regulatory standards over the period of JPOD, will require Shasta and Folsom release changes that are not related to JPOD pumping.

If system operations modeling, temperature modeling, or real-time fish, water level or temperature monitoring indicates that JPOD operations will have a significant negative effect on any of the above criteria, the DAT or B2IT will be convened within 24 hours to evaluate whether JPOD exports should be curtailed.

Criteria for Element (d) of Stage 2 JPOD:

- i) Project operations under Stage 2 JPOD must meet the fish protection temperature and flow objectives on the Sacramento River, American River, and Stanislaus River contained in Attachment 2, WR 90-5, and as described under Element c above.
- ii) If system operations modeling, temperature modeling, or real-time fish or habitat monitoring indicates that JPOD operations will have a significant negative effect on any of the above criteria, the DAT or B2IT will be convened within 24 hours to evaluate whether JPOD exports should be curtailed.

Element (e):

Specific measures to protect other legal users of water.

JPOD operations have the potential to reduce water levels or change water quality conditions in the south Delta. They also have the potential to impact the ability to manage instream temperatures below the source reservoirs. To protect other legal users of water, Reclamation and DWR will coordinate with other water users prior to and during JPOD operations.

DWR and Reclamation already have two response plans in place to protect south Delta diverters from water level and water quality impacts due to Stage 1 or Stage 2 JPOD. As required by these response plans, south Delta diverters are notified via email at least seven days prior to a planned JPOD action. In anticipation of beginning or continuing JPOD operations, DWR produces and shares with interested parties weekly modeling results using Delta Simulation Model 2 (DSM2). The model predicts water levels and water quality, both with and without JPOD operations at a number of stations in the south Delta.

If a south Delta diverter were to object to planned JPOD diversions on the basis of shared model results, and DWR, Reclamation, and the diverter are unable to agree on operations of JPOD, then DWR and Reclamation will contact the SWRCB Chief of the Division of Water Rights for a determination of what, if any, mitigation is required for potential water quality impacts associated with JPOD operations.

During JPOD operations, DWR and Reclamation will monitor real-time electrical conductivity

(EC) and water level data. If south Delta water quality standards are being met, and shared modeling analysis does not indicate future non-compliance, then the incremental JPOD effects to water quality shall be deemed acceptable. On the other hand, if water quality standards are not being met, or shared modeling analysis indicates the trend effect of JPOD is to degrade salinity conditions to the extent that the standards would not be met, then the effect of JPOD on South Delta water quality would be deemed unacceptable, and JPOD would not occur without other mitigation measures for salinity effects.

If, during JPOD operations, observed water levels drop below the minimum elevations described in the Water Level Response Plan, DWR and Reclamation will cease JPOD operations. DWR and Reclamation will also cease JPOD operations if notified that a diverter is experiencing problems diverting water in the south Delta due to low water levels.

In addition to complying with the terms of the water level and water quality response plans described above, DWR and Reclamation will discuss the potential for JPOD operations at least 14 days in advance at the regular monthly CalFed Ops meeting or by notification through the OFF group. These groups have representatives from about 30 stakeholder organizations.

Furthermore, Reclamation and DWR will provide the B2IT and the OFF with points of contact, and will post the same contact information on the CalFed Ops webpage, so that members of the public can reach Reclamation or DWR operators to report any problems which may arise due to JPOD.

In the event that a legal water user alleges harm as a result of JPOD actions, Reclamation and DWR will forward the allegation to the SWRCB and provide the water user an initial written response within 72 hours. Reclamation and DWR will attempt to verify that harm has resulted or is resulting specifically from JPOD operations, and if so, provide mitigation to the extent of the incremental impact due to JPOD. If such mitigation measures cannot be provided within a reasonable time frame, JPOD operations will cease. If allegations of harm are contested by the USBR and/or DWR or if effective incremental mitigation cannot be provided in a timely manner, the issue shall be immediately forwarded to the Executive Director of the SWRCB for resolution.

Criteria for Element (c) of Stage 2 JPOD:

- i) At least 14 days prior to beginning Stage 2 JPOD operations, the potential for such operation will be discussed at the regular monthly CalFed Ops group meeting or by notification through the OFF group.
- ii) In implementing JPOD operations, DWR and Reclamation will comply with the conditions of the Water Level Response Plan and Water Quality Response Plan to protect Delta water users.
- iii) DWR and Reclamation will provide points of contact to the B2IT and the OFF, and these contacts will also be listed on the CalFed Ops web page.
- iv) An initial response to an allegation of harm from a legal user of water will be provided in writing within 72 hours by USBR and/or DWR staff. Reclamation and DWR will attempt to verify that harm has resulted or is resulting specifically from JPOD operations, and if so,

provide mitigation to the extent of the incremental impact due to JPOD. If such mitigation measures cannot be provided within a reasonable time frame, JPOD operations will cease.

v) All allegations of harm will be forwarded to the SWRCB. If allegations of harm are contested by Reclamation and/or DWR, or if effective incremental mitigation cannot be provided in a timely manner, the issue shall be immediately forwarded to the Executive Director of the SWRCB for resolution.

Element (f):

Specific measures to mitigate significant effects on recreational and cultural resources at affected reservoirs.

Recreational impacts shall be deemed to occur only when reservoirs which provide water for export under JPOD meet both of the following conditions:

1. Actual operations with JPOD are forecasted to draw affected reservoirs below the end of water year (Sept 30) storage which would have occurred under D-1485 with Federal replacement pumping; and
2. Actual operations with JPOD are forecasted to draw affected reservoirs below the useable elevation of the lowest boating access prior to Labor Day weekend.

Mitigation for significant recreational impacts may consist of actions such as installation of temporary boat launching facilities or temporary access points to the reservoir. In the event that DWR or Reclamation is unable to implement mitigation actions, JPOD operations will not occur.

Cultural resources have been evaluated and preserved during the pre-construction period and/or in the 1976-1977 and 1987-1992 periods when reservoirs were drawn down to historic minimums. JPOD will not occur when it would cause reservoirs to be drawn down to or below historic minimum elevations. Nevertheless, the USBR shall endeavor to protect and catalog any significant, newly identified cultural resources which may be discovered during JPOD operations. In addition, the USBR Regional Archaeologist or other designated staff will be provided with a copy of expected water surface elevations for affected reservoirs during the period of JPOD to ensure that previously identified cultural resources can be protected or further investigated as required.

An initial response to allegations of impacts to recreational and/or cultural resources shall be provided by the USBR or DWR in writing within 72 hours. Unresolved disputes shall be forwarded to the Executive Director of the SWRCB for resolution.

It is not anticipated that Stage 2 JPOD operations by the SWP will affect operations at Oroville Reservoir or Feather River flow.

Criteria for Element (f) of Stage 2 JPOD:

i) If JPOD operations are forecasted to draw affected reservoirs below: (1) the end of water year (Sept 30) storage which would have occurred under D-1485 with Federal replacement pumping, And (2) the useable elevation of the lowest boating access prior to Labor Day weekend, then Reclamation and DWR would implement mitigation actions. These actions may include installing temporary boat launching facilities or temporary access points to the reservoir.

In the event that DWR or Reclamation is unable to implement mitigation actions, JPOD operations will not occur.

ii) To protect cultural resources, JPOD will not occur when it would cause reservoirs to be drawn down to or below historic minimum elevations. Furthermore, Reclamation's Regional Archaeologist will be provided with a copy of expected water surface elevations for affected reservoirs during the period of a contemplated JPOD action to ensure that previously identified cultural resources can be protected or further investigated as required.

iii) An initial response to allegations of impacts to recreational and/or cultural resources shall be provided by the USBR or DWR in writing within 72 hours. Unresolved disputes shall be forwarded to the Executive Director of the SWRCB for resolution.

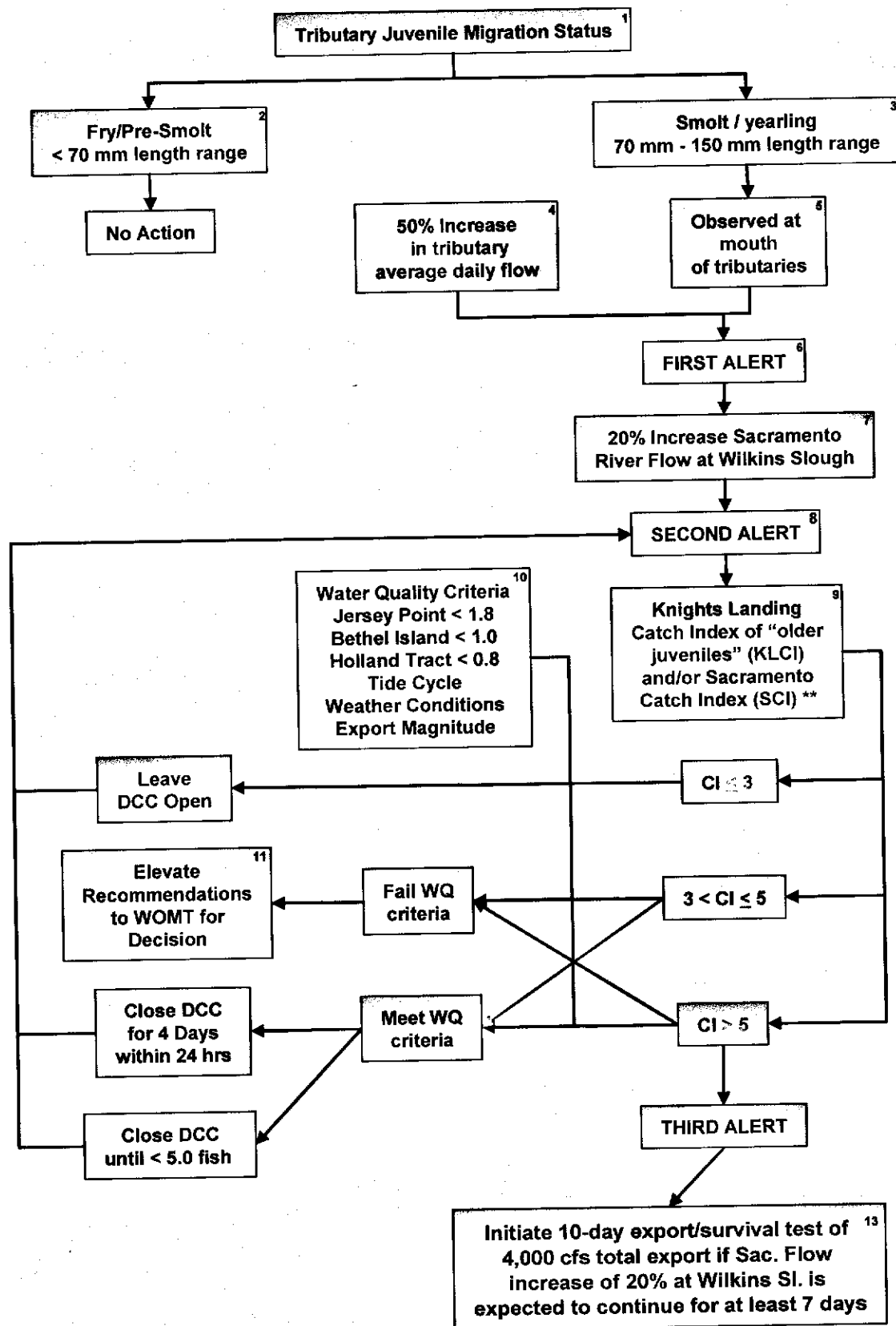
ATTACHMENTS

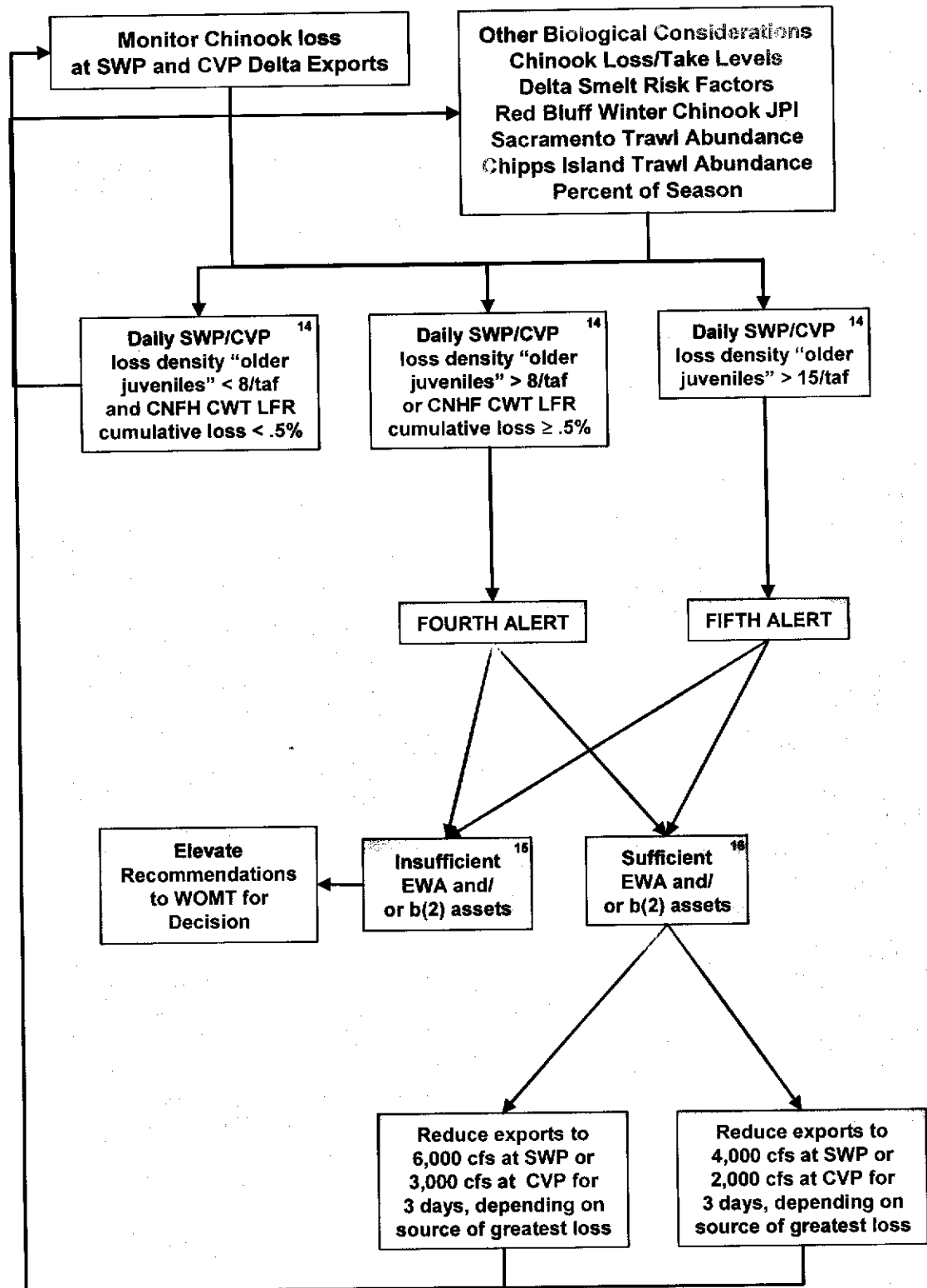
1. Chinook Decision Process
2. NMFS - Biological Opinion on the Long Term Central Valley Project and State Water Project Operations Criteria and Plan, Selected sections related to actions required to avoid significant impact of JPOD operations on salmonids and Central Valley steelhead.
3. Delta Smelt Risk Assessment Matrix

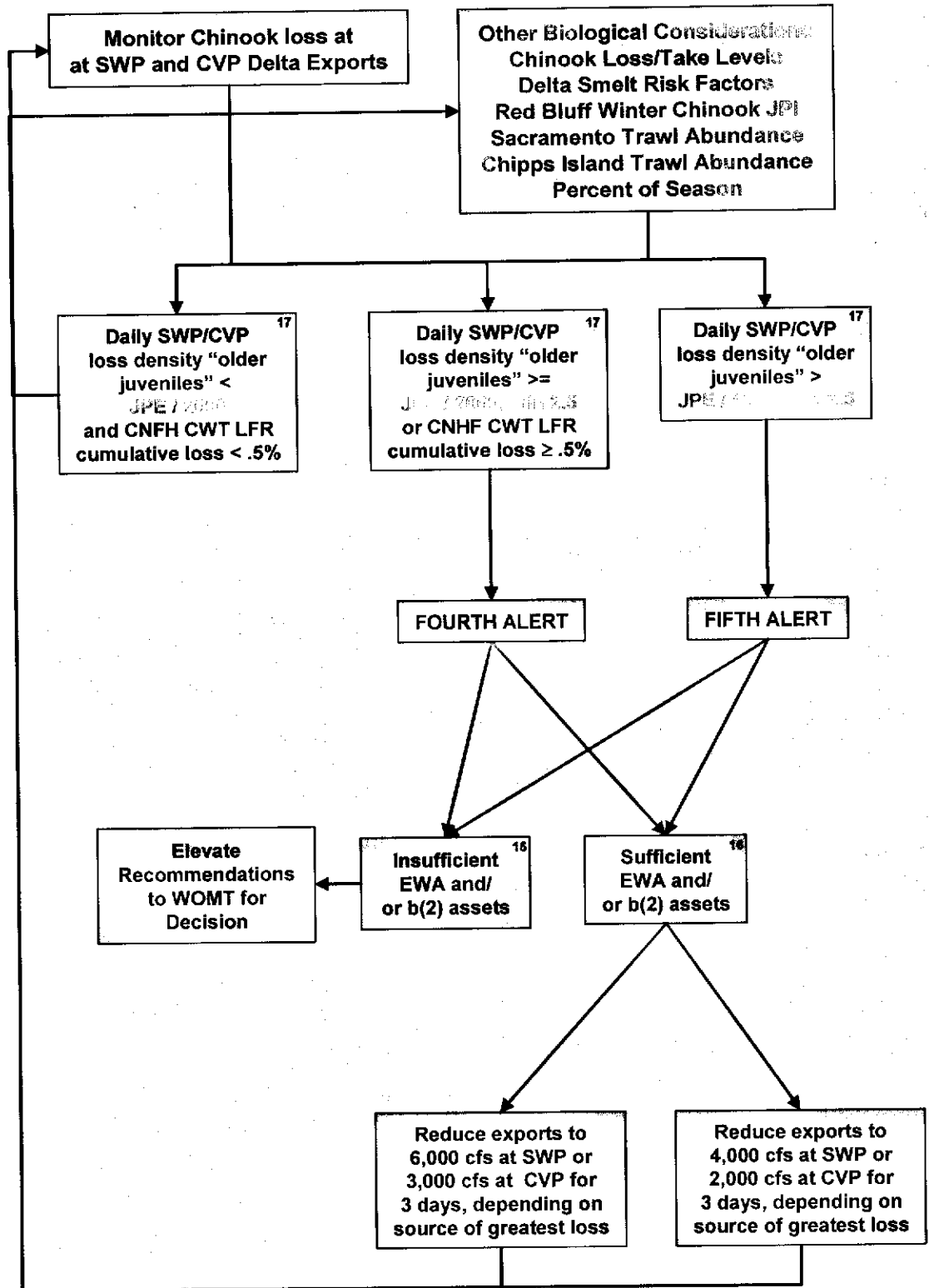
December 21, 2006

ATTACHMENT 1

Chinook Decision Process







Annotation – Chinook Salmon Decision Process

- 1 - Mill, Deer and Butte creeks are the most important populations of spring Chinook today (DFG, June 1998. Report to the Fish and Game Commission: A Status Review of the Spring-run Chinook Salmon in the Sacramento River Drainage. Candidate Species Status Report 98-01). DFG operates rotary screw traps near the mouths of these three tributaries to monitor the emigration of spring-run yearlings, and later, spring-run and fall-run fry.
- 2 - Juvenile Chinook in the spring Chinook tributaries less than 70 mm between October and April are fall-run or spring-run fry or pre-smolts (Figure 1) and not the focus of the Salmon Decision Process actions.
- 3 - Juvenile Chinook in the spring-run tributaries greater than 70 mm between October and April are spring-run yearlings (Figure 1) and the focus of the Salmon Decision Process actions.
- 4 - Yearling spring-run are difficult to trap, due to their low numbers and strong swimming ability, therefore a significant increase in flow is a surrogate for trapping yearling spring-run. The first significant flow in October is associated with the beginning of emigration (Figures 2 - 4).
- 5 - Yearling spring-run at the mouths of the spring-run tributaries are in the Sacramento River and are susceptible to Delta mortality factors associated with the Delta Cross Channel (DCC) and SWP/CVP export operations.
- 6 - The "First Alert" is the early warning criteria for closing the DCC..
- 7 - Wilkins Slough is the flow gage near Knights Landing, and about 35 miles upstream of the Delta. A significant flow increase at Wilkins Slough is associated with juvenile emigration past Knights Landing (Figure 5).
- 8 - The "Second Alert" is the warning criteria for closing the DCC. The First and Second alerts are important warning criteria because information and data dissemination, and agency coordination for an action can take several days.
- 9 - Catches Indexes at Knights Landing and/or Sacramento are the criteria upon which the first action is based; closing the Delta Cross Channel Gates (DCC) (Figures 6 and 7). The raw catches are standardized to one day of effort, but do not include catch efficiency. Depending on the catch magnitude, there are several options for closing the DCC, ranging from not closing them, and continuing to monitor catch at KL and/or Sac, to closing them until the catch index decreases to 5 fish per day.
- 10 - Closing the DCC for fish protection can adversely impact Delta salinity from November through January. Without Sacramento River freshwater flowing through the DCC and into the central Delta to the bay, saline ocean water can intrude into the central and southern Delta. Water project operators developed an objective set of water salinity criteria that indicate when the Delta becomes susceptible to salinity intrusion if the DCC is closed and exports are maintained.
- 11 - Fish and water salinity needs are frequently mutually exclusive, with respect to the DCC position, from November through January. Under the situation, if the Data Assessment Team (DAT) and Operations and Fish Forum (OFF) can't resolve the contradiction, they elevate it to the Water Operations Management Team (WOMT).
- 12 - The KL and/or Sac catch index of > 10 from November through February, and > 15 from March through April indicates the "Third Alert". A significant number of juvenile Chinook are in the Delta and potentially exposed to the south Delta exports in the following weeks.
- 13 - FWS conducts a juvenile Chinook Delta survival experiment each year in December and January. The goal is to try to determine the relationship between survival, exports and flow.

The objective is 10 consecutive days of consistent environmental parameters, exports and inflow. The criteria to achieve the objective is a KL and/or Sac catch index > 10 , and projected Sacramento River flow increased by 20%.

- 14 - Juvenile Chinook loss at the exports is the only export reduction criteria. The two loss criteria are based on non-clipped Chinook loss density (Figure 8), and Coleman late fall hatchery Chinook cumulative loss. Non-clipped Chinook loss density and hatchery Chinook cumulative loss are the "Fourth and Fifth alerts".
- 15 - Fish Management Agencies (MA) determine whether there are sufficient EWA assets to reduce exports. If there are insufficient EWA assets, the MAs elevate the issue to WOMT for resolution.
- 16 - If EWA assets are sufficient, the MAs reduce exports for a number of days and resume monitoring loss.

ATTACHMENT 2

NMFS - Biological Opinion on the Long Term Central Valley Project and State Water Project Operations Criteria and Plan (Selected sections related to actions required to avoid significant impact of JPOD operations on salmonids and Central Valley steelhead)

Shasta Division/Whiskeytown Reservoir Operations

6. Reclamation shall manage the cold water supply within Shasta Reservoir and make cold water releases from Shasta Reservoir to provide suitable habitat for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead in the Sacramento River between Keswick Dam and Bend Bridge.
 - a. Reclamation shall target a minimum end-of-year (September 30) carryover storage in Shasta Reservoir of 1.9 MAF for improvement of cold water resources in the following water year.
 - b. Reclamation shall target daily average water temperatures in the Sacramento River between Keswick Dam and Bend Bridge as follows:
 - i. Not in excess of 56 °F at compliance locations between Balls Ferry and Bend Bridge from April 15 through September 30, and not in excess of 60°F at the same compliance locations between Balls Ferry and Bend Bridge from October 1 through October 31, provided operations and temperature forecasts demonstrate the capability to achieve and sustain compliance.
 - ii. If annual conditions cannot support project compliance at Balls Ferry, Reclamation shall reinitiate consultation and convene the SRTTF to provide input regarding annual cold water management alternatives prior to announcement of the CVP water service delivery allocations.
 - iii. The selection of compliance locations downstream of Balls Ferry shall be accomplished through an annual adaptive management process, initiated by Reclamation in consultation with NOAA Fisheries, utilizing input from the SRTTF (as described in the OCAP BA, Appendix B), and based on the technical assessment of cold water resources information and projections available in the spring months (*i.e.*, March, April, May).
 - iv. The annual adaptive management process will focus efforts to analyze annual cold water management flexibility to provide thermal protections to winter-run Chinook salmon, spring-run Chinook salmon, and steelhead as envisioned in the SWRCB Order 90-5. Initial technical analysis will consider the following selection of compliance locations based on the projected cold water availability and spawning distribution in the upper Sacramento River:

May 1, Shasta cold water volume below 52 °F	Compliance Target
<3.3 MAF	Balls Ferry
>3.3 MAF but < 3.6 MAF	Jellys Ferry
>3.6 MAF	Bend Bridge

7. Reclamation shall minimize the adverse effects of flow fluctuations associated with Shasta Reservoir and Whiskeytown Reservoir operations on Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead spawning, egg incubation, and fry and juvenile rearing within the upper Sacramento River and Clear Creek.
 - a. Reclamation shall coordinate with NOAA Fisheries before reducing releases downstream of Keswick Dam when monitoring suggests such changes may have adverse affects.

American River
Division

9. Reclamation shall manage the cold water supply within Folsom Reservoir and make cold water releases from Folsom Reservoir to balance the needs of Central Valley steelhead with fall-run Chinook salmon in the American River downstream of Nimbus Dam.
 - a. Reclamation shall coordinate with the B2IT group to target a spring filling (May or June) of at least 700 TAF of storage in Folsom Reservoir in order to conserve available cold water resources and to develop a water temperature control plan.
 - b. Reclamation shall develop a water temperature control plan for review and approval of NOAA Fisheries. The draft annual temperature control plan will be submitted by Reclamation for review by NOAA Fisheries not later than May 1 of each year. In the development of that annual temperature control plan, Reclamation shall seek input from the membership of the American River Operations Group (AROG).
 - c. The water temperature control plan will give a preference to utilization of available cold water resources and Folsom Dam shutter management for the protection of steelhead by targeting 68 °F at Watt Avenue Bridge, before assessing cold water reserves available for the fall. A target of 68 °F at Watt Ave will likely provide a limited section of habitat between Nimbus Dam and Watt Ave in the preferred 65 °F range without seasonally exhausting the limited cold water available. If sufficient cold water availability exists to seasonally provide 68 °F at Watt Ave., then and only then would the potential to reserve the last shutter pull for the fall season exist.
10. Reclamation shall minimize the adverse effects of flow fluctuations associated with Folsom and Nimbus Reservoir operations on Central Valley steelhead spawning, egg incubation, and fry and juvenile rearing within the American River.

- a. During periods outside of flood control operations and to the extent controllable during flood control operations, Reclamation shall ramp down releases in the American River below Nimbus Dam as follows:

Lower American River Daily Rate of Change (cfs)	Amount of Decrease in 24 hours (cfs)	Maximum Change per Step (cfs)
20,000 to 16,000	4,000	1,350
16,000 to 13,000	3,000	1,000
13,000 to 11,000	2,000	700
11,000 to 9,500	1,500	500
9,500 to 8,300	1,200	400
8,300 to 7,300	1,000	350
7,300 to 6,400	900	300
6,400 to 5,650	750	250
5,650 to 5,000	650	250
< 5,000	500	100

**New Melones
Division**

11. Reclamation shall manage the cold water supply within New Melones Reservoir and make cold water releases from New Melones Reservoir to optimize suitable rearing habitat for Central Valley steelhead in the Stanislaus River downstream of Goodwin Dam.
- a. Reclamation shall manage cold water releases from New Melones Reservoir to maintain daily average water temperature in the Stanislaus River between Goodwin Dam and the Orange Blossom Road Bridge at no more than 65°F during the period of June 1 through November 30 to protect rearing juvenile Central Valley steelhead.
- b. Reclamation shall coordinate water temperature releases with DFG and FWS to use fishery release water, to the extent possible, consistent with NMIPO, D-1641, and CVPIA.
- c. If it becomes necessary to deviate from condition 7.a. above, Reclamation shall consult with DFG, FWS and NOAA Fisheries to develop a plan using all means possible to maximize suitable rearing habitat for Central Valley steelhead juveniles within the Stanislaus River below Goodwin Dam prior to June 1 each year.
12. Reclamation shall minimize the adverse effects of flow fluctuations associated with New Melones Reservoir and Goodwin Dam operations on Central Valley steelhead

spawning, egg incubation, and fry and juvenile rearing within the Stanislaus River.

- a. During periods outside of flood control operations and to the extent controllable during flood control operations, Reclamation shall ramp down releases in the Stanislaus River below Goodwin Dam as follows:

Existing Release Level (cfs)	Rate of Increase (cfs)	Rate of Decrease (cfs)
at or above 4,500	500 per 4 hours	500 per 4 hours
2,000 to 4,499	500 per 2 hours	500 per 4 hours
500 to 1,999	250 per 2 hours	200 per 4 hours
300 to 499	100 per 2 hours	100 per 4 hours

Delta Operations

- 14. Reclamation shall improve and maintain in good working order fish screens at the Tracy pumping facility to minimize entrainment of juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead as a result of Delta export operations. This shall include fish screen inspections and developing and implementing a collection and release program, designed to provide for the survival of fish salvaged at the facility.

- c. Reclamation shall conduct annual fish screen inspections, in coordination with NOAA Fisheries, of all Tracy pumping facility fish screens and permit reasonable unannounced access to the TFCF by NOAA Fisheries staff at least one additional time each year for additional inspections. These inspections shall include access all to records of operation, fish salvage, and fish transportation and release activities.

- d. Reclamation shall ensure that fish transportation runs conducted as part of the collection and release (salvage) program for listed salmonids are conducted at least every 12 hours or more frequently if required by the "Bates Table" calculations made at each count and recorded on the monthly report.

- 15. Reclamation, in cooperation with the Contra Costa Water District (CCWD), shall continue to collect additional data at the Tracy Fish Collection Facility and the Rock Slough Intake to monitor the extent of incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead associated with the operation of the CVP's Tracy and CCWD's Rock Slough pumping facilities.

- a. Incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead shall be monitored daily at the Tracy pumping facility and Rock Slough Intake from October 1 through May 31 of each year. Tissue samples from salvaged fish shall be collected for genetic analysis and provided to a lab identified by NOAA Fisheries. Loss and salvage at each facility shall be computed using formulas

developed in consultation with DFG and FWS and approved by NOAA Fisheries.

- b. At the Tracy pumping facility, the following monitoring procedures must be performed at the Tracy Fish Collection Facility by personnel experienced in salmon biology. For a minimum period of 10 minutes within each 2 hour interval throughout the day and night (minimum of 120 minutes per day) all salmon and steelhead are to be measured (fork length to the nearest millimeter), examined for the presence or absence of the adipose fin and enumerated. At the Rock Slough Intake a monitoring program must be implemented similar to the expanded monitoring plan developed by DFG and implemented in 2004 and performed by personnel experienced in salmon biology.
18. DWR shall improve and maintain in good working order fish screens at the Harvey Banks pumping facility to minimize entrainment of juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead as a result of Delta export operations. This shall include developing and implementing a collection and release program for salvaged fish designed to provide for the survival of fish salvaged at the facility.

 - a. Incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead shall be monitored daily at the Skinner Fish Collection Facility. Loss and salvage shall be computed using formulas developed in consultation with DFG and FWS and approved by NOAA Fisheries.
19. DWR shall collect additional data at the Clifton Court Forebay, the John Skinner Fish Collection Facility, and the Harvey Banks pumping plant to monitor the incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead and to develop and implement improvements to pumping facility operations to further reduce or minimize losses of listed salmonids.

 - a. DNA tissue samples and CWT samples from juvenile spring-run and winter-run Chinook salmon and steelhead at the Tracy and Skinner fish collection facilities shall be collected by DWR or DFG for genetic analysis or tag removal/reading pursuant to the sampling protocols established by the IEP Salmon Genetics Project Work Team. Tissues shall be stored at the DFG tissue bank at Rancho Cordova for subsequent analysis by Oregon State University or similar lab approved by NOAA Fisheries. Whole fish or heads for CWT processing and identification shall be stored at the FWS Bay/Delta Office in Stockton. All samples shall be clearly marked according to office protocol and a log maintained at each storage facility. Unclipped steelhead samples for DFG otolith studies may be collected and stored at the above facilities after providing NOAA Fisheries, Sacramento Office with a detailed study plan.

- b. DWR shall submit weekly reports to the interagency DAT and an annual written report to NOAA Fisheries describing, as a minimum, the estimated loss and salvage of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and Central Valley steelhead associated with operations of the Harvey Banks pumping facility. This annual written report shall be submitted no later than October 1.

State Water Project Operations at Oroville:

Oroville Reservoir and Feather River Operations

- 16c. During periods outside of flood control operations and to the extent controllable during flood control operations, DWR shall ramp down releases to the low flow channel as presented in the table below:

Feather River Low-Flow Channel Releases (cfs)	Rate of Decrease (cfs) per 24 hours
5,000 to 3,501	1000
3500 to 2,501	500
2,500 to 600	300

- 17. DWR shall manage cold water storage in Oroville Reservoir and make cold water releases from Oroville Reservoir to provide suitable spawning and rearing habitat within the Feather River for Central Valley spring-run Chinook salmon and Central Valley steelhead between the Fish Barrier Dam and Robinson's Riffle (RM 61.6).
 - a. DWR shall maintain daily average water temperatures in the Feather River, between the Fish Barrier Dam and Robinson's Riffle (RM 61.6) from June 1 through September 30 less than or equal to 65 °F to protect over-summering steelhead. This term is not intended to preclude pump-back operations at the Oroville Facilities that are needed to assist the State of California with supplying energy during periods when the California ISO has anticipated Stage 2 or higher alerts.
 - b. DWR shall consult with the Feather River Technical Team and receive approval from NOAA Fisheries, prior to making any necessary deviations from the average daily water temperature compliance criteria as described in 2.a above.

ATTACHMENT 3

Delta Smelt Risk Assessment Matrix

The Delta Smelt Working Group and the Delta Smelt Risk Assessment Matrix

The delta smelt risk assessment matrix (DSRAM) consists of month by month criteria which, when exceeded will trigger a meeting of the Delta Smelt Working Group (Working Group). The Working Group consists of experts in delta smelt biology from the U.S. Fish and Wildlife Service (Service), U.S. Bureau of Reclamation (Reclamation), U.S. Environmental Protection Agency (EPA), and California Departments of Water Resources (DWR) and Fish and Game (DFG). The purpose of the DSRAM is to take actions to protect delta smelt in a proactive manner prior to salvage events at the Federal and State Delta export facilities. Reclamation and/or DWR are responsible for monitoring the DSRAM criteria and reporting back to the Service and the Working Group. The DSRAM has been modified from the delta smelt decision tree, which was peer-reviewed and presented in the Interagency Ecological Program (IEP) Newsletter. It is the intent of the Service that the DSRAM be sent out for independent peer review. The DSRAM is an adaptive management tool which may be further modified by the Working Group and the interagency Water Management Operations Team (WOMT) as new information becomes available, without undergoing formal reconsultation. An informative link to an existing website will be developed that compiles monitoring data from IEP and DFG to enable members of the Working Group to easily track the progress of the triggering criteria. Data will be updated at least weekly to determine the need for a meeting.

Should a triggering criterion be met or exceeded, Reclamation and/or DWR will inform the members of the Working Group and the Working Group will determine the need to meet. Any member of the Working Group may initiate a meeting of the Working Group at any time. A meeting of the Working Group may consist of an in-person meeting, a conference call, or a discussion by email. If needed, the Working Group will meet prior to the weekly meetings of the DAT and the WOMT and information will be shared with these groups. The Working Group will be available to present management briefings as needed.

If a meeting of the Working Group proves necessary, the group will review the available monitoring and survey data and decide whether to recommend a change in water project operations (referred to as "fish actions"). These potential fish actions are listed in the DSRAM by the months wherein each of these tools generally becomes available. Generally, if the Working Group recommends a fish action, it will be shared with the Data Assessment Team (DAT) during its weekly conference call and forwarded to the WOMT for discussion and potential implementation; however, the Working Group may make recommendations to WOMT at any time. Recommendations will include a discussion of the level of concern for delta smelt and will include a list of the participants in the Working Group discussions. All dissenting opinions and/or discussion points will also be forwarded to the WOMT. The Working Group will meet at least weekly throughout the period in which the triggering criteria are met or exceeded, to determine the need to provide further recommendations to the WOMT.

Notes and findings of Working Group meetings will be submitted to the Service and members of the WOMT for their records. Meeting notes will also be available to the public on the Sacramento Fish and Wildlife Office's web page. The WOMT will respond to the Working Group's recommendations and the actions taken by the WOMT will be summarized by Reclamation and/or DWR annually and submitted to all WOMT agencies.

If an action is taken, the Working Group will follow up on the action to attempt to ascertain its effectiveness. An assessment of effectiveness will be attached to the notes from the Working Group's discussion concerning the action.

Life Stage	Adults	Adults	Adults	Adults	Adults and larvae	Adults and larvae	Adults and juveniles	Larvae and juveniles	Juveniles
Previous Year's Fall Midwater Trawl Recovery Index (1)	Index below 74	Index below 74	Index below 74	Index below 74	Index below 74	Index below 74	Index below 74	Index below 74	Index below 74
Risk of Entrainment (2)					X2 upstream of Chipps Island and temps are $\geq 12^\circ$	X2 upstream of Chipps Island and temps are between 12° and 18°C	X2 upstream of Chipps Island and mean delta-wide temps $< 18^\circ\text{C}$ and south delta temps below 25°C	X2 upstream of Chipps Island and temps are below 25°C	X2 upstream of Chipps Island and temps are below 25°C
Duration of Spawning period (number of days temperatures are between 12 and 18°C) (3)						39 days or less by April 15	50 days or less by May 1		
Spawning Stage as determined by spring Kodiak trawl and/or salvage (4)				Presence of Adults at spawning stage ≥ 4	Adult spawning stage ≥ 4	Adult spawning stage ≥ 4			
smelt distribution (5)	See footnote #5	See footnote #5	See footnote #5	See footnote #5	See footnote #5 or negative 20mm centroid or low juvenile abundance	Negative 20mm centroid or low juvenile abundance	Negative 20mm centroid or low juvenile abundance	Negative 20mm centroid or low juvenile abundance	Negative 20mm centroid or low juvenile abundance
Salvage Trigger (6)	Adult concern level calculation	Adult concern level calculation	Adult concern level calculation	Adult concern level calculation	Adult concern level calculation		If salvage is above zero	If salvage is above zero	

Tools for Change (7)	December	January	February	March	April	May	June	July
Export reduction at one or both facilities	X	X	X	X	X	X	X	X
Change in barrier operations						X	X	X
Change in San Joaquin River flows				X	X	X	X	X
Change position of cross channel gates						X	X	X

Delta Smelt Risk Assessment Matrix Footnotes (note: the references for the DSRAM are also included in the literature cited section of the biological opinion)

- 1 The Recovery index is calculated from a subset of the September and October Fall Midwater Trawl sampling (<http://www.delta.dfg.ca.gov/>). The number in the matrix, 74, is the median value for the 1980-2002 Recovery Index (Figure DS1)

The temperature range of 12 to 18 degrees Celsius is the range in which most successful delta smelt spawning occurs. This has been analyzed by using observed cohorts entering the 20-mm Survey length frequency graphs (1996-2002). Cohorts were defined by having a noticeable peak or signal and occurring over three or more surveys during the rearing season. Back calculations were made using the first survey of that cohort with fish less than 15 mm fork length. Temperature data from IEP's HEC-DSS Time Series Data web site was compiled using three stations representing the south Delta (Mosssdale), confluence (Antioch), and north Delta (Rio Vista) and averaged together. Spawning dates for each cohort were back-calculated by applying an average daily growth rate (wild fish) of 0.45 mm/day (Bennett, DFG pers. comm.) and egg incubation period of 8-14 days (Baskerville-Bridges, Lindberg pers. comm.)(Mager et al. 2004) from the median value of the analyzed cohort. Each spawning event was then plotted against temperature over time (Figure DS2.1). While spawning does occur outside of the 12-18 degree range, larval survival is most likely reduced when temperatures are either below (DFG pers. comm.) or above this range (Baskerville-Bridges & DFG pers. comm.).

Critical thermal maxima for delta smelt was reached at 25.4 degrees Celsius in the laboratory (Swanson et al., 2000); and at temperatures above 25.6 degrees Celsius smelt are no longer found in the delta (DFG, pers. comm.).

Websites for the temperature data: <http://iep.water.ca.gov/cgi-bin/dss/dss1.pl?station=RSAN007>

<http://iep.water.ca.gov/cgi-bin/dss/dss1.pl?station=RSAN087>

<http://iep.water.ca.gov/cgi-bin/dss/dss1.pl?station=RSAC101>

Mager RC, Doroshov SI, Van Eenennaam JP, and Brown RL. 2004. Early Life Stages of Delta Smelt. American Fisheries Society Symposium 39:169-180.

Swanson C, Reid T, Young PS, and Cech JJ. 2000. Comparative environmental tolerances of threatened delta smelt (*Hypomesus transpacificus*) and introduced Wakasagi (*H. nipponensis*) in an altered California estuary. *Oecologia* 123:384-390.

- 3 Figure DS3: The working hypothesis for delta smelt is that spawning only occurs when temperatures are suitable during the winter and spring. In years with few days having suitable spawning temperatures, the spawning "window" is limited, so the species produces fewer cohorts of young smelt. When there are fewer

cohorts the risk that mortality sources such as entrainment may substantially reduce population size increases. The figures below were used to help define years when there were relatively few days with suitable temperatures. For April 15 and May 1, the figures show the cumulative spawning days for each year during 1984-2002. The cumulative spawning days for each year were calculated based on the number of days that the mean water temperature for three Delta stations (Antioch; Mossdale and Rio Vista) was in the 12 - 18 C range starting on February 1. The results are plotted in terms of the ranks to identify the lower quartile. In other words, years in the lower quartile represent examples of years with relatively few spawning days.

- 4 The adult spawning stage is determined by the Spring Kodiak Trawl and/or fish collected at the salvage facilities (<http://www.delta.dfg.ca.gov/>). A stage greater than or equal to 4 indicates female delta smelt are ripe and ready to spawn or have already spawned (Mager 1996).

Mager RC. 1996. Gametogenesis, Reproduction and Artificial Propagation of Delta Smelt, *Hypomesus transpacificus*. [Dissertation] Davis: University of California, Davis. 115 pages. Published.

- 5 The spring kodiak trawl will be used to generally evaluate the distribution of adult delta smelt. However, since the spring kodiak trawl is not intended to be a survey for abundance or distribution, no definitive trigger for concern can be determined at this time.

Juveniles (March-July) – distribution of juvenile delta smelt where the centroid is located upstream (negative) or downstream (positive) of the Sacramento-San Joaquin River confluence (Sacramento RKI 81; Figure DS5.1). The 20-mm Survey centroid is calculated by multiplying the observed delta smelt station CPUE (fish/10,000 m³) by a distance parameter in km from Sacramento RKI 81. The summed result (summed over a survey) is divided by the survey CPUE which gives the survey centroid position (Figure DS5.2).

Low juvenile abundance will also be a trigger. When juvenile abundance is low, concern is high. Low abundance is indicated when the total cumulative catch in the 20-mm Survey is less than or equal to the 1995-2003 median value of cumulative 20-mm Survey catch for the same surveys (Table DS5).

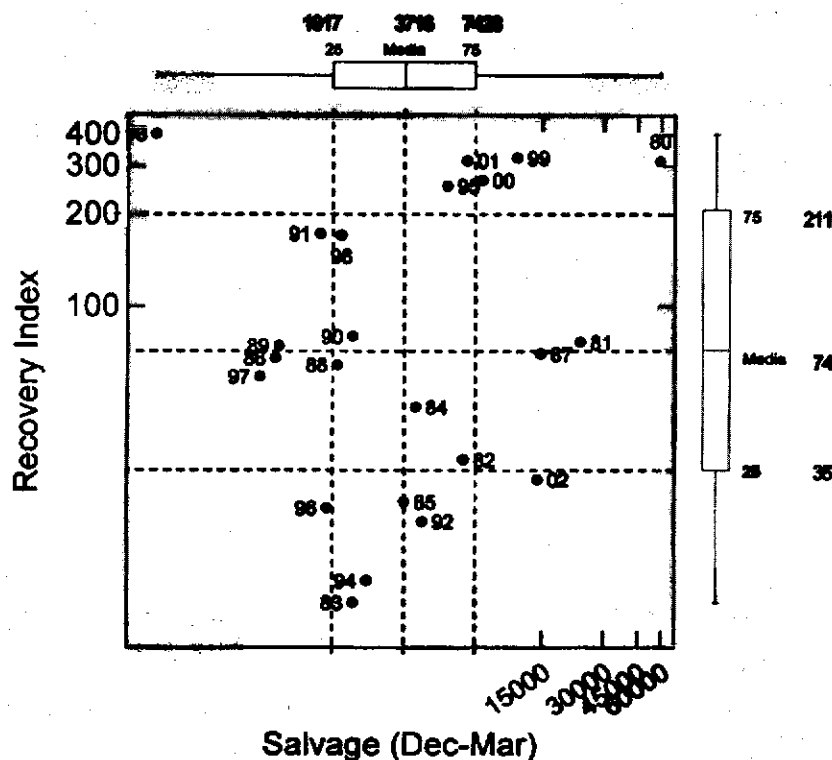
- 6 Adult salvage trigger: the adult delta smelt salvage trigger period is December through March and the trigger is calculated as the ratio of adult delta smelt salvage to the fall MWT index. This ratio will increase as fish are salvaged during the winter months. If the ratio exceeds the median ratio observed during December-March 1980-2002, then the trigger has been met (see Figure DS6 for more explanation of the calculation)

Juvenile salvage trigger: During May and June, if delta smelt salvage at the SWP/CVP facilities is greater than zero, then the working group will meet. This

is because May and June are the peak months of delta smelt salvage and salvage densities cannot be predicted. Therefore, during these two months, the delta smelt working group expects to meet regularly to look at relevant information such as salvage, delta temperatures, delta hydrology and delta smelt distribution and decide whether to recommend proactive measures to protect these fish.

- 7 The tools for change are actions that the working group can recommend to the WOMET to help protect delta smelt. Exports may be reduced at one or both of the south delta export facilities and a proposed duration of the reduction would be recommended by the working group. Export reductions and changes in San Joaquin River flows may be covered by B(2) or EWA assets. Details of past fish actions can be found at the Calfed Ops website:
<http://www.woco.water.ca.gov/calfedops/index.html>; >Operations [year]

Figure DS1



Points are labeled with the year representing the recovery index.
 The winter salvage for this analysis starts on December 1 of the recovery index year and continues through March 31 of the following year.

Figure DS2.1. Successful delta smelt spawning periods (shaded blue area) and cohorts (black bars) plotted against water temperature (1996-2002). Spawning periods and cohorts were back calculated using 20-mm Survey catch data. Start of spawning season uses an egg incubation period of 14 d and a growth rate of 0.45 mm/day and end of spawning season 8 d with a growth rate of 0.45 mm/day. Black bars represent the range of 8-14 d egg incubation with a growth rate of 0.45 mm/day from laboratory results. Temperature data ($^{\circ}\text{C}$) was compiled from IEP's HEC-DSS Time Series Data using mean daily temperatures from the confluence (Antioch), south Delta (Mossdale), north Delta (Rio Vista) and averaged together.

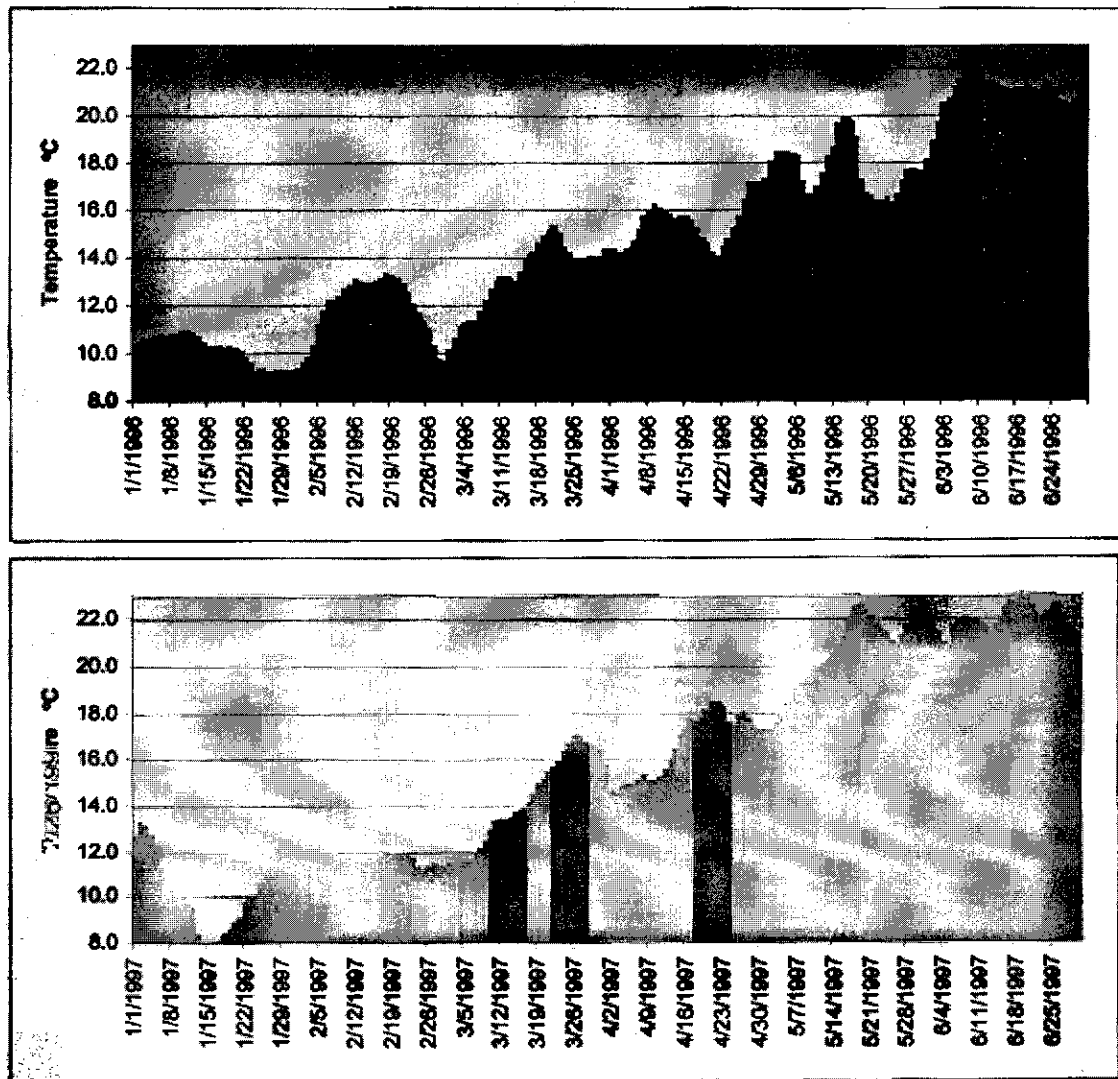


Figure DS2.1 cont.

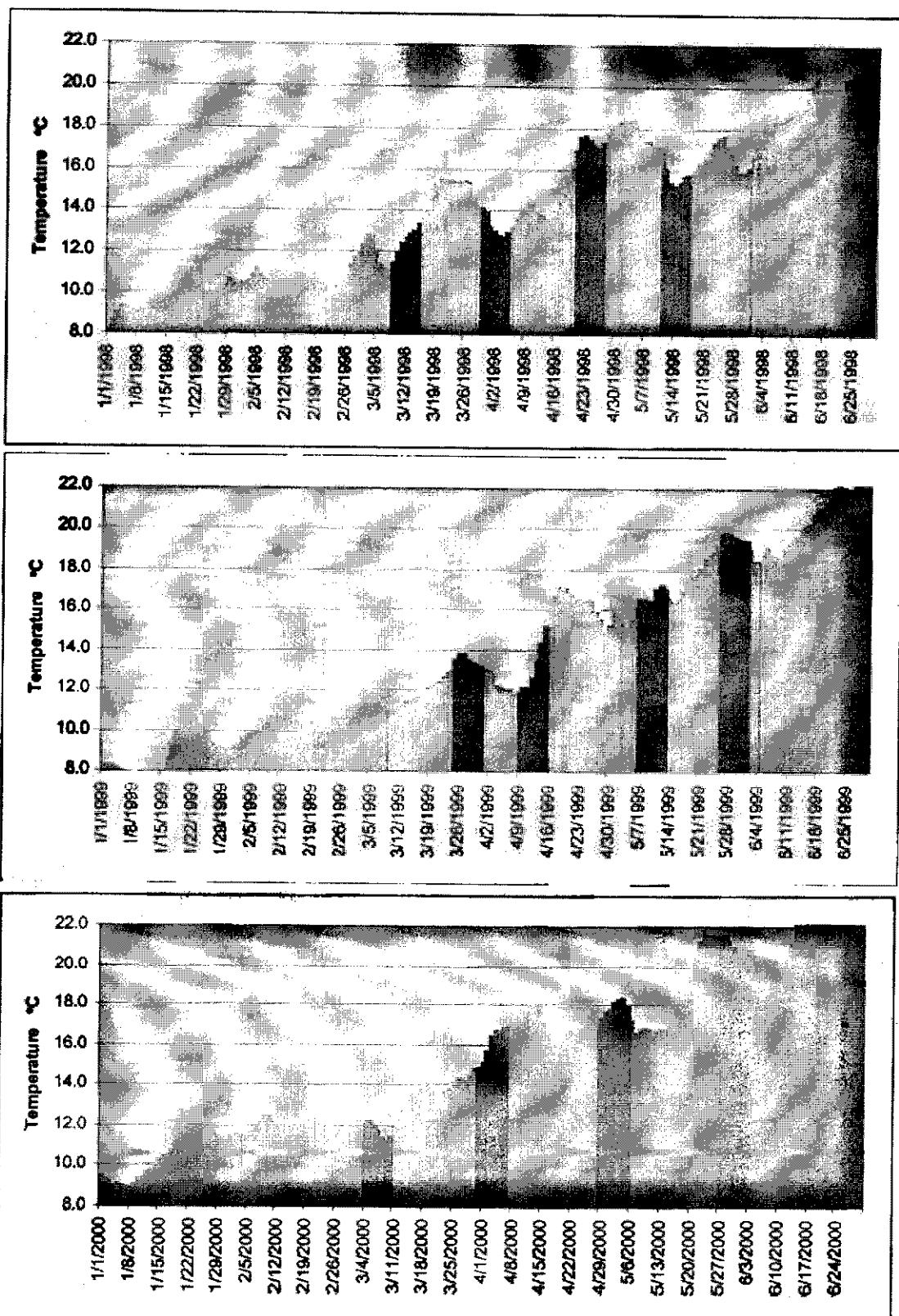


Figure DS2.1 cont.

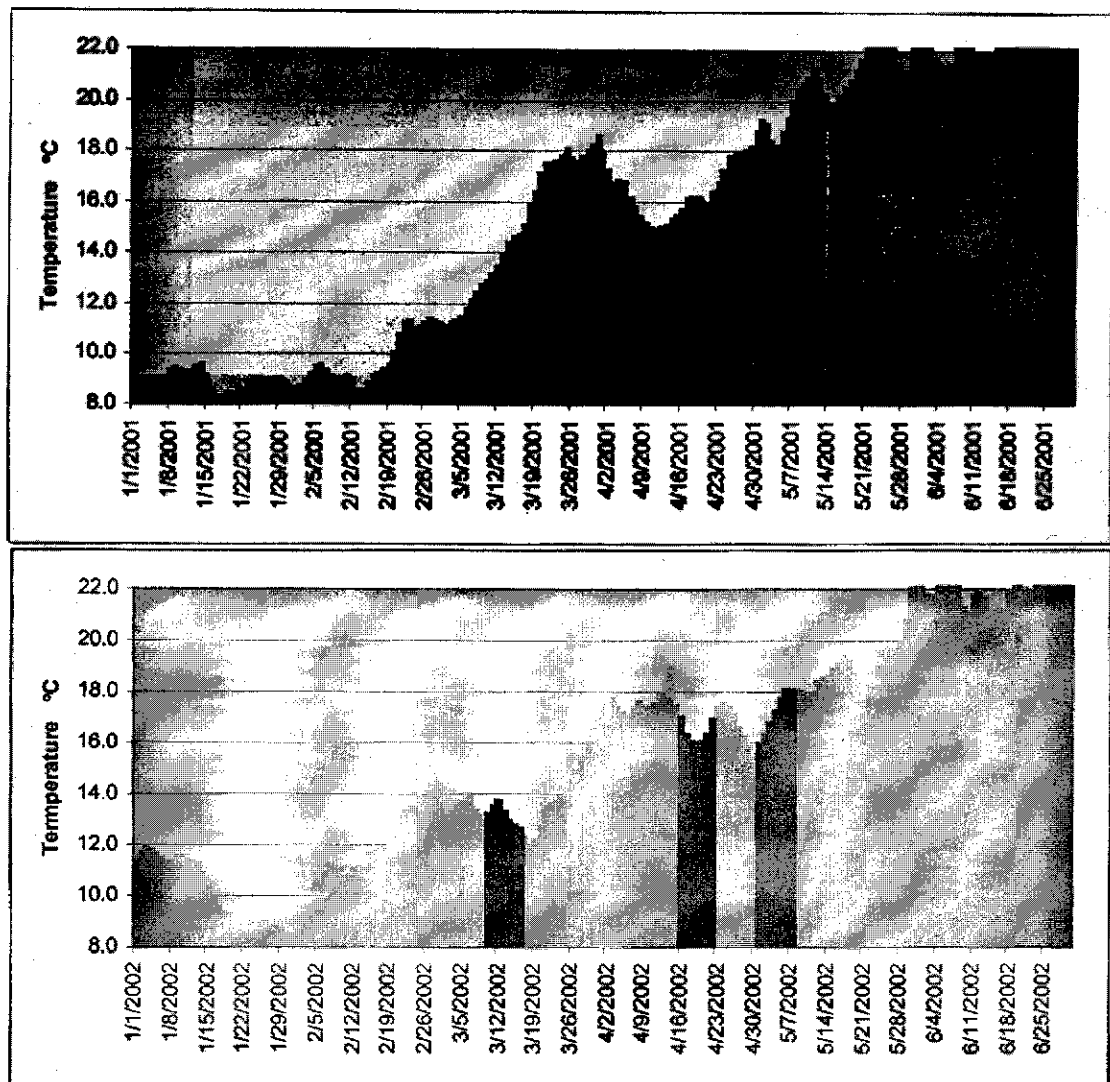


Figure DS3.

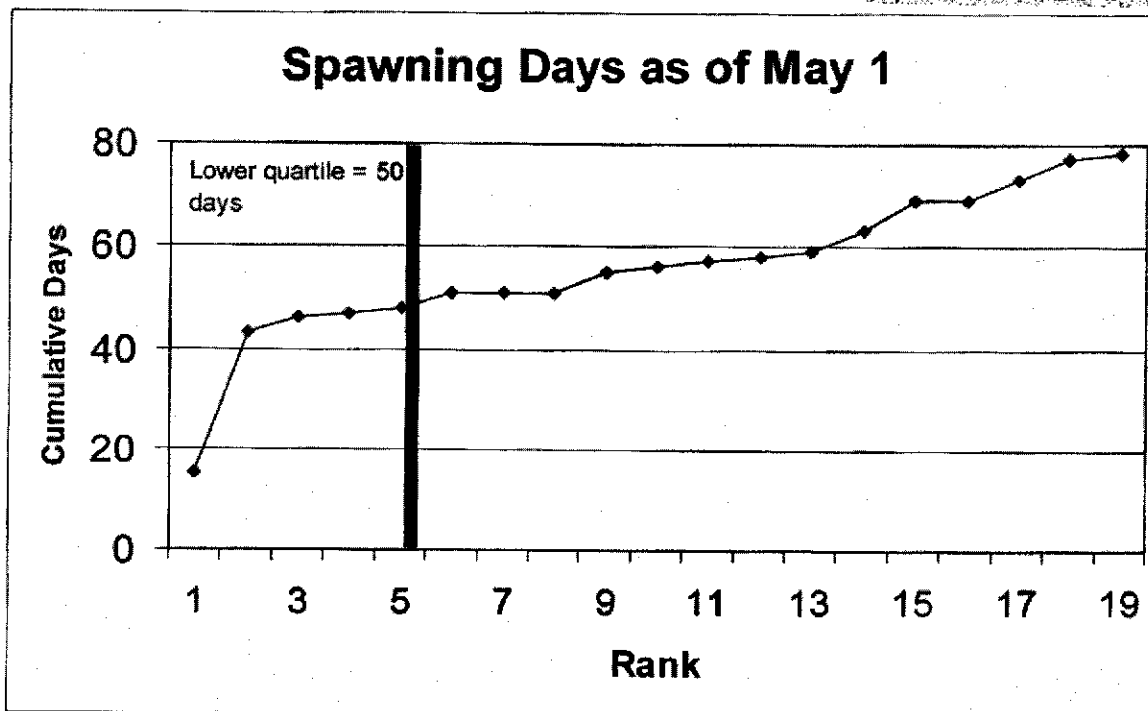
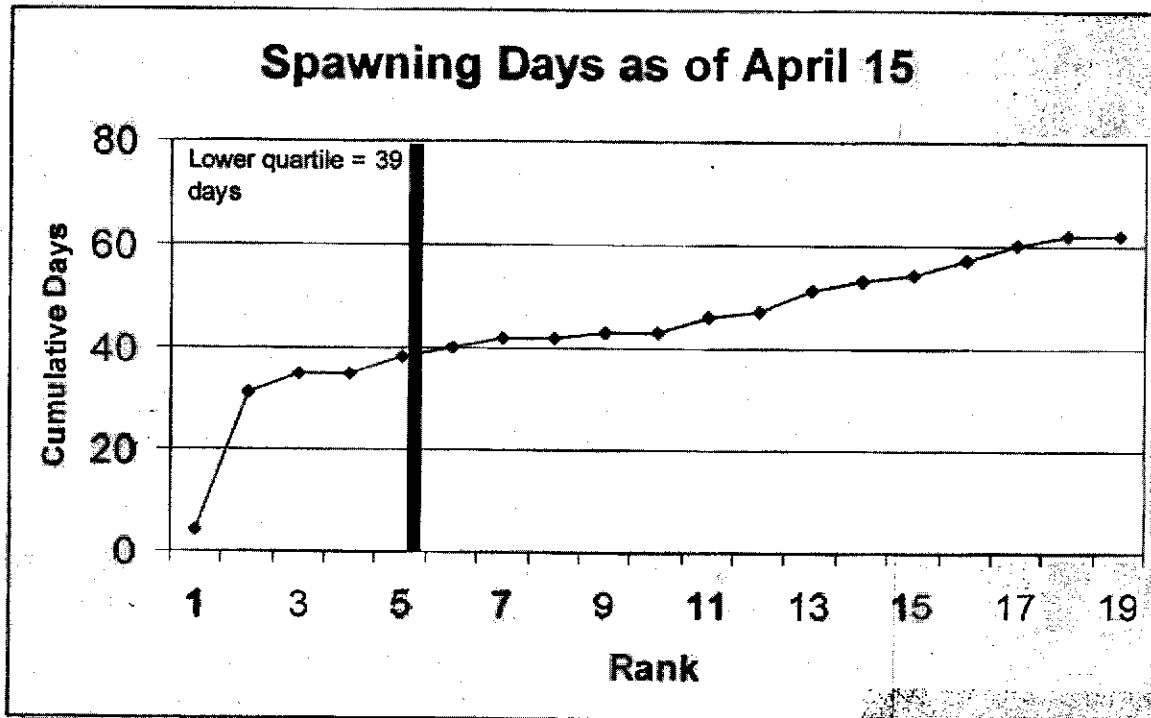


Figure DS5.1. A 20-mm Survey delta smelt bubble plot map with calculated centroid position from the confluence of Sacramento-San Joaquin Rivers with one standard deviation.

SELECT SPECIES:
 YEAR:
 SURVEY:
 View Station ID:
 Optional Max Value:

View Centroid:
 Values less than actual maximum will be ignored.

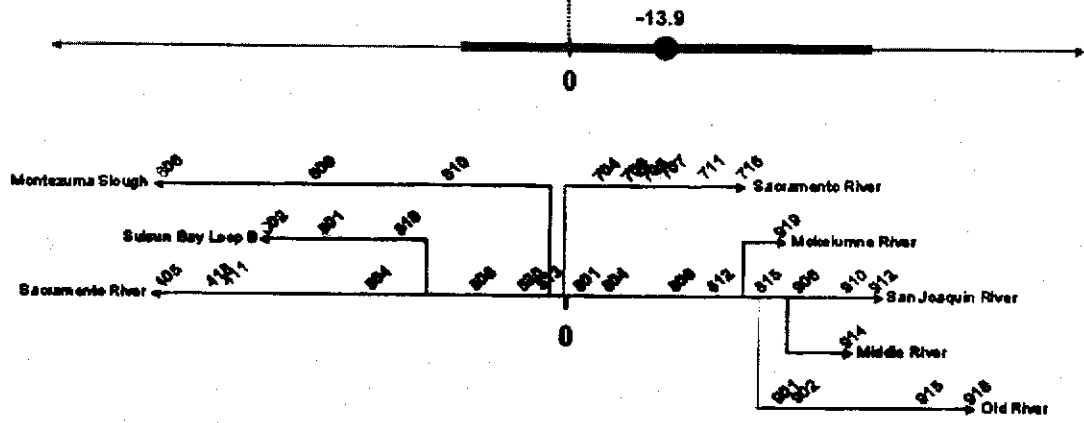
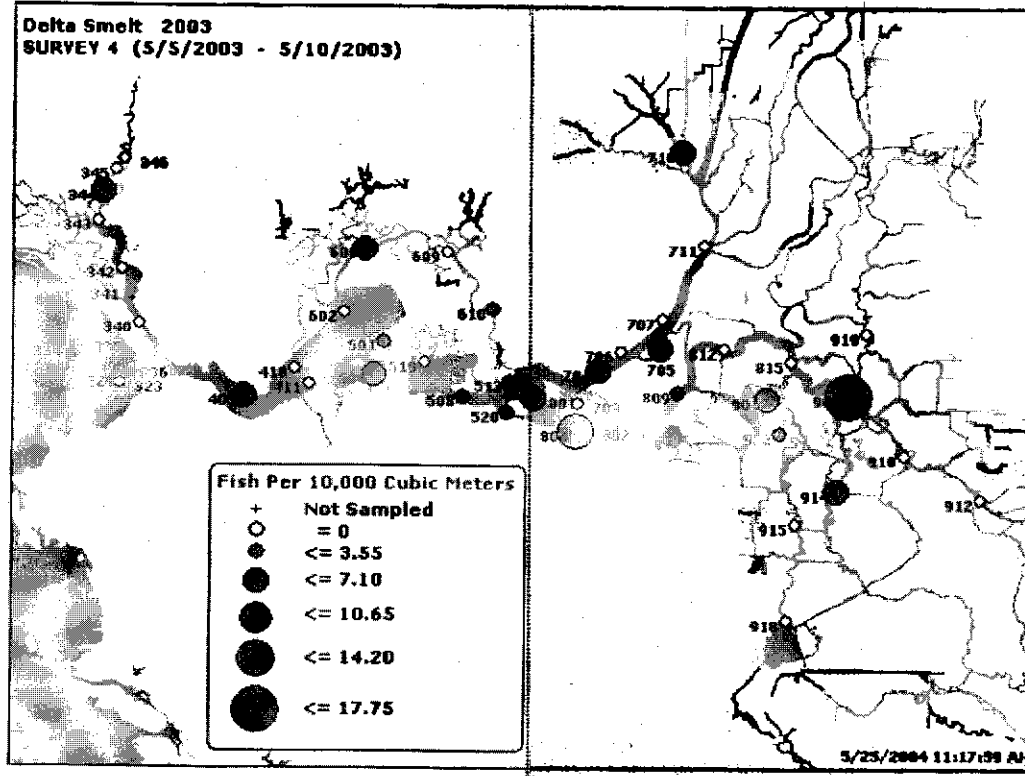


Figure DS5.2. Historic juvenile centroid position (20-mm Survey) with one standard deviation.

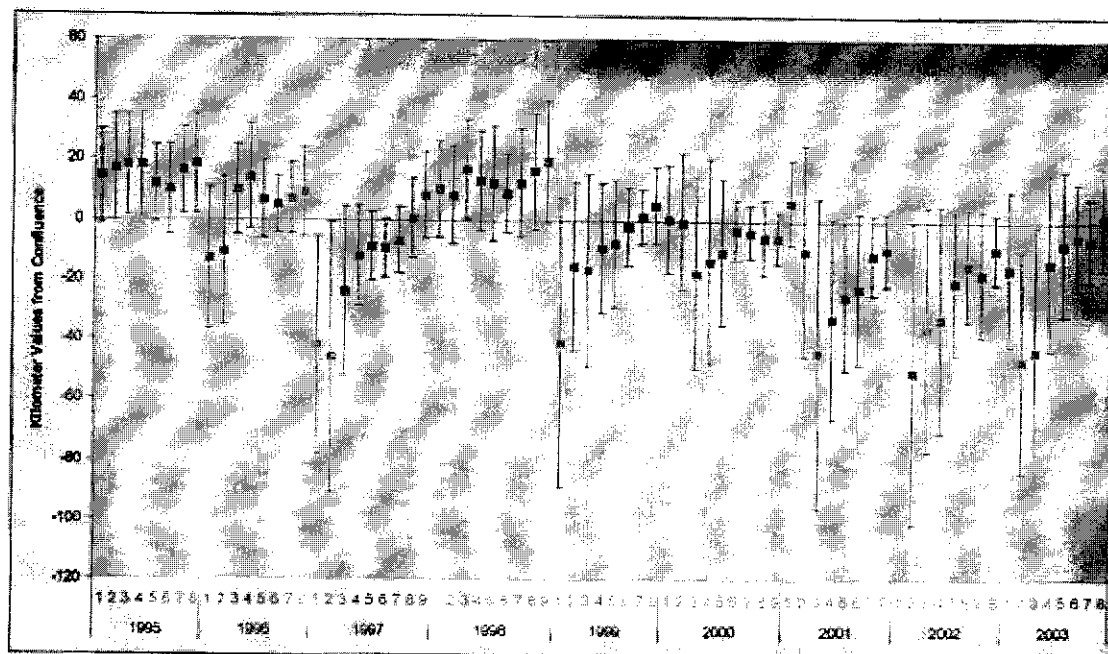


Table DS5. Median values of cumulative catch from the 20-mm Survey. When cumulative catch per survey during a season is at or below the calculated value, concern is high.

	survey 1	survey 2	survey 3	survey 4	survey 5	survey 6	survey 7	survey 8
Median Value	12	40	144	188	346	500	924	1019

Figure DS6

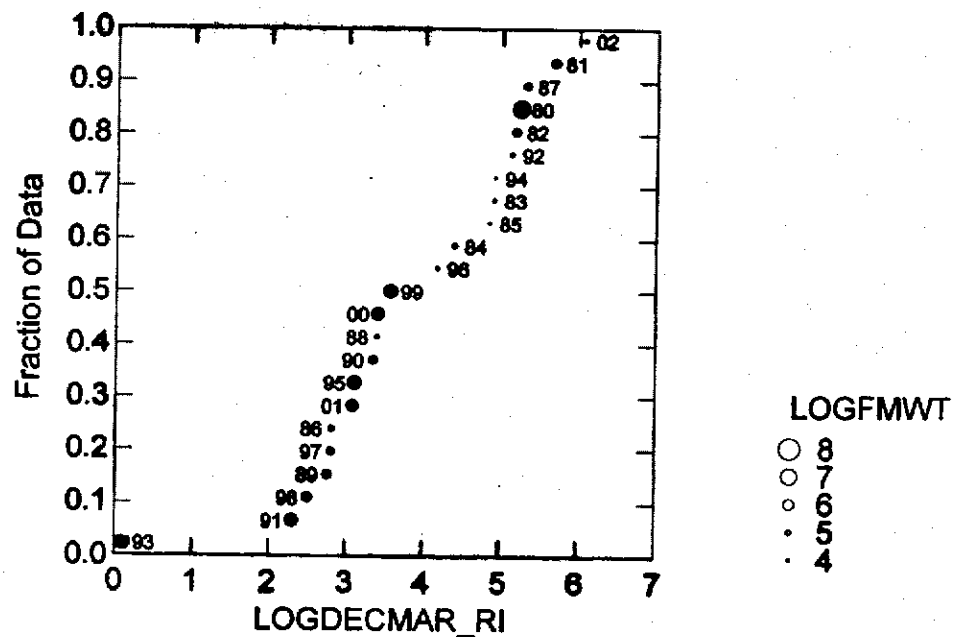
The objective is to quantify a level of concern for adult delta smelt during the winter that is based upon the number of fish salvaged and the overall abundance of delta smelt. Our trigger reflects that when abundance is low and salvage is high concern is high, and conversely when abundance is high and salvage is low that concern is low.

Below is a Quantile plot of the ratio of winter salvage to the MWT recovery index ($\ln(\text{winter salvage/recovery index})$). Winter salvage is defined as the total salvage from December through March. In the figure below, the size of the bubbles is proportional to the log of the fall midwater trawl to demonstrate that concern may be high in years of

high or low fall abundance. The resulting quartiles of the ratio are as follows: 25% = 2.950; 50% = 3.575; 75% = 5.029.

Using this approach to calculate winter concern levels, all years above the 1999 point in the graph would have been years of concern. In other words, these are the years in which we may have recommended some protection. Comparing it to the protection afforded adult delta smelt in the winter by the 1995 Biological Opinion: "red light" was, or would have been, reached in fewer winters (1980, 1981, 1982, 1984 and 1999).

The median was selected as the measure of concern and will be calculated by:
 concern level = $\text{anti ln}(3.575) * \text{Recovery index}$



The goal for the DSRAM is to avoid the upper quartile of the above graph, which the Working Group thinks will avoid salvage events that are high relative to fall abundance. Actions may be taken prior to major salvage events.