

## Appendix B Chinook Salmon Decision Tree

The Chinook Salmon Decision process was last revised in 2007.

During all periods biologists, will monitor juvenile Chinook migration in the tributaries and in the Delta, and juvenile Chinook losses at the Delta Fish Facilities. The biologists will also consider delta smelt risk factors, Red Bluff winter-run Chinook Juvenile Production Index (JPI), Sacramento River Trawl catch, Chipps Island Trawl catch, and date (% of season).

### DCC Gate Operations

**First Alert:** yearling Chinook detected at mouths of tributaries and/or average daily tributary flow increase by 50%.<sup>1</sup>

**Second Alert:** Sacramento River at Wilkins Slough water temperature < 13.5°C and flow > 7,500cfs.<sup>2</sup>

	Action Trigger	Action
<b>November 1 - November 30</b>	<ul style="list-style-type: none"> <li>Water quality criteria are met<sup>3</sup></li> <li>and Knights Landing (KLCl) and/or Sacramento (SCI) &gt; 3 and &lt;=5<sup>4</sup></li> </ul>	Close Delta Cross Channel (DCC) gates for 4 days within 24 hours.
	<ul style="list-style-type: none"> <li>Water quality criteria are met</li> <li>and KLCl and/or SCI &gt; 5</li> </ul>	Close DCC gates until catch < 3.
	<ul style="list-style-type: none"> <li>Water quality criteria not met</li> <li>and KLCl and SCI &gt; 3</li> </ul>	Elevate decision to WOMT. <sup>5</sup>
<b>December 1 - January 31</b>	First two weeks of December and first two weeks of January.	Delta Action 8 (DA-8) experiment. <sup>6</sup>
	Water quality criteria are met. <sup>7</sup>	DCC Gates closed. The DCC gates may be opened if part of the experimental design for DA-8.
	<ul style="list-style-type: none"> <li>Water quality criteria is not met</li> <li>and KLCl and/or SCI &lt; 3.</li> </ul>	Open DCC gates until criteria are met.
	<ul style="list-style-type: none"> <li>Water quality criteria is not met</li> <li>and KLCl and/or SCI &gt; 3</li> <li>or insufficient Environmental Water Account (EWA) and/or b(2) assets.<sup>8</sup></li> </ul>	Elevate decision to WOMT.
<b>February 1 - May 20</b>	DCC gates closed per 2006 WQCP criteria. <sup>9</sup>	None.
<b>May 21 - June 15</b>	DCC gates operated based on the 2006 WQCP criteria.	DCC gates must be closed for 14 days during this period.

### Chinook Salmon Decision Process (con't)

During all periods, biologists will monitor juvenile Chinook migration in the tributaries and in the Delta, and juvenile Chinook losses at the Delta Fish Facilities. The biologists will also consider delta smelt risk factors, Red Bluff winter-run Chinook JPI, Sacramento River Trawl catch, Chipps Island Trawl catch, and date (% of season).

#### Delta Fish Facilities Operations

**Third Alert: KLCI and/or SCI > 10 from November to February or > 15 from March to April.<sup>10</sup>**

	Action Triggers	Actions
<b>October 1 - February 14</b>	<ul style="list-style-type: none"> <li>Daily SWP/CVP older juvenile loss density &gt; 8/taf and/or</li> <li>daily loss &gt; 95 and/or</li> <li>CHFHH CWT LFR or LSNFH CWT WNT cumulative loss &gt; 0.5%<sup>11</sup></li> </ul>	Reduce exports to a combined 6,000cfs for 3 days or until density < 8. Reductions based on source of greatest loss.
	<ul style="list-style-type: none"> <li>Daily SWP/CVP older juvenile loss density &gt; 15/taf</li> <li>and/or daily loss &gt; 120</li> <li>and/or CHFHH CWT LFR or LSNFH CWT WNT cumulative loss &gt; 0.5%</li> </ul>	Reduce exports to a combined 4,000cfs for 3 days or until density < 8. Reductions based on source of greatest loss.
	Criteria met but insufficient EWA and/or b(2) assets. <sup>12</sup>	Elevate decision to WOMT
<b>February 15 - April 14</b>	<ul style="list-style-type: none"> <li>Daily SWP/CVP older juvenile loss density &gt; Take Limit/2000, 2.5taf min,</li> <li>and/or daily loss &gt; density*12taf</li> <li>and/or CHFHH CWT LFR or LSNFH CWT WNT cumulative loss &gt; 0.5%<sup>13</sup></li> </ul>	Reduce exports to a combined 6,000cfs for 3 days or until density < trigger. Reductions based on source of greatest loss.
	<ul style="list-style-type: none"> <li>Daily SWP/CVP older juvenile loss density &gt; Take Limit/1000, 2.5taf min</li> <li>and/or daily loss &gt; density*8taf</li> <li>and/or CHFHH CWT LFR or LSNFH CWT WNT cumulative loss &gt; 0.5%</li> </ul>	Reduce exports to a combined 4,000cfs for 3 days or until density < trigger. Reductions based on source of greatest loss.
	Criteria met but insufficient EWA and/or b(2) assets.	Elevate decision to WOMT
<b>April 15 - May 15</b>	VAMP. <sup>14</sup>	Reduce exports to combined 1,500cfs, 2,250cfs, or 3,000 depending on water year type
	Modified VAMP (without HORB and flows < 7,000cfs) <sup>15</sup>	Reduce exports to combined 1,500cfs and increase flow targets.
	Modified VAMP (without HORB and flows > 7,000cfs)	VAMP Technical Team will recommend export targets to WOMT.
	Criteria met but insufficient EWA and/or b(2) assets	Elevate decision to WOMT.
<b>May 19 - June 15</b>	Triggers currently being developed. <sup>16</sup>	

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<sup>1</sup> Mill, Deer, and Butte creeks are the most important populations of spring Chinook (DFG). DFG operates rotary screw traps near the mouths of these three tributaries to monitor the emigration of spring-run yearlings, and later spring and fall-run fry. Juvenile Chinook in the spring-run tributaries greater than 70mm between October and April are spring run yearlings (Figure 1) and are the focus of the Salmon Decision Process actions. 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). The “First Alert” is the early warning criteria for closing the DCC since yearling spring-run are now entering the Sacramento River and are susceptible to Delta mortality factors associated with the Delta Cross Channel (DCC) and SWP/CVP export operations once they reach the Delta.

<sup>2</sup> Wilkins Slough is the flow gauge near Knights Landing and about 35 miles upstream of the Delta. A decrease in water temperature below 13.5C and flow increase at Wilkins Slough greater than 7,500cfs is associated with juvenile emigration past Knights Landing (Figure 5). 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.

<sup>3</sup> 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 (pers. comm. Art Hinojosa (DWR)). Water criteria are Jersey Point < 1.8, Bethel Island 1.0, Holland Tract < 0.8. Other water quality considerations include the tide cycle, weather conditions, and export magnitude.

<sup>4</sup> The 2006 Water Quality Control Plan (WQCP) states that the DCC gates can be closed for up to 45 days from November through January to protect winter-run Chinook. The State Water Resources Control Board (SWRCB) Plan is available at <http://www.waterrights.ca.gov/baydelta/2006controlplan.html>. Catch indexes at Knights Landing (KLCI) and/or Sacramento (SCI) are the criteria upon which the first action is based; closing the DCC gates (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 gates, ranging from not closing them and monitoring catch at KL and/or Sac, to closing the gates until the catch index decreases to less than 3 fish per day.

<sup>5</sup> Fish and water salinity needs are frequently mutually exclusive, with respect to the DCC position, from November through January. Under this 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).

<sup>6</sup> 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 to 14 consecutive days of consistent environmental parameters, exports and inflow. Background information on the Delta Action 8 experiment can be found at [http://www.delta.dfg.ca.gov/jfmp/PatFiles/Delta\\_Action\\_8\\_Workshop.doc](http://www.delta.dfg.ca.gov/jfmp/PatFiles/Delta_Action_8_Workshop.doc).

<sup>7</sup> The Spring-run Protection Plan (1998) states that the USBR will close the DCC gates on December 1st for the protection of spring-run yearlings unless there is a water quality issue. The Data Assessment Team can recommend opening the DCC gates for water quality purposes during this period. In addition, based on a DFG analysis, there is a significant relationship between DCC gate operations and subsequent loss of winter-run Chinook at the Delta Fish Facilities. Closing the DCC gates between December 15th and January 15th reduces the total loss of winter-run Chinook at the Delta Fish Facilities (Figures 8 and 9). The report is posted at: [http://www.science.calwater.ca.gov/pdf/ewa/EWA\\_delta\\_cross\\_channel\\_closures\\_06\\_111406.pdf](http://www.science.calwater.ca.gov/pdf/ewa/EWA_delta_cross_channel_closures_06_111406.pdf).

<sup>8</sup> Fish Management Agencies (MAs) determine whether there are sufficient b(2) assets to reduce exports to offset any water quality impacts related to closing the DCC. If there are insufficient b(2) assets, the MAs elevate the issue to WOMT for resolution. If the 45 days from the 1995 WQCP have been exceeded the MAs determine whether there are sufficient EWA assets to reduce exports to offset any water quality impacts. If there are insufficient EWA assets, the MAs elevate the issue to WOMT for resolution. DCC gate closures due to high flows do not count against the 45 days.

<sup>9</sup> The SWRCB 2006 WQCP requires that the DCC gates be closed from February 1<sup>st</sup> through May 20<sup>th</sup> for the protection of winter-run Chinook.

<sup>10</sup> The KLCI and/or SCI of > 10 from November through February, and > 15 from March through April triggers 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. The “Third Alert” is the early warning criteria for export reductions.

<sup>11</sup> Juvenile Chinook loss at the Delta Fish Facilities is the only export reduction criteria. The two loss criteria are based on non-clipped Chinook loss density (Figure 10), Coleman Hatchery late-fall Chinook (CNFH CWT LFR) surrogate cumulative loss and Livingston Stone Hatchery winter-run (LSNFH CWT WR) cumulative loss. If EWA and/or b(2) assets are sufficient the MAs reduce exports for a number of days and resume monitoring loss.

<sup>12</sup> Fish Management Agencies (MAs) determine whether there are sufficient EWA and/or b(2) assets to reduce exports. If there are insufficient assets the MAs elevate the issue to WOMT for resolution.

<sup>13</sup> The two loss criteria are based on non-clipped Chinook loss density (Figure 10), Coleman Hatchery late-fall Chinook surrogate cumulative loss and Livingston Stone Hatchery winter-run cumulative loss. The loss density trigger is based on the “Take Limit”. The “Take Limit” is 2% of the winter-run juveniles estimated to enter the Delta, using the NMFS Juvenile Production Estimate (JPE).

<sup>14</sup> The Vernalis Adaptive Management Program (VAMP) is generally implemented from April 15<sup>th</sup> to May 15<sup>th</sup>. Export curtailments and flow targets are based on water year type. The Head of Old River (HORB) barrier is installed when flows are < 7,000cfs on the San Joaquin River at Vernalis. Background information on VAMP is available at [http://www.sjrg.org/fishprogram\\_2001.htm](http://www.sjrg.org/fishprogram_2001.htm).

<sup>15</sup> The installation of the Head of Old River Barrier (HORB) during the VAMP period increases the survival of juvenile SJR salmon but can negatively affect the distribution of delta smelt. If the HORB is not installed during VAMP further protections are needed for SJR salmon during this period.

<sup>16</sup> We are currently working on action triggers to protect SJR fall Chinook during this period. The triggers will be added in 2008.

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<b>Second Alert:</b> Sacramento River at Wilkins Slough water temperature < 13.5°C and flow > 7,500cfs. <sup>2</sup>		
Action Trigger	Action	
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