



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
West Coast Region  
650 Capitol Mall, Suite 5-100  
Sacramento, CA 95814-4700

January 31, 2014

Mr. David Murillo  
Regional Director  
Bureau of Reclamation  
2800 Cottage  
Sacramento, California 95825

Mr. Mark Cowin  
Director  
California Department of Water Resources  
1416 Ninth Street  
Sacramento, California 95814

Dear Mr. Murillo and Mr. Cowin:

Re: Contingency Plan for February Pursuant to Reasonable and Prudent Alternative (RPA) Action I.2.3.C of the 2009 Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP) Biological Opinion (2009 BiOp)

This letter is in response to your January 31, 2014, letter, submitting the Temporary Urgent Change Petition (the TUC Petition) as a contingency plan and outlining your and California Department of Water Resources' (DWR) requested approval from the State Water Resources Control Board (SWRCB) for temporary modification to the Water Rights Decision 1641 (D-1641) permit terms related to the Delta outflow and Delta Cross Channel (DCC) standards described in D-1641, Table 3, for the month of February 2014. The U.S. Bureau of Reclamation (Reclamation) requested NOAA's National Marine Fisheries Service's (NMFS) concurrence that these actions are consistent with the current Endangered Species Act section 7 biological opinion on the long-term operation of the Central Valley Project (CVP) and State Water Project (SWP, CVP/SWP Opinion) that NMFS issued on June 9, 2009.

We understand that California is experiencing unprecedented drought conditions, entering its third straight year of below-average rainfall and very low snowmelt runoff. Calendar year 2013 was the driest year in recorded history for many parts of California, resulting in the low initial storage at the beginning of water year 2014. Water year 2014 is the driest to date. On January 17, 2014, the Governor of California announced an Emergency Proclamation, finding that "conditions of extreme peril to the safety of persons and property exist in California due to water shortage and drought conditions." NMFS stands ready to provide the assistance needed to manage through drought conditions in California. We realize that it is not possible to meet all



needs during this very unusual water year; and we are working with the project operators of the CVP and SWP to protect health and safety while providing needed protections for fish.

NMFS built flexible drought provisions into the current CVP/SWP Opinion. We anticipated drought conditions, when we wrote the CVP/SWP Opinion and its reasonable and prudent alternative (RPA). The RPA Action I.2.3.C (pages 26-27 of the 2009 RPA with 2011 amendments) of the CVP/SWP Opinion provides drought exception procedures and requires that the U.S. Bureau of Reclamation (Reclamation) develop and submit to NMFS a drought contingency plan. The rationale for this action explicitly recognizes that in drought conditions, there is potential for conflict between the need to maintain storage at Shasta Reservoir and other legal and ecological requirements in the Delta, including outflow and salinity standards. This RPA provision is triggered if the February forecast, based on 90 percent hydrology, shows that the Clear Creek temperature compliance point or 1.9 million acre feet end of September storage at Shasta Reservoir is not achievable.

Although the February forecast will not be available for several weeks, the 90 percent hydrology for the January forecast (enclosure 1) indicates that the end of September storage in Shasta Reservoir will be approximately 453 thousand acre feet. The weather and lack of precipitation throughout January indicates that the February forecast will be similar, if not worse, than the January forecast. We agree with your determination that it is not possible for Reclamation to meet the Shasta Reservoir storage requirement and maintain Delta outflow and water quality standards requirements pursuant to D-1641, and that Action I.2.3.C is triggered.

Action I.2.3.C requires that a contingency plan be developed, and NMFS understands that Reclamation is submitting the TUC Petition to serve as the drought contingency plan for the month of February. NMFS finds that all required aspects of the contingency plan have been met, as follows:

- Reclamation commits to target a navigation control point at Wilkins Slough not to exceed 4,000 cfs during the month of February. Since January 8, 2014, flows at Wilkins Slough have been below 4,000 cfs (<http://cdec.water.ca.gov/cgi-progs/queryDaily?WLK>).
- On January 29, 2014, Reclamation and DWR filed a Temporary Urgency Change Petition (TUC Petition) with the State Water Resources Control Board, indicating that there is not an adequate water supply to meet water right permit obligations under D-1641 to support instream and Delta beneficial uses.
- Exports have been curtailed to the combined minimum health and safety rate of 1,500 cfs. Recently, combined exports were reduced to 550 cfs.

In the TUC Petition, Reclamation and DWR requested that the D-1641 Delta outflow standard be changed from a 3-day average of net delta outflow of 7,100 cfs at Collinsville to allow for the necessary 1,500 cfs minimum health and safety deliveries while also allowing additional preservation of cold water pool. Reclamation and DWR indicated that this operation may result in a Delta outflow in the 3,000 cfs to 4,500 cfs range. Reclamation and DWR also requested permission to open the DCC gates for human health and safety purposes based on the consultation process with the fishery agencies provided in the TUC Petition, Attachment 1, sections II.1.c and II.1.d.

The current hydrology and habitat conditions that juvenile Sacramento River winter-run Chinook salmon (winter-run) are experiencing are anomalous, and therefore, winter-run are not following emigration patterns typically seen for this time of year. There are differences in opinion regarding the current location of the bulk of juvenile winter-run, ranging from the majority rearing in the upper Sacramento River, to slow and steady rearing and migration down the Sacramento River as they await environmental cues (pulse flows and higher turbidity) for longer and quicker migrations. Professional opinions range from approximately 5-30% of the cohort are currently in the north Delta.

An interagency team of fisheries biologists from NMFS, Reclamation, DWR, and California Department of Fish and Wildlife (DFW) developed a set of operational criteria that provides for initial DCC gate opening on February 1, 2014, and a set of monitoring triggers that result in DCC gate closures or diurnal gate openings for various durations (enclosure 2). During the development of the operational criteria, hydrological migrational cues, the team discussed the differences in migrational behavior during the day and night, and the influence of flood and ebb tides on the hydrology of the Sacramento River at the confluence of the DCC. Additional monitoring activities have been deployed to augment the current monitoring in order to facilitate the real-time monitoring needs of the modified DCC gate operations (enclosure 3).

During any period in which Reclamation and DWR are operating the CVP/SWP under a temporary change order, there will be close coordination on current and projected operations on a weekly basis through existing meetings [Delta Operations for Salmonids and Sturgeon (DOSS) group, Delta Conditions Team, Water Operations Management Team (WOMT), *etc.*]. NMFS will continue to make weekly determinations under our RPA actions (to include consideration of operations pursuant to a temporary change order) regarding whether changes in operations are necessary to protect listed fish species. These determinations will continue to be presented at the weekly WOMT call. The DOSS, along with consideration of data provided by the Delta Conditions Team, will also continue to provide weekly advice to the NMFS. As discussed below, an additional weekly drought coordination meeting will also be needed to ensure effective coordination. This meeting will help guide development of a CVP/SWP operational strategy and corresponding contingency plan to address operations through the operating season if conditions fail to improve. The result of this effort will inform any future determinations pursuant to the CVP/SWP Opinion as well as any additional TUC Petitions to the SWRCB that may be submitted.

In the TUC Petition, Reclamation and DWR have proposed to convene a team of managers from Reclamation, DWR, SWRCB, DFW, NMFS, and the U.S. Fish and Wildlife Service in order to coordinate management of water supplies and protection of natural resources during the course of the declared drought emergency. NMFS recommends that weekly drought coordination meetings address the following topics:

- Reclamation's and DWR's consideration of any new TUC Petitions during the current water year, utilizing the drought exception procedures described in the 2009 NMFS BiOp.
- To extend the current request beyond February 28, 2014, or for any future changes or modifications to the project description, Reclamation will provide the fish agencies with

detailed descriptions of the changes and a complete effects analysis and determinations of effects to listed species, unless following emergency consultation provisions. NMFS will provide our findings or concurrence in writing prior to Reclamation taking the action.

- Reclamation's development of a contingency plan, to include the development of a comprehensive, system-wide approach to address future ESA compliance for coordinated water project operations during the drought beyond February 28, 2014.

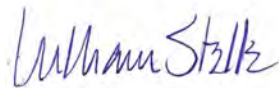
In conclusion, NMFS concurs that the TUC Petition, as modified by the more specific DCC Gate closure criteria provided in enclosure 2, is consistent with Action 1.2.3.C and meets the specified criteria for a drought contingency plan. We are making this finding based on both the real-time physical and biological data and monitoring information attached to your letter, our supplemental rationale for DCC gate operational triggers in enclosure 2, and the underlying analysis of the CVP/SWP Opinion which concluded that implementation of the RPA is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, the Southern Distinct Population Segment of North American green sturgeon, and the Southern Resident killer whales, and will not result in the destruction or adverse modification of their designated critical habitats. Furthermore, the best available scientific and commercial data indicate that implementation of this plan will not exceed levels of take anticipated for implementation of the RPA specified in the CVP/SWP Opinion.

We anticipate that the DCC gate operational triggers will continue to be refined throughout the month of February as more real-time data is made available through the extensive monitoring program. That information will be continuously analyzed for changes in risk to species and risk to water quality. In addition, the drought contingency plan will be reviewed and updated based on data gathered through the monitoring efforts to ensure implementation of the plan continues to meet all ESA requirements.

We look forward to continued close coordination with you and your staff throughout this extremely challenging water year.

If you have any questions regarding this letter, please contact me at [will.stelle@noaa.gov](mailto:will.stelle@noaa.gov), (206)526-6150, or contact Maria Rea at (916)930-3600, [maria.rea@noaa.gov](mailto:maria.rea@noaa.gov).

Sincerely,



William W. Stelle, Jr.  
Regional Administrator

Enclosures:

1. January forecast at 90 percent hydrology
2. Matrix of DCC gates operational criteria
3. Additional Monitoring Relative to Delta Cross Channel Operations

cc: Copy to file 151422SWR2006SA00268

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**Storages**

**Federal End of the Month Storage/Elevation (TAF/Feet)**

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trinity	1187	1165	1151	1150	1136	1008	842	687	532	408	355	343	354
	Elev.	2273	2271	2271	2270	2256	2236	2215	2190	2167	2155	2152	2155
Whiskeytown	205	206	206	206	238	238	238	238	238	206	206	205	206
	Elev.	1199	1199	1199	1209	1209	1209	1209	1209	1199	1199	1198	1199
Shasta	1673	1706	1782	1821	1639	1464	1099	698	473	453	#N/A	#N/A	#N/A
	Elev.	939	944	947	935	923	894	854	824	#N/A	#N/A	#N/A	#N/A
Folsom	187	176	182	244	262	272	242	198	198	190	196	206	237
	Elev.	361	362	377	380	382	376	366	366	365	366	368	375
New Melones	1049	1036	1025	1000	937	851	758	651	544	466	453	465	480
	Elev.	947	946	942	934	921	906	887	867	850	847	850	853
San Luis	329	357	384	388	375	331	251	155	94	152	243	371	415
	Elev.	422	432	434	426	410	393	373	354	361	383	420	428
<b>Total</b>		4645	4730	4808	4587	4163	3430	2626	2079	1875	#N/A	#N/A	#N/A

**State End of the Month Reservoir Storage (TAF)**

Oroville	1286	1294	1353	1413	1365	1247	1065	845	725	692	704	645	656
	Elev.	705	713	720	714	699	674	639	617	611	613	601	604
San Luis	274	347	415	431	368	273	219	171	113	98	149	316	346
<b>Total San Luis (TAF)</b>	603	704	799	819	743	603	469	326	207	250	391	687	761

**Monthly River Releases (TAF/cfs)**

Trinity	TAF	18	17	18	36	92	47	28	28	27	23	18	18
	cfs	300	300	300	600	1,498	783	450	450	450	373	300	300
Clear Creek	TAF	12	11	12	12	12	9	7	5	9	12	12	12
	cfs	200	200	200	200	200	150	120	85	150	200	200	200
Sacramento	TAF	200	180	267	405	436	631	645	467	268	295	230	231
	cfs	3250	3250	4350	6800	7100	10600	10500	7595	4501	4800	3873	3750
American	TAF	41	28	33	48	49	51	73	31	30	31	30	31
	cfs	660	500	534	801	800	860	1185	500	500	500	500	500
Stanislaus	TAF	13	12	16	29	25	33	24	22	14	36	12	12
	cfs	210	215	268	480	410	561	396	352	240	580	200	200
Feather	TAF	61	53	58	119	55	86	144	77	74	77	74	77
	cfs	1000	950	950	2000	900	1450	2350	1250	1250	1250	1250	1250

**Trinity Diversions (TAF)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Carr PP	9	5	1	39	76	127	128	127	98	40	15	11
Spring Crk. PP	4	5	8	10	70	120	120	120	120	30	10	11

**Delta Summary (TAF)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tracy	50	75	45	45	46	45	45	63	153	161	157	62
USBR Banks	0	0	0	0	0	0	0	0	0	0	0	0
Contra Costa	9.2	7	7	6.4	6.4	6.4	4.9	5.6	6.4	7	8.4	9.2
<b>Total USBR</b>	59	82	52	51	53	51	50	69	159	168	165	71
State Export	75	72	67	21	22	45	45	26	39	125	203	90
<b>Total Export</b>	134	154	119	72	74	96	95	95	198	293	368	161
COA Balance	0	0	0	9	-16	-1	-2	-2	-2	-2	-2	-2
Old/Middle River Std.												
Old/Middle R. calc.	-1,715	-2,062	-1,330	-873	-894	-1,351	-1,359	-1,412	-2,793	-3,479	-4,799	-2,058
Computed DOI	8589	7096	7109	7245	4002	4001	4002	3026	3043	3872	3933	7483
Excess Outflow	4083	0	0	0	0	0	0	33	34	374	437	3985
% Export/Inflow	20%	27%	18%	11%	14%	15%	16%	21%	41%	54%	61%	27%
% Export/Inflow std.	65%	45%	35%	35%	35%	35%	35%	65%	65%	65%	65%	65%

**Hydrology**

Water Year Inflow (TAF)	Clair Engle	Shasta	Folsom	New Melones
Year to Date + Forecasted % of mean	195 16%	2,281 41%	623 23%	184 17%

**Delta Cross Channel Gates Operational Triggers with Supporting Information**

**Delta Cross Channel Gates Operational Triggers**

		<b>Fish monitoring and physical information</b>	<b>Action to be taken</b>
Outmigrating Fish protection	Alert	Tisdale Rotary Screw trap catch index (CI) is $\geq 3$ winter-run per day standardized to catch per unit effort	<b><u>No action taken:</u></b> Alert to potential emigration event. Fish are expected to be entering the lower Sacramento River from upstream.
	Alert	Wilkins Slough flows increase over base flows by 45% within a 5-day time period. Current flows are approximately 3,692 cfs; 45% increase is equal to 5353 cfs	<b><u>No action taken:</u></b> Fish are expected to be entering the lower Sacramento River from upstream due to an increase in flows.
	Low trigger	Knights Landing Catch Index (KLCI) or Sacramento River trawl Catch Index (SCI) is $\geq 3$ fish per day, standardized to catch per unit effort. This signifies that a moderate increase in downstream migrating fish is currently occurring. These fish will be in the Delta within days.	<b><u>Action:</u></b> Within 24 hours of meeting the trigger criteria, the DCC gates will be closed for 4 consecutive days. Gates will reopen if the KCI or SCI remain below the trigger threshold for the entire 4-day period. If during the 4-day closure, the trigger is again exceeded, then a new 4-day closure will be initiated.
	High trigger	KLCI or SCI is $\geq 5$ fish per day, standardized to catch per unit effort. This signifies that a large increase in downstream migrating fish is currently occurring. These fish will be in the Delta within days. A KLCI or SCI $\geq 5$ fish per day typically correspond to the major emigration events of the year class, with a	<b><u>Action:</u></b> Within 24 hours of meeting the trigger criteria, the DCC gates will be closed for 7 consecutive days. Gates will reopen if the KCI or SCI remain below the trigger



		significant proportion of the annual emigrating population of winter-run Chinook salmon passing Knights Landing occurring during these events.	threshold for the entire 7-day period. If during the 7-day closure, the trigger is again exceeded, then a new 7-day closure will be initiated.
Protection of Rearing Fish in vicinity of the DCC Gates		Sacramento area standardized beach seines or SCI = 0 for winter-run Chinook salmon and no upstream triggers have been exceeded following previous gate closures.	<b><u>No action taken:</u></b> If no captures of fish occur in the SCI or Beach seines after triggers have been exceed and the required duration of gate closures have been met without exceeding the triggers again, then the DCC gates shall remain open until a trigger criterion has been exceeded.
	Low trigger	Sacramento area standardized beach seine or SCI is equal to 1 or 2 winter-run Chinook salmon. This indicates that although winter-run Chinook are in the area surrounding the location of the DCC gates, the fish are typically holding or rearing and not actively migrating downstream in large numbers.	<b><u>Action: Gates Operated Diurnally</u></b> After prior triggers are no longer exceeded, and the DCC gate closures have met their required duration without re-triggering gate closures, then the DCC gate will be operated diurnally to protect fish in the vicinity of the gates
	Alternative trigger	Standardized area beach seine catch is greater than 2 but no fish have been captured in the Sacramento River Trawl. This indicates that winter-run are still present in the vicinity of the DCC gates and are using the area to hold and rear.	<b><u>Action: Gates Operated Diurnally</u></b> After prior triggers are no longer exceeded, and the DCC gate closures have met their required duration without re-triggering

			gate closures, then the DCC gate will be operated diurnally to protect fish in the vicinity of the gates.
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Diurnal operations in response to tidal conditions

	Day (6am-6pm window) approximately up to 6 hour window for opening DCC gates within 12 hour diurnal period.	Night (6pm-6am)
Ebb	Preferred operations of DCC gates will occur during the ebb tidal phase during daylight periods. Periods of gate openings should avoid the period of slack water surrounding the low tide and high tide ( $\pm 1$ hour). This phase of the tide has been shown to create hydraulic conditions at junctions that enhance fish entrainment. Best to use period of the Ebb tide with the strongest downstream flow. Avoid overlapping this phase of the tide with crepuscular periods. Fish migratory movement is elevated during the crepuscular period	Do not open DCC.
Slack	Avoid this period of the tide, fish may be holding in the vicinity of the DCC and the increased movement by fish (milling behavior) will create conditions for greater exposure to entrainment. Avoid crepuscular periods for reasons stated above.	Do not open DCC.
Flood	This a less optimal period of DCC gate operations for fish protection since flow convergence will occur with the water moving upstream on the flood tide meeting water still moving downstream at the beginning of the flood tide. This will send more water into an open DCC channel and extend the zone of entrainment across a significant proportion of the Sacramento River channel. If gates are opened 1 to 2 hours after the change of flow direction at the bottom of the tide, you are likely to have less impact due to opening during this period. Avoid crepuscular periods	Do not open DCC.

### Supporting information

The U.S. Bureau of Reclamation (Reclamation) provided a current status of the species for Sacramento River Winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon, California Central Valley steelhead (*O. mykiss*), and Southern Distinct Population Segment of North American green sturgeon (*Acipenser medirostris*) in its supporting analysis for the Temporary Urgency Change (TUC) Petition.

In response to Reclamation’s and the Department of Water Resources (DWR) request for the TUC Petition, an interagency group of fisheries biologists from NOAA’s National Marine Fisheries Service, Reclamation, California Department of Fish and Wildlife, and California Department of Water Resources (Interagency Team) met and developed the following proposed Delta Cross Channel (DCC) gate operational triggers, in consideration of their need to provide minimum health and safety supplies, conserve water for later protections of instream uses and water quality, and the need to protect the endangered winter-run Chinook salmon.

Because of the anomalous dry hydrology in water year 2014 (WY2014) and lack of sufficient precipitation driven pulse flows in the Sacramento River to trigger behavioral responses in juvenile winter-run Chinook salmon that stimulates downstream migration, some believe that the majority of juvenile winter-run are still rearing in the upper Sacramento River, awaiting the appropriate environmental cues to migrate. However, others believe that the winter-run juveniles are slowly migrating downstream in persistent low numbers towards the Delta. As a result, Reclamation’s assessment of the current status and distribution of winter-run Chinook salmon has indicated that there are from <5% to >30% of the winter-run population currently in the Delta, with the remainder above the monitoring locations of the Tisdale Weir and Knights Landing rotary screw traps (RSTs). In previous dry years, migration past the Knights Landing location has been delayed into late January or February, awaiting a pulse event (see Table 1).

Table 1. Percentage of annual recovery of Winter-run Juveniles at Knight Landing by date

	Water Year												
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	
Water Year type	D	D	AN	BN	BN	W	D	C	D	BN	W	BN	
Date first WR @ KL	11/6/2000	11/16/2001	10/11/2002	10/6/2003	10/29/2004	10/11/2005	10/6/2006	12/12/2007	12/29/2008	10/15/2009	10/11/2010	10/10/2011	
25% @ KL	1/19/2001	11/27/2001	12/17/2002	12/9/2003	12/11/2004	12/3/2005	12/15/2006	12/31/2007	1/26/2009	10/28/2009	12/8/2010	1/23/2012	
50% @ KL	1/29/2001	12/11/2001	12/22/2002	12/11/2003	12/13/2004	12/6/2005	12/17/2006	1/12/2008	2/24/2009	1/20/2010	12/17/2010	1/25/2012	
75% @ KL	2/23/2001	1/4/2002	1/4/2003	12/20/2003	1/5/2005	12/24/2005	12/30/2006	1/28/2008	2/27/2009	1/26/2010	12/23/2010	1/27/2012	
100% @ KL	4/25/2001	4/24/2002	4/21/2003	4/5/2004	4/22/2005	4/18/2006	3/13/2007	3/3/2008	4/6/2009	4/16/2010	4/9/2011	4/11/2012	

In most years, precipitation events trigger emigration events. Recovery of winter-run juveniles at Knights Landing increases with these precipitation events that increase flows in the Sacramento River. These flows fluctuations have been typically measured at Wilkins Slough where a monitoring gage is located. Wilkins Slough is located upstream of the Knights Landing RST location and provides real time measurements of flow. A team of scientist from multiple federal and state agencies was convened in 1994 and over the course of more than 10 years developed the Salmon Decision Tree, to provide a framework for making operational decisions using the Knights Landing catch data and physical measurements such as the Wilkins Slough river flow data to determine when older juveniles, which include winter-run Chinook salmon juveniles, are entering the Delta and may need protection from water operations. This decision tree was modified in the 2009 NMFS biological opinion for the long term operations of the

Central Valley Project (CVP) and State Water Project (SWP, CVP/SWP Opinion). The Salmon Decision Tree team developed triggers based on standardized numbers of fish captured in the Knights Landing RSTs as well as monitoring efforts occurring downstream of that location in the Delta (Sacramento River trawls and beach seines). During the development of the Salmon Decision Tree criteria, the timing and magnitude of the passage of older juvenile Chinook salmon, *i.e.*, those fish larger than the minimum winter run Chinook salmon size criteria, were assessed from the Knights Landing RST monitoring data. In addition to the presence of the salmonids, physical data such as water temperature and river discharge were examined. The Knights Landing RST data have been collected since the fall of 1995 by CDFG staff using paired traps. The monitoring study has been conducted annually, collecting data to develop information on timing, composition (race and species) and relative abundance of juvenile Chinook salmon and steelhead emigrating from the upper Sacramento River. The traps have typically been placed in the river from early October through June of each year to coincide with the periods of salmonid out migration from the Sacramento River basin, however in some years the traps have been run for a longer period of time. The Salmon Decision Tree group also used data from the monitoring efforts conducted by the U.S. Fish and Wildlife Service (FWS) in the Sacramento River near the City of Sacramento as part of the Juvenile Salmon Monitoring Program/Delta Juvenile Fish Monitoring Program. The FWS conducts a river trawl using either a mid-water trawl or Kodiak trawl to sample fish (Sacramento trawl) and a beach seine at several shore locations in the Sacramento region (Sacramento Area beach seines). During the salmon emigration period, the sampling effort is intensified to 3 times per week.

The Salmon Decision Tree work group used data from these monitoring studies to develop the trigger criteria for the Decision Tree. The Knights Landing data was standardized to the number of older juvenile Chinook salmon (defined as fish larger than the minimum size length for winter-run Chinook salmon at date, *i.e.*, >70mm) captured in one trap day (24 hours). The number of older juvenile fish captured in each RST is enumerated, and then the cumulative number of fish is divided by the number of hours the two RSTs were operated between sampling days divided by 24. For example, if the two traps are fished for 2 days there is a maximum of 96 hours that the 2 traps could have been fished: (2 days x 24 hours per day x 2 traps = 96 hours total time fished). If 100 fish were caught between both traps, then the catch per trap day is:  $100 \div (96 \text{ hours} / 24 \text{ hours per day}) = 25 \text{ fish per trap day}$ . In a similar fashion, the catch from the Sacramento trawl and Sacramento area beach seines are standardized to one catch day with 10 tows per sampling day for the trawl data and eight hauls per day for the beach seine data. The daily catch data is adjusted so that the effort per day is always equivalent, taking into account any variance in the number of tows or hauls actually completed each day. These data are then referred to as the Knights Landing Catch Index (KLCI) or the Sacramento Catch Index (SCI) respectively. The Salmon Decision Tree work group found that the older juvenile Chinook salmon arrived at the Knights Landing RST location in “pulses” that were associated with precipitation driven increases in the river flow at Knights Landing (see Figure 1). The work group developed numerical criteria that served as the thresholds for closure of the DCC gates, and are the basis for the threshold triggers used in the current operations table. In addition to the numerical values for the Knights Landing and Sacramento Catch indices that trigger operational responses, the work group developed physical hydrological triggers that indicated that older juvenile salmonid migration was imminent. This included a flow criterion at Wilkins Slough of 7,500 cfs and a water temperature of 13.5°C. In a recent paper by del Rosario *et al.* (2013),

analysis of the Knights Landing data suggest that catch spikes of as little as 5% cumulative catch are observable and are nearly coincident with rapid increases in flow greater than 14,125 cfs. In light of the very dry hydrology for 2014, flows of this magnitude are unlikely, barring a significant precipitation event. The Interagency Team decided, based on professional judgment, that a lower flow might serve as an alert for active downstream migration, in this case, and developed a standard in which flow increases of 45% over a period of 5 days at Wilkins Slough would signify a physical trigger for indicating movement of fish downstream past Knights Landing. Past data regarding small pulses of less than 10,000 cfs at Wilkins Slough from low flows indicated that there was movement of fish, but not as pronounced as the larger flows.

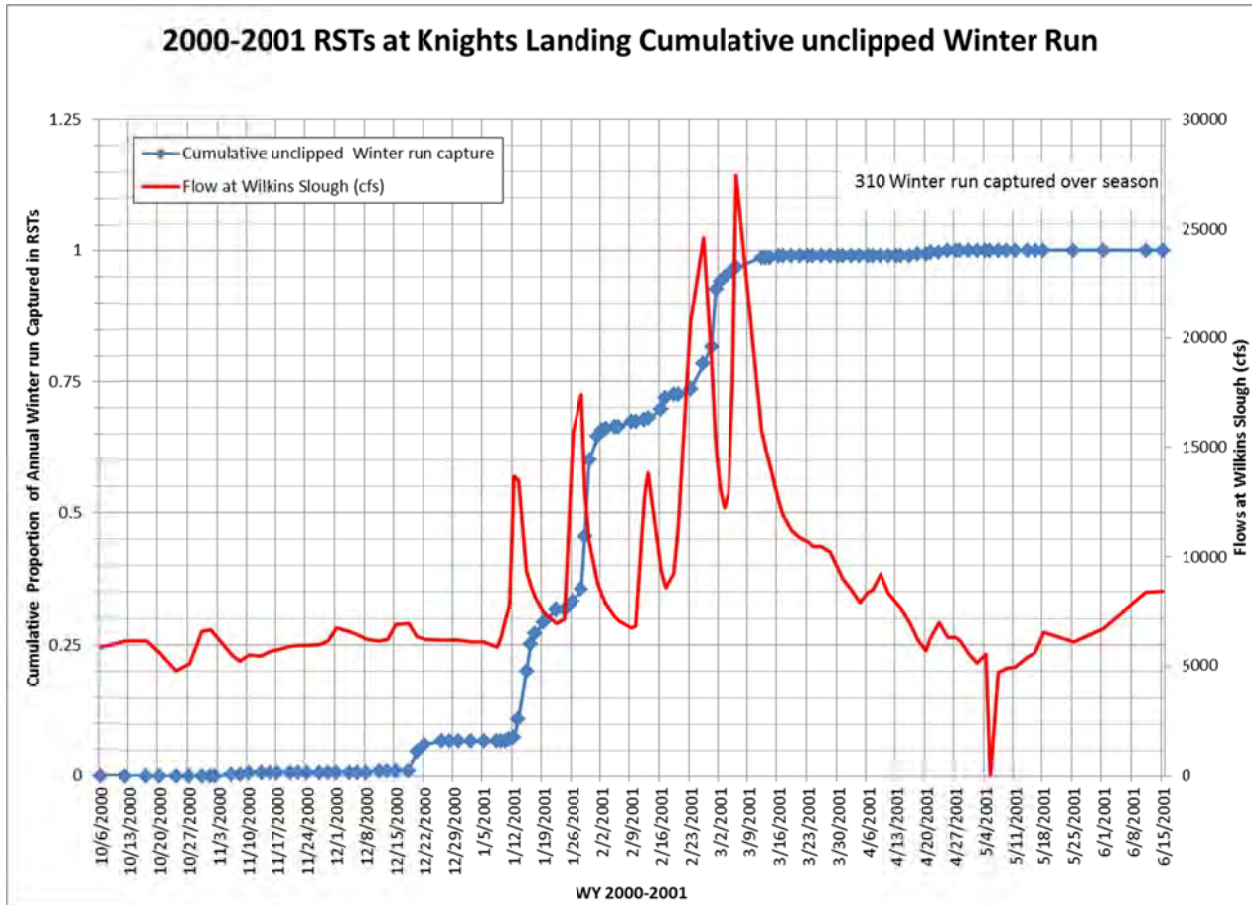


Figure 1. Knights Landing rotary screw trap cumulative captures of winter-run Chinook salmon for water year 2001, a dry year.

The first and second triggers indicate that a significant emigration event is occurring (see Figures 1 and 2). When the indices of 3 or 5 fish per trap day are exceeded, the cumulative number of fish increases rapidly and as previously described occurs with a co-occurring pulse in flow as measured at Wilkins Slough. We expect that in 2014, a smaller flow pulse as measured at Wilkins Slough will stimulate migratory behavior and a resultant increase in winter run captures will occur. The trigger thresholds of 3 and 5 fish per trap day will allow operators to have notice that a pulse of fish are moving down through the system and the protective actions of closing the DCC gates can be implemented.

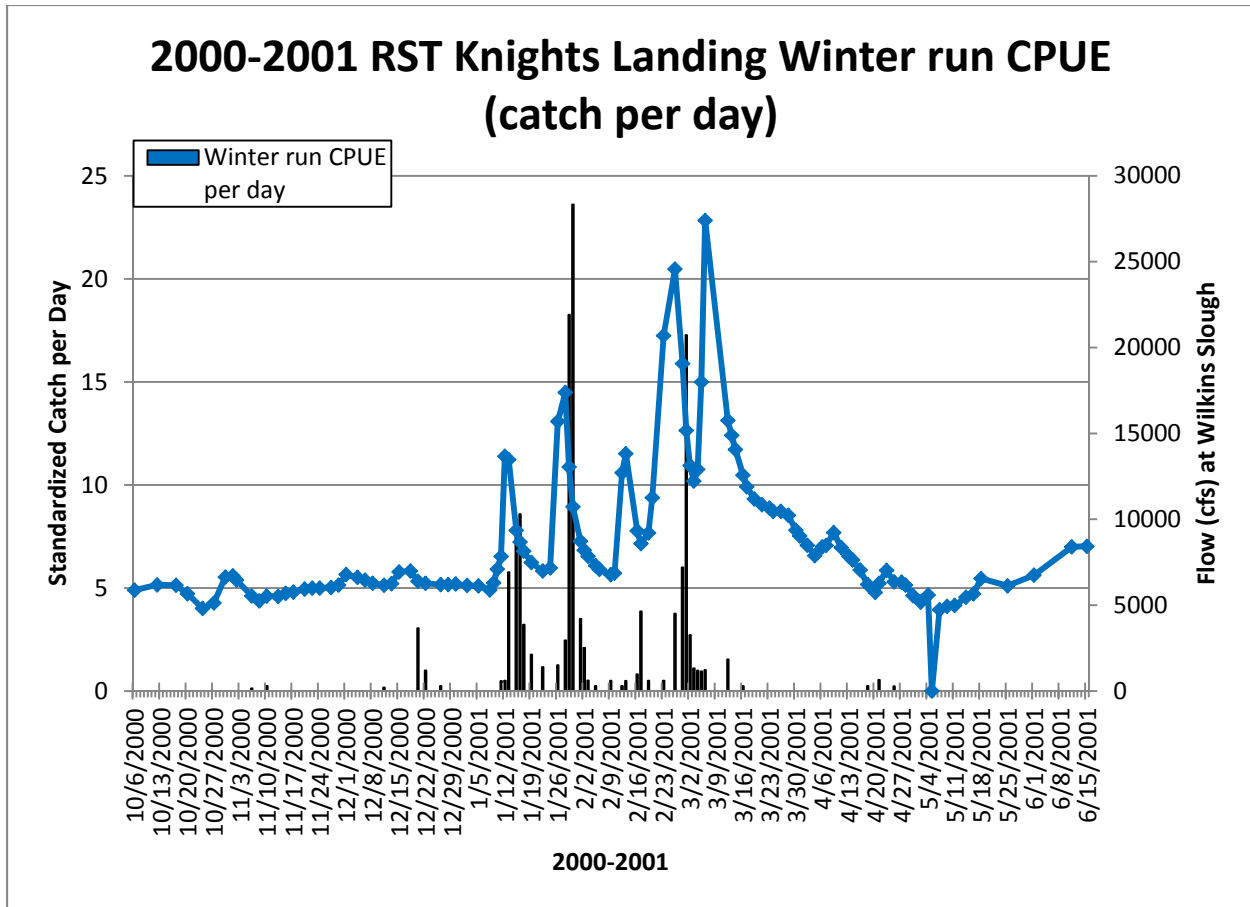


Figure 2. Catch of winter-run Chinook salmon at Knights Landing measured as catch per unit effort for water year 2001.

As juvenile Chinook salmon move downstream, they are more likely to move at night rather than during the day. Several studies have indicated such behavior (Martin *et al.* 2001, Chapman *et al.* 2013). Results from the 2012 Georgiana Slough non-physical barrier study illustrate that behavior when looking at fish. Entrainment into Georgiana Slough was highest during the night as compared to the day time hours. Fish tended to hold during the day and were less vulnerable to entrainment into Georgiana Slough.

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**Additional Monitoring Relative to Delta Cross Channel Operations**

*January 31, 2014*

Below are specific additional monitoring activities confirmed to be completed in order to facilitate Delta Cross Channel Gate Operations.

Knights Landing Rotary Screw Trap

Rotary Screw Trapping at Knights Landing, 24 hours per day, 7 days per week to provide salmon outmigration trends. 24 hour sampling start January 31, 2014. This effort is led by Department of Fish and Wildlife.

Sacramento Kodiak Trawl

Kodiak trawling at Sacramento will be completed to provide salmon presence information. A total of 10, 20-minute tows per day will be completed. Sampling is confirmed to start week of February 3 and will be completed on Monday, Wednesday, Thursday, and Friday of the first week. Boat Operator assistance is needed to complete trawling on Tuesday. Future sampling frequency to be discussed. This effort is led by the U.S. Fish and Wildlife Service.

Sacramento Area Beach Seine

Daily beach seining in the Sacramento region at up to 8 specific seine sites is confirmed to be completed to provide salmon presence information. Sampling is confirmed to start week of February 3 and will be completed on Monday, Tuesday, Wednesday, Thursday, and Friday of the first week. Future sampling frequency to be discussed. This effort is led by the U.S. Fish and Wildlife Service.

Acoustic Receivers

A request for receiver equipment has been sent and deployment has yet to be scheduled. Status of USGS Chinook release studies is unknown at this time and more information will be gathered over the weekend. Kevin Reece, DWR is leading this effort.

All preliminary sampling summaries including date of sample, sample effort, and catch by salmon race will be sent following sampling activities each day to Barbara.Byrne@noaa.gov, and Jeff.McLain@noaa.gov. Sampling summaries will also be forwarded to DOSS group.